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April 27, 2020

James M. Lynch
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Director
Office of Environmental Quality Control
State of Hawai'i
235 S Beretania Suite # 702
Honolulu, HI 96813

Re: Transmittal of Draft Environmental Impact Statement

Dear Director:

With this letter, the Pet Industry Joint Advisory Council (PIJAC) hereby transmits the documents package for the Draft Environmental Impact Statement (DEIS) for the Issuance of Commercial Aquarium Permits for the Honolulu, Ewa, Waianae, Waialua, Koolauloa, Koolaupokodistricts on the island of Oahu for publication of a notice of availability for public comment for 45-days in the next available edition of the Environmental Notice. The DEIS includes copies of all written comments received during the 30-day public consultation period for the FEA EISPN.

Also enclosed is an Adobe Acrobat PDF file containing the DEIS and a distribution list for the verification of OEQC under Section 11-200-20, Hawai'i Administrative Rules. Upon receiving verification from OEQC (along with the bulletin proof of the notice containing the pertinent details for commenters), we will make the DEIS and the bulletin proof available to those so indicated on the distribution list so that they will have the full 45-day statutory period to review and comment on the DEIS.

If you have any questions or if you need additional information, please feel free to contact me.

Sincerely,

James Lynch

James M. Lynch

Enclosures

20-253

From: webmaster@hawaii.gov
To: HI Office of Environmental Quality Control
Subject: New online submission for The Environmental Notice
Date: Monday, April 27, 2020 1:03:51 PM

Action Name

Issuance of Commercial Aquarium Permits and Commercial Marine Licenses for the Island of O'ahu

Type of Document/Determination

Draft environmental impact statement (DEIS)

HRS §343-5(a) Trigger(s)

- (1) Propose the use of state or county lands or the use of state or county funds
- (2) Propose any use within any land classified as a conservation district

Judicial district

O'ahu - multiple districts

Tax Map Key(s) (TMK(s))

Fishing areas around O'ahu identified in Figure 1 of the DEIS.

Action type

Applicant

Other required permits and approvals

Numerous

Discretionary consent required

Aquarium Fishing Permits

Approving agency

Hawaii Department of Land and Natural Resources

Agency contact name

David Sakoda

Agency contact email (for info about the action)

david.sakoda@hawaii.gov

Email address or URL for receiving comments

david.sakoda@hawaii.gov

Agency contact phone

(808) 587-0104

Agency address

1151 Punchbowl Street
Room 330
Honolulu, Hawaii 96813
United States

Map It

Accepting authority

Hawai'i Department of Land and Natural Resources

Applicant

Pet Industry Joint Advisory Council

Applicant contact name

JAMES LYNCH

Applicant contact email

jim.lynch@klgates.com

Applicant contact phone

(206) 370-6587

Applicant address

925 Fourth Ave, Suite 2900
SEATTLE, Washington 98104
United States
Map It

Was this submittal prepared by a consultant?

Yes

Consultant

Stantec Consulting Services Inc

Consultant contact name

Terry VanDeWalle

Consultant contact email

terry.vandewalle@stantec.com

Consultant contact phone

(319) 334-3755

Consultant address

2300 Swan Lake Blvd.
Suite 202
Independence, Iowa 50644
United States
Map It

Action summary

The purpose of the Applicant's action is to ensure that commercial aquarium fish collection allows for the lawful, responsible, and sustainable commercial collection of various fish species from nearshore habitats. The objective of the proposed action is for the Department of Land and Natural Resources (DLNR) to issue 20 Aquarium Permits for the island of O'ahu.

The need for the Applicant's action is to continue commercial aquarium fishers' livelihoods in compliance with all applicable laws, rules, and regulations pertaining to the industry.

Attached documents (signed agency letter & EA/EIS)

- Appendix-D_Distribution-List.pdf
- Oahu_DEIS_04-27-2020_complete.pdf
- Oahu_DEIS_04-27-2020_complete1.pdf
- Oahu_DEIS_04-27-2020_complete2.pdf
- Oahu_DEIS_04-27-2020_complete3.pdf
- Letter-to-Director-OEQC.pdf

Shapefile

- The location map for this Draft EIS is the same as the location map for the associated EIS Preparation Notice.

Action location map

- Publication-Form_Chapter-343-Applicant_Hawaii-AQ-Collection_PIJAC.zip

Authorized individual

JAMES LYNCH

Authorization

- The above named authorized individual hereby certifies that he/she has the authority to make this submission.

Draft Environmental Impact Statement

Issuance of Commercial Aquarium Permits and Commercial Marine Licenses for the Island of O'ahu

April 28, 2020

Applicant
Name: Pet Industry Joint Advisory Council (PIJAC)
Address: 1615 Duke St., #100 Alexandria, VA 22314
Phone: 202.452.1525

Approving Agency
Hawai'i Department of Land and Natural Resources
Division of Aquatic Resources
1151 Punchbowl Street, Room 330
Honolulu, HI 96813-3088

APPLICANT PUBLICATION FORM

Project Name:	Issuance of Commercial Aquarium Permits and Commercial Marine Licenses for the Island of O'ahu
Project Short Name:	DEIS O'ahu Commercial Aquarium Permits
HRS §343-5 Trigger(s):	Trigger 1 (use of state lands) and Trigger 2 (use of conservation districts)
Island(s):	O'ahu
Judicial District(s):	Honolulu, Ewa, Waianae, Waialua, Koolauloa, Koolaupoko
TMK(s):	Fishing areas around O'ahu identified in Figure 1
Permit(s)/Approval(s):	Commercial Aquarium Fishing Permits issued pursuant to HRS §188-31, Commercial Marine License issued pursuant to HRS 189-2,3
Approving Agency:	Department of Land and Natural Resources
Contact Name, Email, Telephone, Address	David Sakoda, david.sakoda@hawaii.gov, 808-587-0104,1151 Punchbowl Street, Room 330, Honolulu, HI 96813
Applicant:	Pet Industry Joint Advisory Council (PIJAC)
Contact Name, Email, Telephone, Address	Jim Lynch; jim.lynch@klgates.com; 206.370-6587; 925 Fourth Ave., Suite 2900 Seattle, WA 98104
Consultant:	Stantec Consulting Services Inc
Contact Name, Email, Telephone, Address	Terry VanDeWalle; terry.vandewalle@stantec.com; (319) 334-3755; 2300 Swan Lake Blvd., Suite 202, Independence, IA 50644

Status (select one)	**Submittal Requirements**
__ DEA-AFNSI	Submit 1) the approving agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEA, and 4) a searchable PDF of the DEA; a 30-day comment period follows from the date of publication in the Notice.
__ FEA-FONSI	Submit 1) the approving agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; no comment period follows from publication in the Notice.
____ FEA-EISPN	Submit 1) the approving agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; a 30-day comment period follows from the date of publication in the Notice.
____ Act 172-12 EISPN ("Direct to EIS")	Submit 1) the approving agency notice of determination letter on agency letterhead and 2) this completed OEQC publication form as a Word file; no EA is required and a 30-day comment period follows from the date of publication in the Notice.
__XX__ DEIS	Submit 1) a transmittal letter to the OEQC and to the approving agency, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEIS, 4) a searchable PDF of the DEIS, and 5) a searchable PDF of the distribution list; a 45-day comment period follows from the date of publication in the Notice.
____ FEIS	Submit 1) a transmittal letter to the OEQC and to the approving agency, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEIS, 4) a searchable PDF of the FEIS, and 5) a searchable PDF of the distribution list; no comment period follows from publication in the Notice.

___ FEIS Acceptance Determination	The approving agency simultaneously transmits to both the OEQC and the applicant a letter of its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS; no comment period ensues upon publication in the Notice.
____ FEIS Statutory Acceptance	The approving agency simultaneously transmits to both the OEQC and the applicant a notice that it did not make a timely determination on the acceptance or nonacceptance of the applicant's FEIS under Section 343-5(c), HRS, and therefore the applicant's FEIS is deemed accepted as a matter of law.
____ Supplemental EIS Determination	The approving agency simultaneously transmits its notice to both the applicant and the OEQC that it has reviewed (pursuant to Section 11-200-27, HAR) the previously accepted FEIS and determines that a supplemental EIS is or is not required; no EA is required and no comment period ensues upon publication in the Notice.
____ Withdrawal	Identify the specific document(s) to withdraw and explain in the project summary section.
____ Other	Contact the OEQC if your action is not one of the above items.

Project Summary

The purpose of the Applicant's action is to ensure that commercial aquarium fish collection allows for the lawful, responsible, and sustainable commercial collection of various fish species from nearshore habitats. The objective of the proposed action is for the Department of Land and Natural Resources (DLNR) to issue 20 Aquarium Permits for the island of O'ahu, along with required Commercial Marine Licenses.

The need for the Applicant's action is to continue commercial aquarium fishers' livelihoods in compliance with all applicable laws, rules, and regulations pertaining to the industry.

Project Summary

Project Name: Issuance of Commercial Aquarium Permits and Commercial Marine Licenses for the Island of O'ahu

Proposed Action: Collection of aquarium fish pursuant to the issuance of 20 Commercial Aquarium Permits issued under HRS §188-31 and related permits ensuring lawful, responsible, and sustainable commercial collection of various aquarium fish species from nearshore habitats of O'ahu.

Applicant: Pet Industry Joint Advisory Council (PIJAC)

Applicant Contact: Jim Lynch, KL Gates LLP, 206-370-6587

Approving Agency: Department of Land and Natural Resources

Project Location: Throughout the nearshore region (to 3 nautical miles from shore) of the island of O'ahu except in those areas already designated as no collection areas such as Marine Life Conservation Districts.

Land Use Classification: N/A

Land Area: N/A NON-MLCDs

Tax Map Key: N/A

State Land District: N/A

Land Owner: State of Hawai'i

Permits Required: Commercial Aquarium Fishing Permits issued under HRS §188-31, Commercial Marine Licenses issued pursuant to HRS 189-2.

HRS §343-5 Trigger: Trigger 1 (use of state lands) and Trigger 2 (use of conservation districts). Review of an Environmental Assessment (EA) prepared in 2018 determined an EIS was required based on Significance Criteria #1, #2, #3, #4, and #8.

Anticipated Determination: Acceptance

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Executive Summary

In October 2017, the circuit court ruled that, based upon the Supreme Court of Hawai'i's opinion, existing Commercial Aquarium Permits (Aquarium Permits) for use of fine mesh nets to catch aquatic life for aquarium purposes are illegal and invalid. The circuit court ordered the Department of Land and Natural Resources (DLNR) not to issue any new Aquarium Permits pending environmental review. The DLNR has not issued new or additional Aquarium Permits under HRS §188-31 since September of 2017.

The Applicant initially prepared and submitted an Environmental Assessment (EA) on April 8, 2018, evaluating the impacts of issuance of Aquarium Permits on the island of O'ahu, programmatically to any applicant over a 12-month analysis period. The DLNR determined on July 26, 2018, that preparation of an Environmental Impact Statement (EIS) was required, based on five significance criteria outlined in Title II, Chapter 200, Hawai'i Administrative Rules. An evaluation of the significance criteria, including the five identified by the DLNR, is provided in Section 5.6 of this document.

This Draft Environmental Impact Statement (DEIS) evaluates the impacts of issuance of 20 Aquarium Permits on the island of O'ahu. The Applicant has prepared this DEIS to inform the public of the proposed action (i.e., issuance of 20 Aquarium Permits) and the impacts of the proposed action and its alternatives, and to incorporate information gained through public involvement. The Preferred Alternative includes issuance of 20 Aquarium Permits for the island of O'ahu, implementation of a reduced bag limit for Flame Wrasse of 10 per day, and an expansion of the Waikiki Marine Life Conservation District (MLCD). Implementation of the Preferred Alternative would ensure the lawful, responsible, and sustainable commercial collection of various fish species from nearshore habitats on the island of O'ahu.

Aside from the additional conservation measures included in the Preferred Alternative, the issuance of 20 Aquarium Permits under the Preferred Alternative does not include any activities different from, or in addition to, those that have occurred in the past. There would be no construction of permanent or semi-permanent infrastructure, no discharges into coastal, surface or ground waters, no dredging, and no significant use of hazardous materials that could be released into the environment. The DLNR's issuance of 20 Aquarium Permits is not anticipated to result in significant beneficial or adverse impacts to water and air quality, geology and soil resources, aesthetics, noise, vegetation, terrestrial wildlife, and avian species, threatened and endangered species, land use, public health and safety, communications, transportation, utilities, or population and demographics from their current condition.

The Preferred Alternative does not involve an irrevocable commitment or loss or destruction of any natural or cultural resource. The National Oceanic and Atmospheric Administration's (NOAA) Coral Reef Ecosystems Program (CREP; now known as the Ecosystem Sciences Division) collects data on fish populations in the nearshore waters of the island of O'ahu. These data on population estimates serve as the primary basis for the impact analysis in this DEIS.

If the average annual commercial aquarium fish collection were to occur annually over the 5-year analysis period, collection of 19 of the 22 species with population estimates analyzed in this EIS would result in the loss of less than 1% of their respective overall island of O'ahu populations. For the remaining five species, an estimated 1.0% of the Kole population, 1.5% of the Achilles Tang population, 1.8% of the Potter's Angelfish population, 7.7% of the Yellow Tang population and 9.4% of the Flame Wrasse population would be collected. However, the Flame Wrasse spends much of its time below the 98-foot depth limit of population estimate surveys. The density of Flame Wrasse at 98-132 feet (30-40 meters) is over 1,000 times greater than the density reported from the CREP surveys on O'ahu (0.002293712 Flame Wrasse per 100 square meters (m^2)). Additionally, the density of Flame Wrasse at 132-164 feet (40-50 meters) is over 900 times greater, and the density below 164 feet (50 meters) is over 100 times greater. Therefore, it is not possible to know the exact proportion of the Flame Wrasse population that would be collected, though it is assumed to be less than 1%. Research suggests collection of between 5%-25% is sustainable for various reef species similar to those found on O'ahu (e.g., tang, wrasse, butterflyfish, angelfish, triggerfish). Based on the low percentage of the overall populations collected annually by commercial aquarium fishers, which is spread throughout the year and across multiple areas, as well as the targeted collection of smaller, less fecund individuals, commercial aquarium collection likely has minimal impacts on populations in general.

Two studies have concluded that the aquarium fishery has no significant impact on coral or the reef ecosystem. In addition, herbivores collected by the aquarium fishery typically consist of the smaller size classes which are the least effective sizes for cropping algae. One study found there were no increases in the abundance of macroalgae where the abundance of herbivores was reduced by aquarium collecting.

Despite the low percentage of the overall Flame Wrasse population being collected by commercial aquarium fishers, the Preferred Alternative would include a conservation measure imposing a bag limit of 10 Flame Wrasse per day, which is anticipated to result in a 60% reduction in the number of Flame Wrasse taken by the commercial aquarium fishery on O'ahu.

An additional conservation measure, the Preferred Alternative would expand the Waikiki MLCD. The current Waikiki MLCD covers approximately 77.3 acres (31.3 hectares). The area proposed in the Preferred Alternative expands this MLCD by 740 acres (299.5 hectares) to 817.3 acres (330.7 hectares), more than 10.5 times the size of the current Waikiki MLCD. In addition, the current Waikiki MLCD is bordered to its south by the Waikiki-Diamond Head Shoreline Fisheries Management Area (WDHSFMA) covering approximately 239 acres (96.7 hectares). The WDHSFMA is open to fishing (with restrictions) in even numbered years only.

As concluded in the Cultural Impact Assessment (CIA; Appendix A), cultural impacts would occur if issuance of Aquarium Permits would cause a significant decline in the population of a species considered to be a cultural resource, either directly through the collection of fish or indirectly through habitat impacts. While not all species have a known Hawaiian cultural significance, for this analysis, it was assumed that the species identified as having a cultural use for food, medicinal, religious or ceremonial purposes could have a cultural impact if populations of those species were impacted. Populations of the 23 species analyzed in this EIS are not anticipated to significantly decline under the Preferred Alternative. Therefore, it is not anticipated that a significant impact on cultural resources would occur as a result of the Preferred Alternative.

The Applicant's action does not substantially affect the economy but plays an important role as a nearshore fishery in the state. The Preferred Alternative would add an estimated $2.1 to $3.2 million over the 5-year analysis period (average of $422,612 to $642,225 per year), and another five times this value in indirect economic benefits. Loss of the fishery would result in the loss of income, tax revenue, and jobs.

Abbreviations

BIAAF	Big Island Association of Aquarium Fishermen
CFR	Code of Federal Regulations
CML	Commercial Marine License
CREP	Coral Reef Ecosystems Program
CWCS	Hawai'i's Comprehensive Wildlife Conservation Strategy
DAR	Division of Aquatic Resources
DEIS	Draft Environmental Impact Statement
DLNR	Department of Land and Natural Resources
DOCARE	Division of Conservation and Resources Enforcement
DOH	Department of Health
EA	Environmental Assessment
EC	Environmental Council
EIS	Environmental Impact Statement
ENSO	El Niño Southern Oscillation
EQC	Environmental Quality Commission
ESA	Endangered Species Act
FEA	Final Environmental Assessment

FMA	Fisheries Management Area
FONSI	Finding of No Significant Impact
HEPA	Hawai'i Environmental Policy Act
HAR	Hawai'i Administrative Rule
HRS	Hawai'i Revised Statute
IUCN	International Union for the Conservation of Nature and Natural Resources
MHI	Main Hawaiian Islands
MLCD	Marine Life Conservation District
MPA	Marine Protected Area
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NWHI	Northwestern Hawaiian Islands
OEQC	Office of Environmental Quality Control
OHA	Office of Hawaiian Affairs
PIJAC	Pet Industry Joint Advisory Council
QUEST	Quantitative Underwater Ecological Survey Techniques

SAIA	Sustainable Aquarium Industry Association
SAWCS	Statewide Aquatic Wildlife Conservation Strategy
SCUBA	Self-contained Underwater Breathing Apparatus
SGCN	Species of Greatest Conservation Need
SWAP	State Wildlife Action Plan
TL	Total Length
UH	University of Hawai'i
USFWS	United States Fish and Wildlife Service
WHAP	West Hawai'i Aquarium Project
WHFC	West Hawai'i Fishery Council
WHRFMA	West Hawai'i Regional Fishery Management Area
WHRFWG	West Hawai'i Reef Fish Working Group

1.0 INTRODUCTION

This Draft Environmental Impact Statement (DEIS) has been prepared by the Pet Industry Joint Advisory Council (PIJAC; the Applicant) pursuant to the Hawai'i Environmental Policy Act (HEPA). This DEIS evaluates the impacts of issuance of 20 Commercial Aquarium Permits (Aquarium Permit) on the island of O'ahu, pursuant to Hawai'i Revised Statute (HRS) 188-31 (2013; Title 12 – Conservation and Resources; 188 – Fishing Rights and Regulations; 188-31 – Permits to take aquatic life for aquarium purposes). The Applicant has prepared this DEIS to inform the public of the proposed action (i.e., issuance of 20 Aquarium Permits) and the impacts of the proposed action and its alternatives, and to incorporate information gained through public involvement in order to aid decision makers in making an informed decision regarding the proposed action.

Hawai'i Revised Statute 188-31 states that, "Except as prohibited by law, the department (Department of Land and Natural Resources; DLNR), upon receipt of a written application, may issue an Aquarium Permit, not longer than one year in duration, to use fine meshed traps, or fine meshed nets other than throw nets, for the taking of marine or freshwater nongame fish and other aquatic life for aquarium purposes." As set down by the Supreme Court of Hawai'i (SCWC-13-0002125), issuance of an Aquarium Permit constitutes a discretionary State action by the DLNR and is thus subject to the HEPA, which requires that State agencies consider the impact of governmental actions on the environment by preparing an Environmental Assessment (EA) or an Environmental Impact Statement (EIS) to document the potential impacts of the State action. A Draft Environmental Assessment (DEA) evaluating the impacts of the proposed action of issuing Aquarium Permits to fishermen on the island of O'ahu and its alternatives was made available for public comment on April 8, 2018. After review of the EA, the DLNR determined on July 26, 2018, that preparation of an EIS is required, based on the significance criteria outlined in Title II, Chapter 200, Hawai'i Administrative Rules. Accordingly, the Applicant has prepared this DEIS to evaluate the potential impacts of alternatives to issuance of 20 Aquarium Permits on the island of O'ahu, and a No Action Alternative. The consequences of these alternatives on various resources are discussed in this DEIS.

1.1 BACKGROUND

In 2017, the commercial aquarium fishery on the island of O'ahu reported landings greater than $513,000, down from a record $741,500 in 2015 (DAR 2018a). The fishery developed initially on O'ahu in the late 1940's, and then went through a period of expansion in the 1970's where it made up nearly 70% of the total commercial aquarium fish value from the state. Since then the total value of fish taken from O'ahu has decreased to approximately 30% of the total commercial aquarium fish value from the state (DAR 2018a).

Commercial aquarium fish collection in Hawai'i has long been a subject of controversy (DAR 2019a). As early as 1973, public concern over collecting activities prompted Hawai'i's DLNR, then Division of Fish and Game, to suspend the issuance of Aquarium Permits for a week while issues were considered and addressed (DAR 2014a). As a result, Aquarium Permit holders were required to submit monthly catch reports; however, no studies were conducted and no 'sanctuary' areas were created at that time. The first sanctuary areas were created through a gentleperson's agreement primarily between dive/snorkel operators and commercial aquarium fishers in 1987 and four of these sanctuaries were incorporated into the Kona Coast Fisheries Management Area (FMAs) off the coast of the island of Hawai'i in 1991 (DAR 2004).

On the island of O'ahu, three Marine Life Conservation Districts (MLCD) exist, where fishing activities of any kind are prohibited, including Hanauma Bay, Pūpūkea, and, Waikíkí (Figure 1). Hanauma Bay is located near Koko Head at the eastern end of Honolulu, which extends from the highwater mark seaward to a line across the bay's mouth from Palea Point on the left to Pai'olu'olu Point on the right. Pūpūkea MLCD is located on the north shore of O'ahu near the town of Waimea, extending offshore from the highwater mark seaward 100 yards along a line extending due west of Kulalua Point, then south to the most seaward exposed rock of the Wananapaoa Islets. Waikíkí MLCD is located at the Diamond Head end of Waikíkí Beach, extending from the groin at the end of Kapahulu Avenue to the west wall of the Natatorium, from the highwater mark seaward a distance of 500 yards or to the edge of the fringing reef, whichever is greater.

In addition, there are 10 marine locations that have fishing restrictions: Waikíkí-Diamond Head Shoreline Fisheries Management Area (FMA), Ala Wai Canal, Kapalama Canal, Coconut Island – Hawai'i Marine Laboratory Refuge, He'eia Kea Wharf, Honolulu Harbor, Poka'i Bay, Waialua Bay, and the 'Ewa Limu Management Area (Figure 1). Coconut Island does not allow any fishing of any kind within the boundaries of the refuge, while the other nine have specific permit restrictions on the number of fish allowed to be taken, type of equipment used, time of day, or time of year. None specifically prohibit collection under Aquarium Permits; however, the majority of the habitat would not be conducive to aquarium fish collection (e.g., canal, harbor, wharf).

1.1.1 Status of Aquarium Permits

In October 2012, Earthjustice filed a complaint under the HEPA in the First Circuit Court on behalf of four individuals and three non-governmental organizations. The complaint sought a court order to force the State to comply with the HEPA's requirement to examine commercial aquarium fish collection's effects on the environment before issuing collection permits. The complaint also asked the court to halt collection under existing commercial aquarium permits and to stop DLNR from issuing new permits until the environmental review is complete (Earthjustice 2012). On June 24, 2013, the Circuit Court of the First Circuit announced their findings on the case through an 'Order Granting Department of Land and Natural Resources State of Hawai'i's, Motion for Summary Judgment filed February 4, 2013, and Denying Plaintiffs' Motion for Summary Judgment filed February 5, 2013 (Summary Judgment Order), and the Final Judgment in Favor of Defendant and Against Plaintiffs (Judgment), also filed on June 24, 2013. The Hawai'i Intermediate Court of Appeals upheld this decision in August of 2016. Permit issuance by DLNR's Division of Aquatic Resources (DAR) continued.

Through the appeals process, Earthjustice brought the case before the Supreme Court of Hawai'i. On September 6, 2017, the Supreme Court of Hawai'i ruled that aquarium collection using fine meshed traps or nets is subject to the environmental review procedures provided in the HEPA (SCWC-13-0002125). The issue was remanded to the circuit court for further proceedings. In light of the ruling, DLNR discontinued issuance of new Aquarium Permits and renewal of existing Aquarium Permits (DAR 2017).

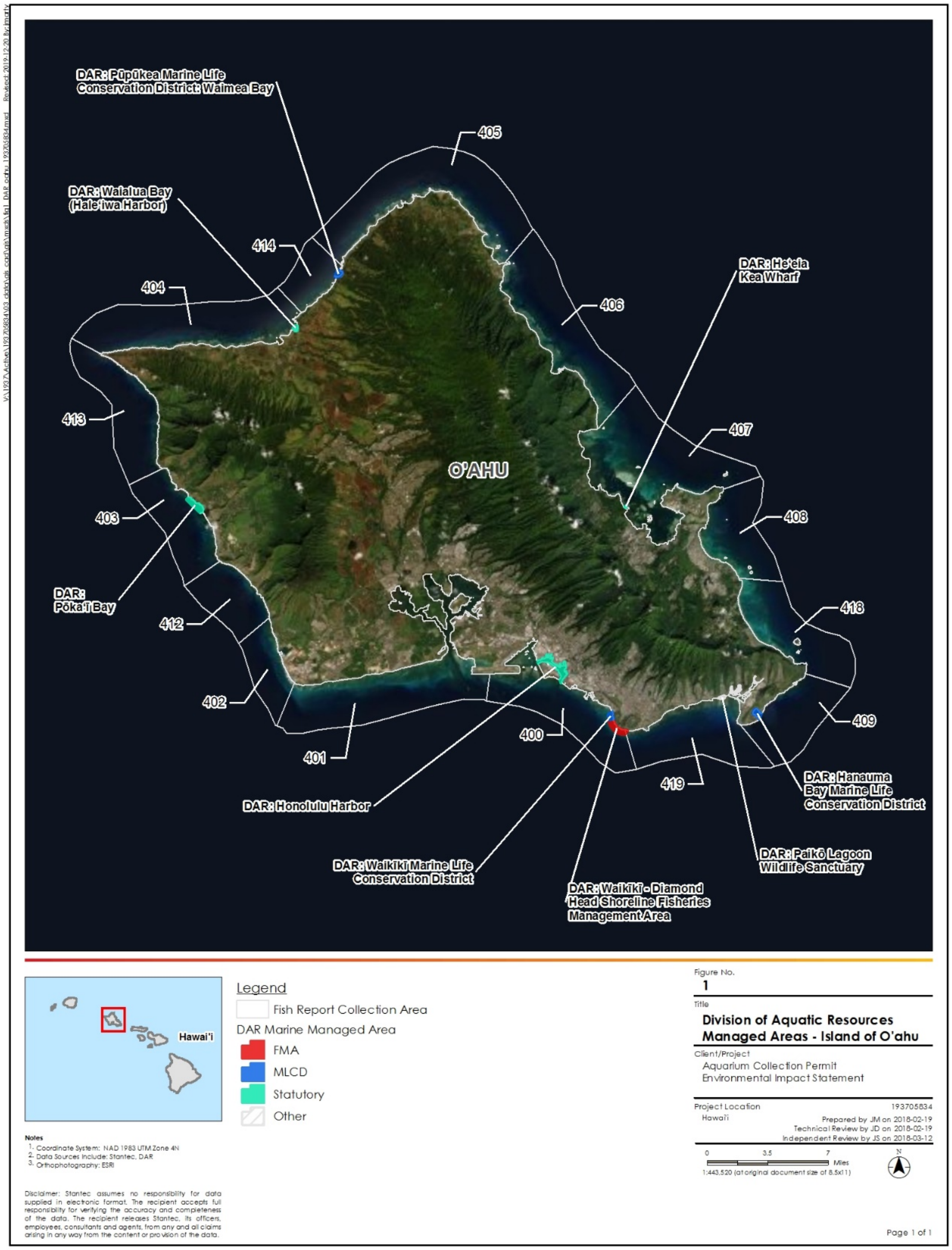


Figure 1. Division of Aquatic Resources Managed Areas – Island of O'ahu.

On October 27, 2017, the circuit court ruled that, based upon the Supreme Court of Hawai'i's opinion, existing permits for use of fine mesh nets to catch aquatic life for aquarium purposes are illegal and invalid. The circuit court ordered the DLNR not to issue any new Aquarium Permits pending environmental review. The DLNR has not issued new or additional permits under HRS §188-31 since the Supreme Court's opinion issued in September of 2017 (DAR 2017).

1.1.2 Previous HEPA Documents

PIJAC initially prepared and submitted an EA on April 8, 2018, evaluating the impacts of issuance of Aquarium Permits on the island of O'ahu programmatically to any applicant over a 12-month analysis period. In accordance with HEPA, the Draft EA was circulated for public review and comment through publication in The Environmental Notice and was also distributed via copies or email to a variety of elected officials, federal agencies, state, county and local offices, and individuals and organizations. Public comments were accepted during a 30-day period following publication. A total of 836 responses were received: 435 supported the conclusions of the DEA and issuance of Aquarium Permits; 398 did not support the conclusions of the DEA and opposed issuance of Aquarium Permits; and 3 did not express support or opposition. Comments received during the comment period were taken into account in assessing impacts of the proposed action and resulted in some modifications in the Final EA, which are also reflected in this EIS. Responses to comments on the DEA can be found in Appendix B of the Final EA[1].

In the cover letter for the publication of the DEA, the DLNR requested comment on four specific issues:

1. The effects of the Commercial Aquarium Fishery on Flame Wrasse (*Cirrhilabrus jordani*) and Yellow Tang (*Zebrasoma flavescens*) and the estimated rate of annual take.
2. The adequacy of the analysis presented in the DEA, including but not limited to removal and replenishment rates for vulnerable species; specifically, how is the estimated sustainable range of 5% to 25% annual take of the estimated total population arrived at, and should the threshold be 5% or 25%.
3. The interpretation of data presented in the DEA, including the analysis of NOAA NMFS Coral Reef Ecosystem Project (CREP) data versus DLNR Division of Aquatic Resources West Hawai'i Aquarium Project (WHAP) data.
4. Conservation measures to minimize or avoid impacts to target species, and specifically, whether other alternatives might be proposed to minimize or avoid impacts other than the two presented of no action, with no Aquarium Permits issued, and the preferred alternative of programmatic issuance of Aquarium Permits for the Island of Oahu - such as consideration of specific management measures for Flame Wrasse, Yellow Tang, or other species.

The Applicant's responses to the request for comment along with an independent scientific reviewer's comments on the responses are found in Appendix D of the Final EA. After review of the Final EA, the DLNR determined on July 26, 2018, that preparation of an EIS is required, based on the significance criteria

[1] http://oeqc2.doh.hawaii.gov/EA_EIS_Library/2018-08-08-OA-FEA-EISPN-Oahu-Commercial-Aquarium-Permits.pdf

outlined in Title II, Chapter 200, Hawai'i Administrative Rules[2]. Specifically, the DLNR requested further analysis related to five specific significance criteria:

- Significance Criteria #1 - Is the annual take of cumulative numbers of fish as a percentage of the estimated population an irrevocable loss or destruction of said populations?
- Significance Criteria #2 - To what extent does the take of aquarium fish curtail the use of the environment, including:
  - Aquatic invasive algae control
  - Tourism industry
  - Integrity of diverse aquatic ecosystems
- Significance Criteria #3 - Does the take of aquarium fish conflict with the state's long-term environmental goals?
- Significance Criteria #4 - To what extent does the take of aquarium fish impact cultural practices in the state?
- Significance Criteria #8 - What is the cumulative impact of the take of aquarium fish when combined with:
  - Commercial take of aquarium fish using other legal methods
  - Recreational take of aquarium fish
  - Commercial and non-commercial take of aquarium fish for consumption (particularly the Achilles Tang and Kole)

1.2 RELEVANT POLICIES AND CONTROLS

1.2.1 Hawai'i Revised Statute (HRS) 188-31

Hawai'i Revised Statute (HRS) §188-31 (2013; Title 12 – Conservation and Resources; 188 – Fishing Rights and Regulations; 188-31 – Permits to take aquatic life for aquarium purposes) states that:

> (a) *Except as prohibited by law, the department, upon receipt of a written application, may issue an aquarium fish permit, not longer than one year in duration, to use fine meshed traps, or fine meshed nets other than throw nets, for the taking of marine or freshwater nongame fish and other aquatic life for aquarium purposes.*

[2] https://governor.hawaii.gov/wp-content/uploads/2018/07/Final-EA-NOD-Aquarium-Permits-Oahu-7-26-18.pdf

(b) *Except as prohibited by law, the permits shall be issued only to persons who can satisfy the department that they possess facilities to and can maintain fish and other aquatic life alive and in reasonable health.*

(c) *It shall be illegal to sell or offer for sale any fish and other aquatic life taken under an aquarium fish permit unless those fish and other aquatic life are sold alive for aquarium purposes. The department may adopt rules pursuant to HRS chapter 91 for the purpose of this section.*

1.2.2 Hawai'i Environmental Policy Act[3]

The HEPA requires that State agencies consider the impact of governmental actions on the environment because humanity's activities have broad and profound effects upon the interrelations of all components of the environment, and an environmental review process would integrate the review of environmental concerns with existing planning processes of both the State and county governments. The HEPA includes the following statutes and administrative rules: a) HRS Chapter 343, Environmental Impact Statements; b) Hawai'i Administrative Rule (HAR) 11-200, Environmental Impact Statement Rules; c) HAR 11-201, Environmental Council Rules of Practice and Procedure (OEQC 2012).

The authorities governing the HEPA process include:

1. The text of the statute (Chapter 343, HRS) and its implementing administrative rules (Chapters 11-200, and 11-201, HAR, Department of Health;

2. The State Environmental Policy (Chapter 344, HRS);

3. The enumerated and written advisory opinions of the Attorney General of the State of Hawai'i;

4. The declaratory rulings of the Environmental Quality Commission (EQC) and the Environmental Council (EC); and,

5. The appellate rulings of the Intermediate Court of Appeals and the Supreme Court of the State of Hawai'i.

The HEPA process also alerts decision makers to significant environmental effects that may result from the implementation of certain actions (HRS 343-1). The specific instances when a proposing agency or an approving agency must prepare an EA (for an action not declared exempt under Section 11-200-8, HAR) derive from Section 343-5(a) HRS and are listed in Table 1-1.

[3] The HEPA was updated in August 2019, however, the EISPN for this DEIS was published on August 8, 2018, prior to the adoption of the new rules. Therefore, as per the new rules, the previous HEPA regulations apply to this DEIS.

Table 1-1. Statutory triggers for Hawai'i Environmental Policy Act (HEPA).

	Instances	Responsible Agency
1.	Use of State or County lands or use of State or County funds, other than funds to be used for feasibility or planning studies for possible future programs or projects that the agency has not approved, adopted, or funded, or funds to be used for the acquisition of unimproved real property; provided that the agency shall consider environmental factors and available alternatives in its feasibility or planning studies; provided further that an EA for proposed uses under Section 205-2(d)(11) or 205-4.5(a)(13) shall only be required pursuant to Section 205-5(b).	The agency with title to the land or is using funds.
2.	Use of any land classified as conservation district by the state land use commission under Chapter 205.	Office of Conservation and Coastal Lands of the DLNR.
3.	Use within a shoreline area as defined in Section 205A-41. The shoreline area in question is defined by county ordinance and consists of a predetermined distance going inland from the certified shoreline. In the City and County of Honolulu, this is forty-feet.	The respective county planning department.
4.	Use within any historic site as designated in the National Register or Hawai'i Register, as provided for in the Historic Preservation Act of 1966, Public Law 89-665, or Chapter 6E.	The respective county planning department.
5.	Use within the Waikiki area of O'ahu, the boundaries of which are delineated in the land use ordinance as amended, establishing the "Waikiki Special District".	The Department of Planning and Permitting of the City and County of Honolulu.
6.	Any amendments to existing county general plans where the amendment would result in designations other than agriculture, conservation, or preservation, except actions proposing any new county general plan or amendments to any existing county general plan initiated by a county.	The respective county planning department.
7.	Any reclassification of any land classified as a conservation district by the state land use commission under Chapter 205.	The Land Use Commission, except in cases involving less than fifteen-acres (which cases are processed by the respective county planning department).
8.	Any construction of new or the expansion or modification of existing helicopter facilities within the State, that may affect: A. Any land classified as a conservation district by the state land use commission B. A shoreline area C. Any historic site as designated in the National Register or Hawai'i Register	The respective county planning department where the project is located processes the clearance of this trigger.
9.	Propose any: A. Wastewater treatment unit, except an individual wastewater system or a wastewater treatment unit serving fewer than fifty single family dwellings or the equivalent B. Waste-to-energy facility C. Landfill D. Oil refinery E. Power-generating facility	The agencies of the State or County government that issue discretionary approvals for the listed items.

The Supreme Court of Hawai'i ruled (SCWC-13-0002125) that an environmental review of the Aquarium Permit process is warranted based on the first (use of state lands) and second (use of conservation districts) statutory triggers identified in Table 1-1.

Actions that do not fall under one of the triggers are excluded by statute from the HEPA process. Any action that is not excluded by statute must undergo the HEPA environmental review process (OEQC 2012). The analysis within an EA is used to determine whether the impact on the environment will be significant enough to warrant the preparation of a full EIS or will be used to declare a Finding of No Significant Impact (FONSI) thus clearing the HEPA process.

In most cases, an agency determines that an action may have a significant impact on the environment and require an EIS if it meets any of the following 13 criteria:

1. Involves an irrevocable commitment to loss or destruction of any natural or cultural resource;
2. Curtails the range of beneficial uses of the environment;
3. Conflicts with the state's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders;
4. Substantially affects the economic or social welfare of the community or State;
5. Substantially affects public health;
6. Involves substantial secondary impacts, such as population changes or effects on public facilities;
7. Involves a substantial degradation of environmental quality;
8. Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions;
9. Substantially affects a rare, threatened, or endangered species, or its habitat;
10. Detrimentally affects air or water quality or ambient noise levels;
11. Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters;
12. Substantially affects scenic vistas and view planes identified in county or state plans or studies; or
13. Requires substantial energy consumption.

Since its inception, the HEPA process has bifurcated into two separate procedural tracks (OEQC 2012):

1. Agency actions (set forth in Section 343-5(b), HRS); refers to those proposed by a government agency; and

2. Applicant actions (set forth in Section 343-5(c), HRS); refers to those that are initiated by a private party and “triggers” an environmental review.

The need for this DEIS is based on the proposed action (i.e. DLNR issuance of 20 Aquarium Permits) and the agency determination that an EIS is required due to possible significant impacts on the environment.

The environmental review process described in the findings and purpose section of Chapter 343, HRS, necessitates integrating citizen concerns into the planning process and forewarning decision makers of potential significant environmental effects should implementation take place. The Hawai’i Office of Environmental Quality Control (OEQC) finds that the process of reviewing environmental effects is desirable because environmental consciousness is enhanced, cooperation and coordination are encouraged, and public participation during the review process benefits all parties involved and society as a whole (OEQC 2012).

1.2.3 Hawai’i Administrative Rule §13-77 - O’ahu Aquarium Life Management

The DAR proposed an Administrative Rule (HAR §13-77) for the management of the O’ahu aquarium fishery within 3 nautical miles of the O’ahu shoreline. The rule proposal was developed by commercial aquarium fishers from O’ahu and presented to DAR in August 2011. A Public Hearing on the proposed rule was held on December 5, 2012. The Administrative Rule was adopted on October 24, 2014 and applies to the collection of aquatic life for an aquarium purpose from the waters of O’ahu while using fine or small mesh traps or fine or small mesh nets, but not throw nets. While governing the taking of aquatic life intended for live aquarium displays, HAR §13-77 shall not apply to the use of nets to take aquatic life for food, bait, or other consumptive purposes.

From HAR §13-77:

1. It is unlawful for any person in or on the waters of O’ahu (3 nautical miles from the shore), possessing a small mesh net authorized under a commercial aquarium fish permit or recreational aquarium fish permit, to possess a small mesh net that is more than 30 feet long; provided that 2 or more permittees may join 2 nets, each no more than 30 feet long, for a total net length of no more than 60 feet long; or more than 6 feet in height. Restriction regarding net length and height took effect after July 1, 2015.

2. It is unlawful for any person, while possessing, using, or having used a small mesh net authorized under a commercial aquarium fish permit and in or on the waters of O’ahu, to possess a small mesh net and take or possess a daily bag limit of more than:

    - One hundred (100) Yellow Tang (*Zebrasoma flavescens*);
    - Seventy-five (75) Kole (= Goldring Surgeonfish; *Ctenochaetus strigosus*);
    - Fifty (50) Potter’s Angelfish (*Centropyge potteri*);
    - Fifty (50) Orangespine Unicornfish (= Naso Tang; Clown Tang; *Naso lituratus*);
    - Twenty-five (25) Moorish Idol (*Zanclus cornutus*); or
    - Ten (10) Achilles Tang (*Acanthurus achilles*).

A daily bag limit includes the cumulative number of regulated aquatic life taken or possessed by a person on any day.

3. It is unlawful for any person while possessing, using, or having used a small mesh net authorized under a commercial aquarium fish permit and in or on the waters of O'ahu, to possess a small mesh net and to take or possess more than six of any of the following per day:
   - Yellow Tang less than one and one-half inches in length;
   - Yellow Tang more than five inches in length;
   - Kole more than five inches in length; or
   - Cleaner Wrasse (*Labroides dimidiatus*) of any size.

4. It is unlawful for any person while possessing, using, or having used a small mesh net authorized under a commercial aquarium fish permit and in or on the waters of O'ahu, to take or possess more than two Bandit Angelfish (*Holacanthus arcuatus*) that are longer than five and a half inches in length, per day.

5. It is unlawful for any person while possessing, using, or having used a small mesh net authorized under a commercial aquarium fish permit, to operate a vessel on the waters of O'ahu with:
   - More than the daily bag limits as provided above, and for the number of permittees on board the vessel; or
   - More than three times the number of any daily bag limit, regardless of the number of permittees on board.

6. It is unlawful for any person, while possessing a small mesh net authorized under a commercial aquarium fish permit or recreational aquarium fish permit while in or on the waters of O'ahu, to take or possess any of the following species:
   - Ornate Butterflyfish (*Chaetodon ornatissimus*);
   - Oval Butterflyfish (*Chaetodon lunulatus*); and
   - Reticulated Butterflyfish (*Chaetodon reticulatus*).

1.2.4 Coral/Live Rock Damage

State law prohibits the breaking or damaging, with any implement, any stony coral from the waters of Hawai'i, including any reef or mushroom coral (HAR 13-95-70). It is unlawful to take, break or damage, any implement, any rock or coral to which marine life of any type is visibly attached or affixed (HAR 13-95-71). The taking of sand, coral rubble or other marine deposits is permitted in certain circumstances. The material may not exceed one gallon per person per day, and may be taken only for personal, noncommercial purposes (HRS §171-58.5, §205A-44).

Fines per specimen may be imposed for each damaged coral head or colony less than one square meter in surface area or for a colony greater than one square meter in surface area, each square meter of colony surface area and any fraction remaining constitutes an additional specimen. Penalties for damage to live rock are based on each individual rock or if the violation involves greater than one square meter of bottom area, then the penalty is based on each square meter of bottom area.

No liability shall be imposed for inadvertent breakage, damage, or displacement of an aggregate area of less than one half square meter of coral if caused by a vessel with a single anchor damage incident, in an area where anchoring is not otherwise prohibited, and not more frequently than once per year; or by accidental physical contact by an individual person.

1.2.5 Enforcement/Compliance

Enforcement and compliance are within the purview of the State of Hawai'i. DOCARE is responsible for enforcement activities, and has full police powers to enforce all State laws and rules involving State lands, State Parks, historic sites, forest reserves, aquatic life and wildlife areas, coastal zones, Conservation districts, State shores, as well as county ordinances involving county parks.

Any person violating any provision of this chapter, or any term or condition of any permit issued pursuant to this chapter, shall be guilty o fa petty misdemeanor and penalized as provided by section 187A-13, Hawaii Revised Statutes. This includes, in addition to any other penalties, a fine not less than (1) $250 for a first offense, (2) $500 for second offense, and (3) $1,000 for a third or subsequent offense. These fines shall not be suspended or waived.

In addition to any criminal penalty, any violation of these rules shall also be subject to civil and administrative penalties as provided by section 187A-12.5, Hawaii Revised Statutes. These include the following:

- For violations involving threatened or endangered species, the administrative fines shall be as follows: (1) For a first violation, a fine of not more than $5,000; (2) For a second violation within five years of a previous violation, a fine of not more than $10,000; and (3) For a third or subsequent violation within five years of the last violation, a fine of not more than $15,000.
    - In addition, a fine of up to $5,000 may be levied for each specimen of threatened or endangered aquatic life taken, killed, or injured in violation of subtitle 5 of title 12 or any rule adopted thereunder.
- For all other violations the administrative fines shall be as follows: (1) For a first violation, a fine of not more than $1,000; (2) For a second violation within five years of a previous violation, a fine of not more than $2,000; and (3) For a third or subsequent violation within five years of the last violation, a fine of not more than $3,000.
    - In addition, a fine of up to $1,000 may be levied for each specimen of all other aquatic life taken, killed, or injured in violation of subtitle 5 of title 12 or any rule adopted thereunder.
- Any criminal penalty for any violation of subtitle 5 of title 12 or any rule adopted thereunder shall not be deemed to preclude the State from recovering additional administrative fines, fees, and costs, including attorney's fees and costs. [L 1998, c 243, §1]

2.0 PURPOSE AND NEED

2.1 PURPOSE FOR APPLICANT'S ACTION

The purpose of the Applicant's action is to ensure that commercial aquarium fish collection allows for the lawful, responsible, and sustainable commercial collection of various fish species from nearshore habitats on the island of O'ahu. The objective of the proposed action is to allow for the issuance of Commercial Aquarium Permits to 20 fishers for the island of O'ahu.

2.2 NEED FOR APPLICANT'S ACTION

The need for the Applicant's action is to continue commercial aquarium fishers' livelihoods in compliance with all applicable laws, rules, and regulations pertaining to the industry.

2.3 PURPOSE FOR APPROVING AGENCY'S (DLNR) ACTION

The purpose of an environmental review process under the HEPA is to provide the Approving Agency (DLNR) with the framework necessary for reviewing the Applicant's action and the environmental effects of issuing Aquarium Permits for O'ahu. The HEPA review also provides an opportunity for the public to be involved in the DLNR's decision-making process. The DLNR can also use a properly conducted HEPA analysis to review and improve plans, functions, programs, and resources under its jurisdiction. Furthermore, this DEIS is the mechanism for recording the results of a comprehensive planning and decision-making process surrounding the Applicant's action.

The underlying purpose of the DLNR's action is to determine the level of significance that issuing 20 Aquarium Permits for the island of O'ahu may have on the environment, based on the 13 criteria listed in Section 1.2.2., with emphasis on the 5 criteria the DLNR determined to need further evaluation (Section 1.1.2). The final determination will be either acceptance or non-acceptance.

2.4 NEED FOR APPROVING AGENCY'S (DLNR) ACTION

The need for DLNR's action is the Applicant's submittal of this DEIS, to which the DLNR must respond.

2.5 SCOPE OF ANALYSIS

The scope of this DEIS's analysis incorporates accepted methods, regulations, and historical data to determine past influences the commercial aquarium fishery and its management have had on resources, including socioeconomic, cultural, and biological resources, in order to evaluate the potential direct, indirect, and cumulative impacts that the four alternatives presented in Section 3.0 would have annually over a 5-year period for the island of O'ahu. Regarding biological resources, this DEIS focuses primarily on the effects of aquarium fishing on wild populations of fish species, as it is at the population level that DAR measures changes in fish species and makes management decisions (e.g., issuance of harvest permits, implementation of bag limits). Therefore, because population effects have already occurred once an individual fish has been removed from the ocean, it is beyond the scope of this analysis to evaluate effects on individual fish once they are removed from the population; nevertheless, post-collection mortality is discussed as an indirect effect in Section 5.4.2.

Commercial Aquarium Permits issued by DLNR under HRS §188-31 are valid for no longer than one year and, therefore, must be renewed annually. Accordingly, every year, DLNR must take an action to issue Commercial Aquarium Permits. As Aquarium Permits for the 20 fishers who would be issued Aquarium Permits under the Proposed Action come up for renewal each year, DLNR will evaluate whether there are significant new circumstances or information relevant to environmental concerns and bearing on the commercial aquarium fishery or its impacts requiring a supplemental HEPA review. Under this approach, any changes in resource data (e.g., increase or decrease in collection numbers, unforeseen circumstances, etc.) would be addressed, as necessary, by supplemental HEPA documents, allowing for the HEPA process to quickly recognize and address any potential issues (i.e., adaptive management). Section 5.0 addresses the cumulative impacts of reasonably foreseeable future commercial aquarium collection.

2.5.1 Resources Evaluated and Dismissed from Further Consideration

This DEIS evaluates the impacts of four commercial aquarium fish collection alternatives on the nearshore habitat (3 nautical miles from shore) in which commercial aquarium fishing (or lack thereof) will take place, over a 5-year period. During the evaluation process, it was determined that some resources typically evaluated in an EIS will not be impacted by any of the alternatives under consideration. The evaluation includes past use and potential impacts by the commercial aquarium fishery because it has been a part of the baseline condition of these resources since the late 1940s. Because a significant increase in commercial aquarium fishing is not anticipated during the 5-year assessment period evaluated in this DEIS, and in fact a decrease when compared to historic conditions is anticipated due to the issuance of only 20 Aquarium Permits, this DEIS does not anticipate a significant change in the current baseline condition of these resources.

The proposed action and resulting commercial aquarium collection does not include any activities different from or in addition to those that have occurred in the past. There will be no construction of permanent or semi-permanent infrastructure, no discharges into coastal, surface or ground waters, and no dredging, and no significant use of hazardous materials that could be released into the environment.

The DLNR's issuance of 20 Aquarium Permits is not anticipated to result in significant beneficial or adverse impacts to water and air quality, geology and soil resources, aesthetics, noise, vegetation, terrestrial wildlife and avian species, threatened and endangered species, land use, public health and safety, communications, transportation, utilities, or population and demographics from the current baseline condition; therefore, these resources will not be evaluated further.

2.5.2 Resources Retained for Further Analysis

The following resources could be impacted by the alternatives under consideration. Current baseline conditions of these resources are presented in Section 4.0 and impacts to these resources are evaluated in Section 5.0 of this DEIS:

- Socioeconomic Resources
- Cultural Resources
- Biological Resources
  - Top 20 O'ahu Collected Species
  - Other Regulated Species
  - Hawai'i Species of Greatest Conservation Need (with a history of aquarium collection)
  - Invertebrate Species
  - Reef Habitat
  - Invasive Species

3.0 ALTERNATIVES

Reasonable alternatives include those that are practical or feasible from cultural, scientific, technical, and economic perspectives. The HEPA recommends that applicants consider and objectively evaluate reasonable alternatives to the preferred alternative and briefly explain the basis for eliminating any alternatives that were not retained for detailed analysis.

The DLNR has been working with stakeholders (e.g., public, various fishing and tourism industries, local governments) since the 1970's, and continues to work with them to ensure the commercial aquarium fishery is environmentally sustainable and prevents degradation of fish populations and the habitats in which they occur. As a result, many aspects of the fishery have changed over the past 40+ years due to the various alternatives recommended by stakeholders and implemented by the DLNR. The Applicant has no legislative or regulatory authority and cannot create, eliminate, or alter conservation areas (e.g., MLCDs); create, eliminate, or alter current regulations (e.g., bag and size limits, season length, permit term); or change reporting requirements. Despite this, during the public comment period on the Draft EA that was published on April 8, 2018, in response to DNLR concerns and in coordination with the DNLR, the Applicant developed an alternative, that required regulation creation by DLNR (i.e. implementation of bag limits). After review of the FEA, the DLNR determined on July 26, 2018 that preparation of an EIS is required based on five specific significance criteria outlined in Title II, Chapter 200, Hawai'i Administrative Rules (Criteria 1,2,3,4, and 8, see Section 1.1.2). Based on DNLR comments on the Draft and Final EAs, the Applicant has analyzed four alternatives in the EIS, including a new Preferred Alternative.

These alternatives were evaluated based on their capacity to meet the purpose and need of the Approving Agency's action (Section 2.3 and 2.4). The potential impacts on the environment of each alternative are described and analyzed in Section 5.0; Environmental Consequences. The alternatives are summarized in Table 3-1 and discussed in detail in Sections 3-1 through 3-4.

Table 3-1. Summary of alternatives.

Alternative	Summary
No Action	No Aquarium Permits issued; commercial collection allowed without the use of fine mesh nets
Pre-Aquarium Collection Ban	Unlimited # of Aquarium Permits issued

Alternative	Summary
Expanded Waikiki MLCD and Flame Wrasse Conservation	Unlimited # of Aquarium Permits issued; bag limit reduced for Flame Wrasse, expansion of the Waikiki MLCD
Limited Permit Issuance (Preferred)	20 Aquarium Permits issued; bag limit reduced for Flame Wrasse, expansion of the Waikiki MLCD

3.1 NO ACTION ALTERNATIVE

Under the No Action Alternative, the court order would remain in place and no Aquarium Permits would be issued for the state of Hawai'i, including the island of O'ahu. The No Action Alternative meets the DLNR's objectives to ensure an applicant's actions do not lead to degradation of fish populations and the habitats in which they occur in the context of commercial aquarium collection alone (i.e., does not address impacts from other Hawaiian fisheries, and influences discussed in Sections 4.0 and 5.0). Under the No Action Alternative, Aquarium Permits would not be issued for the state of Hawai'i, which includes the island of O'ahu, and commercial collection of aquarium fish would no longer occur using fine mesh nets. Aquarium collection using legal gear or methods other than fine-mesh nets would continue. However, the No Action Alternative does not meet the Applicant's purpose and need to continue fishers' livelihoods participating in lawful, responsible, and sustainable commercial collection of fish species from nearshore habitats (3 nautical miles from the shore).

3.2 STATUS QUO ALTERNATIVE

Under the Pre-Aquarium Collection Ban Alternative, the DLNR would issue an unlimited number of Aquarium Permits, as was done prior to the September 6, 2017 Supreme Court ruling, thereby allowing commercial aquarium fish collection using fine mesh nets on the island of O'ahu, to resume. It is assumed that, upon issuance of an Aquarium Permit, a permit condition would be included in each permit limiting the geographic area covered by the permit to the island of O'ahu. Permittees would abide by all existing rules and regulations set forth in HRS-188-31 (Section 1.2.1), governing Aquarium Permit use. For the island of O'ahu, these rules and regulations include restrictions on equipment, restrictions on access to various areas, bag limits on various collected fish species, and reporting requirements (Section 1.2.3).

3.3 EXPANDED WAIKIKI MLCD AND FLAME WRASSE CONSERVATION ALTERNATIVE

Under the Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative, the DLNR would issue an unlimited number of Aquarium Permits, as was done prior to the September 6, 2017 Supreme Court ruling, thereby allowing commercial aquarium fish collection using fine mesh nets on the island of O'ahu to resume. It is assumed that, upon issuance of an Aquarium Permit, a permit condition would be included in each permit limiting the geographic area covered by the permit to the island of O'ahu. Permittees would abide by all existing rules and regulations set forth in HRS-188-31 (Section 1.2.1), governing Commercial Aquarium Permit use. For the island of O'ahu, these rules and regulations include restrictions on equipment, restrictions on access to various areas, bag limits on various collected fish species, and reporting requirements (Section 1.2.3).

In addition to the existing rules and regulations, a conservation measure in the Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative would expand the Waikiki MLCD northward to the southern tip of DAR's Honolulu Harbor Kapalama Canal Fish Management Area (Figure 2). The current Waikiki MLCD covers approximately 77.3 acres (31.3 hectares). The area proposed in the Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative expands this MLCD by 740 acres (299.5 hectares) to 817.3 acres, more than 10.5 times the size of the current Waikiki MLCD. In addition, the current Waikiki MLCD is bordered to its south by the Waikiki-Diamond Head Shoreline Fisheries Management Area (WDHSFMA) covering approximately 239 acres (96.7 hectares). The WDHSFMA is open to fishing (with restrictions) in even numbered years only. Within the expanded Waikiki MLCD, no commercial aquarium fish collection would occur; however, no restrictions would be placed upon other fisheries (e.g., commercial, recreational).

An additional conservation measure in the Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative would limit the commercial aquarium collection of Flame Wrasse to 10 individual fish per day.

3.4 LIMITED PERMIT ISSUANCE ALTERNATIVE

Under the Limited Permit Issuance Alternative, the DLNR would issue Aquarium Permits to 20 aquarium fishers in O'ahu, thereby allowing these 20 individuals to resume commercial aquarium fish collection on O'ahu. It is assumed that, upon issuance of an Aquarium Permit, a permit condition would be included in each permit limiting the geographic area covered by the permit to the island of O'ahu. Permittees would abide by all existing rules and regulations set forth in HRS-188-31 (Section 1.2.1), governing Commercial Aquarium Permit use. For the island of O'ahu, these rules and regulations include restrictions on equipment, restrictions on access to various areas, bag limits on various collected fish species, and reporting requirements (Section 1.2.3).

In addition to the existing rules, under this Alternative, the daily bag limit for commercial aquarium collection of Flame Wrasse would be limited to 10 individuals per day, and the Waikiki MLCD would be expanded northward to the southern tip of DAR's Honolulu Harbor Kapalama Canal Fish Management Area (Figure 2), as described in Section 3.3.

The Preferred Alternative is based on the best available science, supports the DLNR's purpose to ensure Applicant's Actions do not lead to degradation of fish populations and the habitats in which they occur in the context of commercial aquarium collection, and supports the Applicant's purpose and need to continue fishers' livelihoods participating in the lawful, responsible, and sustainable commercial collection of various fish species from nearshore habitats.

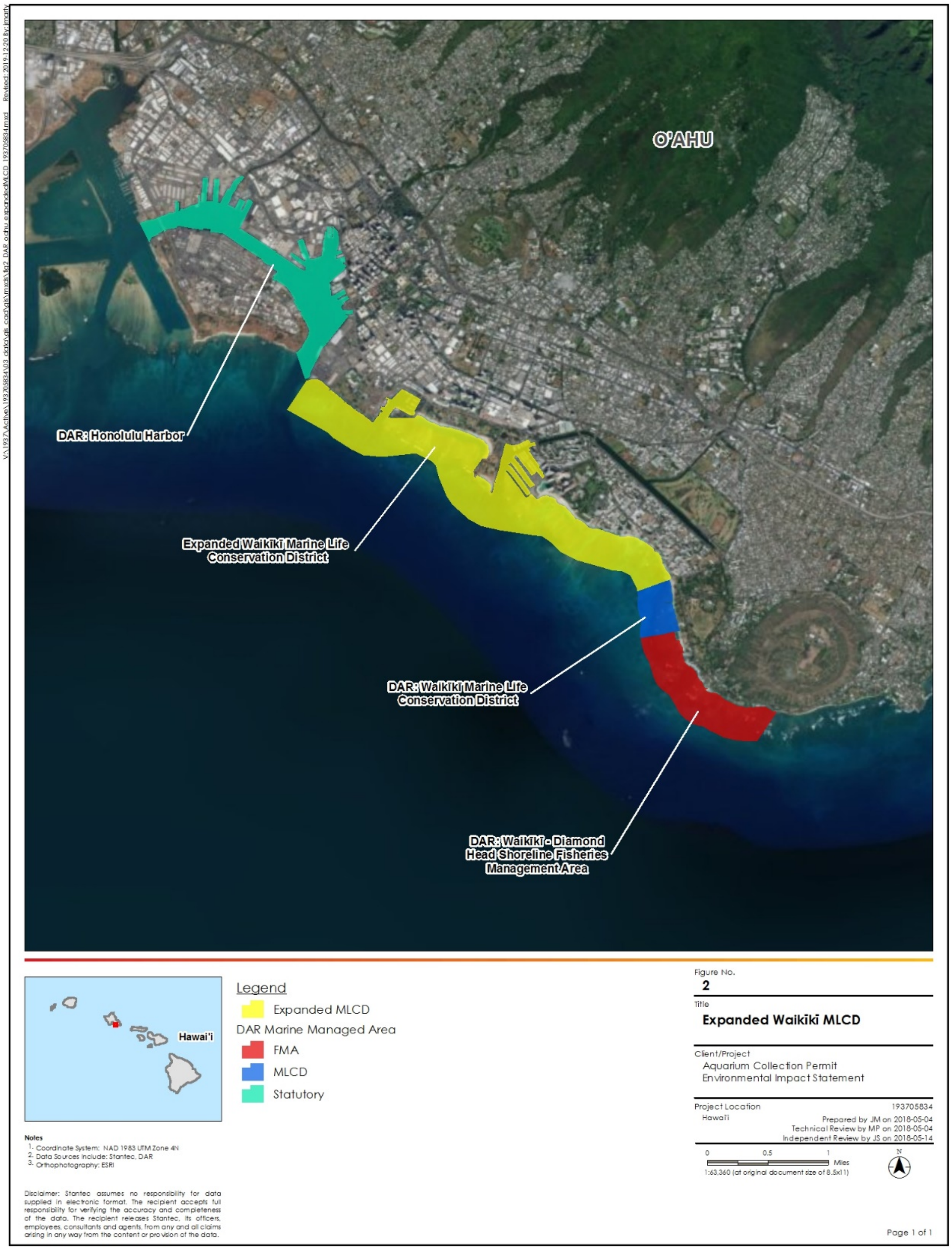


Figure 2. Expanded Waikiki MLCD.

3.5 ALTERNATIVES CONSIDERED BUT DISMISSED

The following alternatives were considered but dismissed from further consideration:

- Full moratorium on commercial aquarium collection
    - This alternative was dismissed because it does not meet the Applicant's need to continue commercial aquarium fishers' livelihoods in compliance with all applicable laws, rules, and regulations pertaining to the industry. Furthermore, the Applicant does not have the authority to stop the DAR from issuing CML to fishers for O'ahu. Therefore, the No Action Alternative includes continued collection of aquarium fish in O'ahu using gear/methods other than fine mesh nets.
- Creation of species-specific bag limits
    - This alternative was dismissed because the best available data on what is considered to be sustainable reef fish harvest suggests that 5% to 25% of populations is sustainable for similar reef species (Ochavillo and Hodgson 2006). Collection of the fish species analyzed in this EIS would impact less than 2.5% of the island-wide populations of 20 species. For the 2 remaining species with population estimates available (Yellow Tang and Flame Wrasse), the Preferred Alternative includes bag and/or size limits.
- Moratorium on collection of herbivores
    - This alternative was dismissed for the same reasons that the creation of species-specific bag limits was dismissed (i.e., collection is below the lower end of the sustainable threshold for 20 species, and bag and/or size limits would be implemented under the Preferred Alternative for the remaining 2 species). In addition, research on the island of Hawai'i shows that commercial aquarium collection is not causing declines in herbivores. The DAR (2019a) reported that herbivore biomass has not changed since 2003 in areas open to commercial aquarium collection, and while not significant, there has been an increasing trend, with a 26.0% increase in herbivore biomass in Open Areas between 2003 and 2017 (DAR 2019a, Gove et al. 2019).
- Moratorium on collection of Species of Greatest Conservation Need (SGCN)
    - There are three SGCN that are in the top 20 collected species or otherwise regulated on O'ahu, Psychedelic Wrasse (*Anampses chrysocephalus*) [see Section 4.4.4.16], Fisher's Angelfish (*Centropyge fisheri*) [see Section 4.4.4.20], and Bandit Angelfish (see Section 4.4.5.2]. Collection of Psychedelic Wrasse and Fisher's Angelfish would be below 0.8% of the island-wide population estimates under any of the alternatives under consideration, which is below the lower end of the 5% to 25% sustainable threshold (Ochavillo and Hodgson 2006). The Bandit Angelfish ranks as the 47th most collected fish since 2000, making up 0.38% (4,866 individuals) of the total fish collection, averaging 209 collected each year. While there are regulations pertaining to this species in HAR §13-77, they only

restrict the number of fish greater than 5.5 inches in length, and not the overall collection. A population estimate for Bandit Angelfish is not available from the CREP data due to the species'' deep-water habits, and as discussed in Section 4.4.5.2, Kane and Tissot (2017) also reported the deep-water habits of the Bandit Angelfish, and their research illustrates that the vast majority of the Bandit Angelfish population occurs at depths below the CREP survey depth. This species is generally only collected at depths at which normal recreational diving does not occur. Due to the complexity and difficulty of collecting the Bandit Angelfish, its population will likely continue to not receive significant pressure from the commercial aquarium fishery. As noted in Section 4.4.5.2, the overall global population is considered stable (Pyle et al. 2010b). Historic collection data on 23 additional SGCN species is provided in Appendix B. This alternative was dismissed because the two SGCN species which are in the top 20 collected species are not anticipated to experience significant population declines as a result of commercial aquarium collection under any of the alternatives under consideration, commercial aquarium collection of the Bandit Angelfish is already regulated, and collection of the remaining SGCN species has historically been low, and is anticipated to be even lower under the Preferred Alternative.

- Moratorium on species experiencing population declines
  - This alternative was dismissed because it is unknown which, if any, species are experiencing population declines, as population trend data is not available for the fish species analyzed in this EIS for the island of O'ahu. Therefore, this alternative could not be meaningfully developed or analyzed.

4.0 AFFECTED ENVIRONMENT

The affected environment is the area and its resources (i.e., socioeconomic, cultural, physical, biological) potentially impacted by the proposed action and the alternatives under consideration. The purpose of describing the affected environment is to define the current baseline of conditions in which the impacts will occur. To make an informed decision about which alternative to select, it is necessary to first understand which resources will be affected and to what extent each alternative would result in changes from the baseline. This section attempts to provide the baseline for this understanding. Relative to the proposed action, the affected environment includes nearshore habitats (3 nautical miles from the shore) along the island of O'ahu.

Commercial aquarium fish collection has occurred in Hawaiian waters since the late 1940s. In 1953, the territorial government of Hawai'i enacted Act 154, which authorized the Board of Agriculture and Forestry to establish a permit system for the use of fine-mesh nets and traps for the taking of aquarium fish (DAR 2014a). Beginning in 1973, collectors were required to report their monthly catch on a detailed aquarium fish catch report. As of 2014, Aquarium Permit holders are required to keep daily trip reports and submit on a monthly basis. The number of permitted commercial aquarium fishers reporting statewide for the period 2000 to 2017 ranged from 61 - 99 (DAR 2018a); however, the number of commercial aquarium permits issued ranged from 113 – 226 (DAR 2018a). For the island of O'ahu, the number of permitted commercial aquarium fishers reporting catch ranged from 28-52 for the same time-period (DAR 2018a). The 20 commercial fishers who are part of this proposed action made up 3 to 16 of the fishers in any given year from 2000 – 2017. Permitted commercial aquarium fishing has been a part of the socioeconomic, cultural, physical, and biological resources for decades and is considered a part of the baseline condition of the affected environment.

The DLNR's mission statement is to 'Enhance, protect, conserve and manage Hawai'i's unique and limited natural, cultural, and historic resources held in public trust for current and future generations of the people of Hawai'i nei, and its visitors, in partnership with others from the public and private sectors.' In pursuit of this mission, the DLNR has compiled, analyzed, and reported on the many facets of Hawai'i's socioeconomic, cultural, physical, and biological resources that make up the affected environment. The following sections rely heavily on the DLNR's *Hawai'i's Comprehensive Wildlife Conservation Strategy* (CWCS; Mitchell et al. 2005) and the DLNR's Hawai'i's State Wildlife Action Plan (SWAP; DLNR 2015), with numerous other sources cited as appropriate.

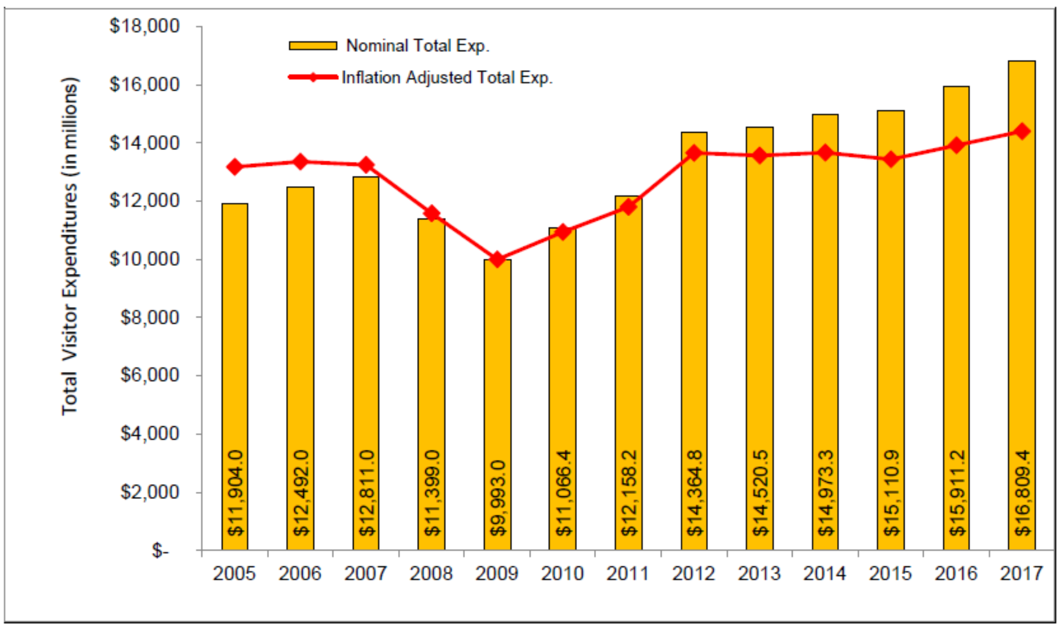
4.1 SOCIOECONOMIC RESOURCES

The state of Hawai‘i has four local governments: the City and County of Honolulu (island of O‘ahu and the Northwestern Hawaiian Islands), the County of Kaua‘i (islands of Kaua‘i and Ni‘ihau), the County of Maui (islands of Maui, Moloka‘i, Lāna‘I, and Kaho‘olawe), and the County of Hawai‘i (island of Hawai‘i). Hawai‘i also has a fifth county, Kalawao County, which does not have a separate government unit (Mitchell et al. 2005). Kalawao County covers the former Hansen's disease settlement at Kalaupapa (Moloka‘i) and is managed by the National Park Service (NPS) under a cooperative agreement with the State Department of Health (Mitchell et al. 2005).

The population of the State of Hawai‘i was estimated at 1,420,491 in 2018, with the majority (69%) found in the County of Honolulu, which includes the island of O'ahu (980,080) (HDBEDT 2019). The over nine million visitors in 2017 included over 5.5 million visitors to O'ahu, and contributed an additional average of over 105,141 people per day on O‘ahu (HTA 2018).

Much of the state's economy is based on the island's coastal and marine resources. Tourism accounts for the majority of the state's economy, with a significant portion of the tourist activities associated with beaches and marine wildlife (DLNR 2015). Coastal development and land values have both increased with the growth in tourism. In 2002, the Hawai‘i Coral Reef Initiative funded a study regarding the economic valuation of the coral reefs of Hawai‘i, where the value of coral reefs to the Hawai‘i economy was estimated to be about $380 million dollars per year (DLNR 2015). In 2001, Cesar et al. documented the annual recreational value of the coral reefs of the Hawaiian reefs for snorkelers and divers was estimated to be $281 million and $44 million, respectively. Although the direct expenditure per diver is much larger than the direct expenditures of snorkelers, the overall value related to the latter group is much larger due to their large numbers. According to the 2019 National Oceanic and Atmospheric Administration (NOAA) Report on the Ocean and Great Lakes Economy of the United States, in 2016 (most recent data), Hawai‘i employed 647,544 people and generated $31.2 billion in wages and $84.9 billion in gross domestic product. Hawai'i's ocean economy then employed 118,083 people and generated $4.5 billion in wages and $8.6 billion in gross domestic product. The ocean economy accounted for 18.2% of Hawaii's employment, 14.3% of its wages, and 10.2% of its gross domestic product (NOAA 2019). Commercial fish landings in Hawai‘i have increased annually since 2006 and NOAA reported total landings in 2013 were valued near $108 million dollars (DLNR 2015).

Hawai‘i’s tourism industry achieved new records in total visitor spending and visitor arrivals in 2017, marking the sixth consecutive year of record growth in both categories. Total spending by visitors to the Hawaiian Islands increased 5.6% to a new high of $16.21 billion (HTA 2018). When adjusted for inflation, total visitor spending was up 3.5% from 2016 (Figure 3). A total of 9,404,346 visitors came by air or by cruise ship to the state, up 5.3% from the previous record of 8,934,277 visitors in 2016. Total visitor days rose 4.8% compared to 2016. The average spending per day by these visitors ($198 per person) was also higher than 2016 ($197 per person; HTA 2018).



Note: Implicit price deflator (2009=100)
Source: 2017 State of Hawai‘i Data Book Table 7.35.

Figure 3. Total visitor spending: nominal and real 2005-2017 (HTA 2018).

Arrivals by airlines in 2016 grew 3% compared to 2015, to 8,821,802 visitors. Additionally, there were 112,475 visitors who came to the islands by cruise ship, but this was down 3.5% from 2015 due to fewer out-of-state cruise ships that visited the islands (HDBEDT 2017).

Total Spending by Category (HTA 2018):

- Lodging was the largest spending category by visitors to Hawai’i, rising 3.4% to $6.96 billion and making up 41.4% of the total visitor spending in 2017.
- Food and beverage was the second largest category, increasing 6.4% to $3.48 billion (20.7%) of total visitor spending in 2017.

- Shopping expenses rose 5.0% to $2.36 billion.
- Transportation expenditures rose 7.9% to $1.67 billion.
- Entertainment and recreation spending rose 10.8% to $1.57 billion.
- Supplemental business spending grew 5.9% to $125.1 million. This includes additional business spending spent locally on conventions and corporate meetings by out-of-state visitors that were not included in personal spending (i.e., costs on space and equipment rentals, transportation, etc.).

The military has a significant presence in Hawaiʻi with large Naval installations located on estuarine and coastal areas such as Pearl Harbor and Kāneʻohe Bay on Oʻahu, the Pacific Missile Range Facility on the south shore of Kauaʻi, and the Pōhakuloa Training Area on Hawai'i Island the largest United States Department of Defense installation in the state of Hawai'i, or anywhere in the Pacific.

The history of Hawai'i has always included agriculture, and it continues to be an important industry, adding $2.9 billion to the state's annual economy, and providing 42,000 direct and indirect jobs (HDA 2013). The sugar and pineapple industries boomed during the plantation era, covering thousands of acres of prime agricultural lands. As these industries have been declining, these lands are being converted to smaller farms growing diversified agricultural product (HDA 2013). Specialty exotic fruits, coffee, macadamia nuts, flowers and foliage are examples of crops that have become major exports to destinations around the globe, as well as providing fresh produce and flowers to local Hawaiian markets. High-tech aquaculture ventures have evolved from the early fishponds, farming varieties of fish, shrimp, lobster, abalone, and seaweed (HDA 2013).

4.1.1 Socioeconomic Aspects of the Commercial Aquarium Fishery

Early aquarium collectors operated almost exclusively in the nearshore waters along the leeward coast of O'ahu, utilizing rudimentary equipment for collecting (Stevenson et al. 2011). Today, commercial aquarium fishers on the island of O'ahu often perform day trips, or operate individually or with a partner, using more advanced equipment such as self-contained underwater breathing apparatus (SCUBA) and synthetic hand nets (nets used to exclude, contain, or direct fish) to capture fish (Stevenson et al. 2011). Most aquarium fishers are between the ages of 30 and 60 years, have remained active in the fishery for more than 20 years, and fish approximately 2–3 days per week (Stevenson et al. 2011). As throughout the state, O'ahu fishers are required to report their monthly catch on an aquarium fish catch report separate from, and more detailed than, the Commercial Marine License (CML) reports. At present, there is no provision for the verification of submitted reports, so any catch numbers and dollar amounts should be regarded as minimum, not absolute values (DAR 2018a).

The commercial aquarium fishery has contributed an average of $2,172,028 (inflation-adjusted 2019 dollars) to the State's economy over the past 18 years (Table 4-1). According to DAR (2019a), the marine aquarium fishery is the most economically valuable commercial inshore fishery in the State of Hawai'i.

Table 4-1. Summary of commercial Aquarium Permits and values by year from 2000-2017 for the State of Hawai'i (DAR 2018a). These data include n.d. data and O'ahu data, as well as the other islands that make up the state of Hawai'i.

Fiscal Year[1]	Number of Commercial Aquarium Permits	Number Reporting	Total Value	Total Value Adjusted for Inflation[2]
2000	113	82	$1,000,750	$1,491,077
2001	128	75	$936,811	$1,357,958
2002	139	63	$935,009	$1,333,497
2003	123	68	$1,174,168	$1,637,269
2004	145	77	$1,442,946	$1,959,863
2005	142	79	$1,579,370	$2,074,862
2006	186	87	$2,093,857	$2,664,797
2007	195	99	$1,646,167	$2,037,015
2008	178	94	$2,065,816	$2,461,779
2009	197	92	$1,894,015	$2,265,107
2010	178	91	$2,282,618	$2,685,794
2011	172	87	$2,188,227	$2,495,946
2012	166	77	$2,306,179	$2,577,152
2013	153	64	$2,172,561	$2,392,786
2014	165	61	$2,322,564	$2,517,161
2015	163	69	$2,502,178	$2,708,609
2016	166	66	$2,257,021	$2,412,789
2017	226	68	$1,932,747	$2,023,037
Average	**163**	**78**	**$1,818,500**	**$2,172,028**

[1]Fiscal year runs from July 1 through June 30.
[2]http://www.usinflationcalculator.com/, adjusted for 2019 values in August 2019.

Since 2000, the commercial aquarium fishery has averaged annual total catch landings (fish and invertebrates) on the island of O'ahu valued at $540,542 (inflation-adjusted 2019 dollars), representing 25% of the state-wide landings described above. Landings on O'ahu have ranged from a low of $211,246 (inflation-adjusted 2019 dollars) in 2003 to a high of $778,491 (inflation-adjusted 2019 dollars) in 2012 (Table 4-2; DAR 2018a). The economic value of fish collected has ranged from 67.2% to 91.1% of the total value, with an average of 79.4%, whereas the economic value of invertebrates has ranged from 6.8% to 31.3% of the total value, with an average of 16.7% (Table 4-2; DAR 2018a).

For the 20 fishers who would be issued commercial Aquarium Permits under the Proposed Action, 3 to 16 fishers reported catch in any given year between 2000 and 2017, contributing from 34.3% to 74.2% of the total overall O'ahu fishery value (Table 4-2).

Table 4-2. Number of Aquarium Permit holders, reports, total catch (fish and invertebrates), and value by year on the island of O'ahu between 2000 and 2017 (DAR 2018a).

Fiscal Year[1]	Number of Commercial Aquarium Permits	Number of Permits Reporting	All Fishers				20 Fishers				
			Fish Value (% of total)	Invertebrate Value (% of total)	Total Value[2]	Total Value Adjusted for Inflation[3]	Fish Value (% of total)	Invertebrate Value (% of total)	Total Value[2]	Percent Contribution of 20 fishers	Total Value Adjusted for Inflation[3]
2000	68	47	$186,592 (76.8%)	$40,220 (16.6%)	$242,856	$362,939	$66,958 (86.3%)	$10,533 (13.6%)	$77,575	31.9%	$115,932
2001	75	39	$141,314 (69.3%)	$55,567 (27.2%)	$203,984	$296,579	$54,481 (77.9%)	$14,699 (21.0%)	$69,981	34.3%	$101,748
2002	72	28	$117,055 (74.4%)	$32,915 (20.9%)	$157,387	$225,141	$57,124 (80.9%)	$13,358 (18.9%)	$70,571	44.8%	$100,951
2003	66	30	$115,503 (76.5%)	$30,734 (20.3%)	$151,039	$211,246	$77,203 (81.8%)	$17,155 (18.2%)	$94,365	62.5%	$131,981
2004	68	39	$233,937 (68.6%)	$103,608 (30.4%)	$341,049	$464,265	$113,943 (88.7%)	$14,478 (11.3%)	$128,439	37.7%	$174,978
2005	76	39	$241,628 (67.2%)	$112,463 (31.3%)	$359,424	$473,612	$150,680 (93.0%)	$11,229 (6.9%)	$161,959	45.1%	$213,413
2006	102	46	$372,229 (76.4%)	$102,273 (21.0%)	$487,187	$621,903	$157,353 (93.0%)	$11,920 (7.0%)	$169,272	34.7%	$216,079
2007	106	50	$344,658 (71.8%)	$129,251 (26.9%)	$480,341	$596,183	$162,611 (95.6%)	$7,556 (4.4%)	$170,166	35.4%	$211,204
2008	85	52	$445,274 (84.7%)	$73,949 (14.1%)	$525,791	$628,464	$218,407 (96.4%)	$8,242 (3.6%)	$226,651	43.1%	$270,910
2009	100	46	$422,842 (83.3%)	$54,249 (10.7%)	$507,860	$609,199	$287,586 (97.1%)	$8,511 (2.9%)	$296,097	58.3%	$355,181
2010	81	45	$475,564 (86.3%)	$54,463 (9.9%)	$550,940	$650,210	$290,922 (96.2%)	$11,403 (3.8%)	$302,325	54.9%	$356,799
2011	81	39	$516,577 (81.8%)	$70,086 (11.1%)	$631,632	$722,631	$365,365 (97.4%)	$9,845 (2.6%)	$375,210	59.4%	$429,267

Fiscal Year[1]	Number of Commercial Aquarium Permits	Number of Permits Reporting	All Fishers				20 Fishers				
			Fish Value (% of total)	Invertebrate Value (% of total)	Total Value[2]	Total Value Adjusted for Inflation[3]	Fish Value (% of total)	Invertebrate Value (% of total)	Total Value[2]	Percent Contribution of 20 fishers	Total Value Adjusted for Inflation[3]
2012	84	41	$578,042 (83.2%)	$76,836 (11.1%)	$694,539	$778,491	$297,987 (96.5%)	$10,714 (3.5%)	$308,710	44.4%	$346,025
2013	71	32	$406,585 (80.0%)	$73,652 (14.5%)	$508,251	$561,461	$314,627 (96.3%)	$12,255 (3.7%)	$326,882	64.3%	$361,104
2014	78	32	$488,314 (82.7%)	$63,785 (10.8%)	$590,659	$642,081	$415,902 (98.4%)	$6,680 (1.6%)	$422,589	71.5%	$459,379
2015	93	42	$622,529 (91.1%)	$46,357 (6.8%)	$683,282	$741,887	$443,709 (98.9%)	$4,707 (1.0%)	$448,429	65.6%	$486,891
2016	92	39	$500,152 (88.8%)	$44,865 (8.0%)	$563,418	$604,121	$297,187 (98.2%)	$5,544 (1.8%)	$302,733	53.7%	$324,604
2017	126	41	$448,258 (87.3%)	$46,669 (9.1%)	$513,723	$539,346	$302,998 (98.5%)	$4,493 (1.5%)	$307,496	59.9%	$322,833
2018[4]	NA	NA	$353,967 (93.5%)	$24,482 (6.5%)	$378,449	$387,852	$278,673 (99.2%)	$2,127 (0.8%)	$280,799	74.2%	$287,776
Average (2000-2017)	**85**	**40**	**$369,836 (79.4%)**	**$67,330 (16.7%)**	**$455,187**	**$540,542**	**$238,153 (96.1%)**	**$9,718 (3.9%)**	**$247,926**	**54.5%**	**$286,174**
Total (2000-2017)	**NA**	**NA**	**$6,657,053 (81.2%)**	**$1,211,943 (14.8%)**	**$8,193,363**	**$9,729,759**	**$4,353,716 (95.9%)**	**$185,449 (4.1%)**	**$4,540,249**	**55.4%**	**$5,267,055**

[1]Fiscal year runs from July 1 through June 30
[2]Total value includes non-disclosure data (Section 5.1) and collection that was not identified to the finfish or invertebrate categories (i.e., unknown or miscellaneous species)
[3] http://www.usinflationcalculator.com/, adjusted for 2019 values
[4]Data from 2018 were provided for the calendar year for all fishers, and for the fiscal year for the 20 fishers. However, both datasets contain 12 calendar months, and are considered comparable for analysis.

It should be noted that the dollar value of these fisheries represents only the ex-vessel value, i.e., what the fishers are paid for their catch, and does not include the value which would be generated by additional dealer and retail sales. The actual economic value of the catch is thus substantially greater than the ex-vessel values. A study done in 1994 found that the DAR reported total average value for FY 1993/FY 1994 at only $819,957 (Miyasaka 1994 as cited in Walsh 2004), while analysis in 1993 by an aquarium trade group (Hawai'i Tropical Fish Association) estimated the total sales of Hawaiian aquarium fish (including freight and packaging) to be nearly 6 times this, at $4.9 million (Walsh et al. 2003). Although specific export data do not exist for the aquarium fishery, it is clear that most of the aquarium catch is shipped out of the state to dealers on the mainland United States, Europe, and Asia (Dierking 2002). This is neither surprising nor atypical for commercial fisheries in Hawai'i (DAR 2014a). For example, seafood exports of various Hawaiian species exceed 3.7 million pounds annually (Loke et al. 2012).

From 2000-2017, the total catch value (fish and invertebrates) of the commercial aquarium collection on O'ahu was $9,729,759 (inflation-adjusted 2019 dollars) (Table 4-2). Of the 304 species collected from O'ahu between 2000 and 2017, 238 have been fish species and 66 have been invertebrates. Six species (5 fish and 1 invertebrate) compose over 52% of the total economic value of the catch (DAR 2018a):

- Yellow Tang - 15.0%
- Potter's Angelfish - 10.3%
- Feather Duster Worms *(Sabellastarte spectabilis)* - 7.3%
- Bandit Angelfish – 7.3%
- Kole - 6.6%
- Flame Wrasse (*Cirrhilabrus jordani)* - 6.4%

4.2 CULTURAL RESOURCES

The cultural significance of each of the 23 fish species analyzed in this DEIS is discussed in Section 4.4.

Cultural, historic, and archaeological resources were evaluated within the nearshore habitats (3 nautical miles from the shore, where commercial aquarium collection occurs). A Cultural Impact Assessment (CIA) was prepared assessing the potential cultural impacts of issuance of 20 Aquarium Permits, and is included as Appendix A. A brief overview of cultural resources is provided here. The ocean, its ecosystem, and the practice of fishing were and continue to be important in Native Hawaiian culture and tradition.

The belief system of Native Hawaiians links people with all living and non-living things (Mitchell et al. 2005). Under this belief system, because all components of ecosystems were descended from *Wākea* (sky father) and *Papahanau-moku* (earth mother) and their offspring*, kini akua* (multitude of gods), both living and non-living elements possess spiritual qualities and mana (spiritual power). As such, Native Hawaiians, as *kanaka maoli* (native people), are guardians of these ecosystems and their well-being is directly related to the well-being of these ecosystems (Mitchell et al. 2005).

For example, areas such as *wao akua* (upland forests) are sacred places, the realm of the gods (Mitchell et al. 2005). Native Hawaiian land ownership and resource management were often based on a unit called the *ahupua'a*, which typically corresponded with what we today call watershed areas. This understanding of the link from uplands to the ocean was ahead of its time (Mitchell et al. 2005). *Kapu* (taboo) systems that limited certain classes or sexes from eating certain animals or fishing in certain places or at certain times may have aided in the conservation of some species (e.g., only men were allowed to eat *honu* (green sea turtle) and only royalty could eat certain fishes) (Mitchell et al. 2005).

Additionally, native species in Hawai‘i play a significant role in Native Hawaiian culture. Historically, feathers from forest birds were used to make elaborate capes, leis, and helmets for the *ali‘i* (royalty). Whale ivory, shells, and shark's teeth were used for necklaces and other adornments (Mitchell et al. 2005). Fish and sea turtle bones were used as kitchen implements, tools, and fishhooks, while sea turtle shells and scutes were used as containers. Koa (*Acacia koa*) trees were used for the ocean-voyaging canoes (Mitchell et al. 2005).

Native wildlife also play an important role in Native Hawaiian culture as many species such as *the pueo (Asio flammeus sandwichensis* [Hawaiian short-eared owl]), *‘io* (*Buteo solitarius* [Hawaiian hawk]), *‘elepaio (Chasiempis sandwichensis* [Hawaiian elepaio]), ‘alalā (*Corvus hawaiiensis* [Hawaiian crow]), sea turtles (e.g., *Caretta* spp., *Chelonia* spp., *Dermochelys* spp., *Eretmochelys*, and *Lepidochelys* spp.), and sharks (*Hexanchus* spp.) are believed to be *‘aumakua* (ancestors or guardians) of certain Hawaiian families (Mitchell et al., 2005). Hawaiian names have been given to many of the native wildlife and they have been incorporated into *oli* (chants) and *mo‘olelo* (legends).

Native Hawaiian culture also contains specific customs, beliefs, and practices related to fisheries and aquatic resources (Maly and Maly 2003). Historical narratives include specific references to cultural sites, such as *ko'a* (on shore and in ocean fishing shrines and station markers), resources procurement sites (both on land and in the water), and the traditional and customary laws governing the care for, and use of, the wide range of resources from the uplands to the ocean (Maly and Maly 2003). These historical accounts demonstrate that Native Hawaiians worked the land, water, and marine resources and, through a system of religious-based fisheries management protocols, were able to sustain themselves through the natural resources of the islands (Maly and Maly 2003). Native Hawaiian traditions surrounding aquatic resources demonstrate the cultural-historical importance of fisheries and land in the lives of Native Hawaiians and form the basis for Native Hawaiian's cultural attachment to the ocean and fishing today (Maly and Maly 2003).

Historical accounts demonstrate that Native Hawaiians were expert fishermen, and that fishing was a skill passed down generation to generation (Maly and Maly 2003). Native Hawaiians relied on fishing in the ocean for subsistence and consumption and employed traditional fishing methods that included the use of nets, hooks and lines, baskets, and hands (Maly and Maly 2003). In addition to serving as a source of food, aquatic resources and the practice of fishing were also linked to religious practices. Fishing was associated with religious ceremonies and fishermen traditionally worshipped fishing gods and goddesses and performed rituals related to certain species of fish (Maly and Maly 2003).

Numerous other examples of the use of native plants and animals in both daily life and ritual exist. In present day Hawai‘i, the link between Native Hawaiian culture and native species has not been lost and continues to be practiced in belief systems, as well as in traditional practices such as gathering of native plants for hula, traditional medicines, carving, weaving, and ceremonies (Mitchell et al. 2005).

Today, Native Hawaiian teachings play an increasing role in natural resource management, especially in areas of cultural significance like *Kahoʻolawe* or *Wao Kele o Puna* (island of Hawaiʻi). The CWCS recognizes that the State and its agencies are obligated to protect the reasonable exercise of customarily and traditionally exercised rights of Native Hawaiians to the extent feasible, in accordance with Public Access Shoreline Hawai'i versus Hawai'i County Planning Commission and subsequent case law (Mitchell et al. 2005).

4.2.1 Cultural Aspects of the Commercial Aquarium Fishery

From Jokiel et al. (2011):

> *For the past century Hawaiʻi has been dominated by a "Western" model of marine environmental management. Recently, however, there has been a renewed interest in the traditional management practices of ancient Hawaiians. Throughout Hawaiʻi, a growing cultural, sociological, and scientific movement is working to investigate and revive some of these traditional management tools and to integrate them with modern scientific methodology. The native islanders had devised and implemented every basic form of what are now considered modern marine fisheries conservation measures centuries ago, long before the need for marine conservation was even recognized in Western nations (Johannes 1982). Traditional restrictions on fishing in Hawaiʻi were achieved by the use of closed seasons, closed areas, size restrictions, gear restrictions, and restricted entry. Additional social, cultural, and spiritual controls strengthened the conservation ethic under the old system. Ancient Hawaiians used a holistic approach that we might now recognize and strive for as integrated coastal management. Bridging the gap between traditional management and Western science represents a challenge to researchers, government agencies, resource managers, cultural practitioners and organizations, and to the people of Hawaiʻi.*

Commercial aquarium fish collection has been on-going in Hawai'i since the late 1940's, with most fishers active in the fishery for more than 20 years and many active for 35 – 40 years. Hawai'i is their home and the fish are their livelihood. Protecting and preserving the reef, the fish, and the cultural heritage of both Hawai'i and the fishery, is in their best personal and business interest. Commercial aquarium fish collection is not a part of Native Hawaiian culture; however, Native Hawaiians do participate in the fishery and Hawaiian culture has been a significant aspect of the fishery's management since the 1970's. For example, significant review and incorporation of Hawaiian culture was incorporated Act 306 SLH – West Hawai'i Regional Fishery Management Area. Although Act 306 initiatives do not directly pertain to O'ahu, it does demonstrate the overall management strategy and public involvement with the aquarium fishery in the state. Section 4.4.4 summarizes the cultural significance of the 20 most collected fish species and Section 4.4.5 includes the cultural significance of other regulated species.

4.2.1.1 Public and Private Aquariums

More than 700 million people visit zoos and aquariums worldwide each year, and these zoos and aquariums spent more than $350 million on wildlife conservation in 2008 (Gusset and Dick 2011). Visits to aquariums may be for entertainment or educational purposes (as cited in Cracknell et al. 2015), but there are psychological benefits as well. Cracknell et al. (2015) looked at the behavioral, physiological and psychological reactions of people viewing a large aquarium exhibit, and found greater reduction in heart rate, greater increases in self-reported mood, higher interest, and longer spontaneous viewing times when species diversity within the aquarium was higher. Aquarium fish are also sold to home aquaria owners, of which 70% report that their fish are calming and stress reducing (Kidd and Kidd 1999, as cited in Cracknell et al. 2015), and for this reason aquariums are often present in health care settings as well, to provide a relaxing and calm environment (Cracknell et al. 2015).

4.3 PHYSICAL RESOURCES

The Hawaiian archipelago is composed of 8 main islands and approximately 124 smaller islands, reefs, and shoals spanning over 1,500 miles that vary in size from fractions of acres to thousands of square miles (Mitchell et al. 2005). The archipelago was formed over the last 70 million years through volcanic eruptions from a relatively stationary hotspot beneath the slowly moving seafloor. The island of O’ahu was created by two large shield volcanoes (Ko’olau and Wai’anae; Mitchell et al. 2005). O’ahu has a number of large estuaries and bays and one of only two barrier reef complexes in the State. Millions of years of erosion, subsidence, and reef building resulted in the formation of the atolls which form the Northwestern Hawaiian Islands (NWHI) and the submersion under the sea surface of the seamounts which used to be islands (Mitchell et al. 2005).

Located over 2,000 miles from the nearest continent, Hawai‘i is the most remote island chain in the world (Mitchell et al. 2005). Despite its relatively small area (less than 4.1 million acres), an elevation range from sea level to 13,796 feet results in Hawai‘i containing all the major known ecological zones. With a wide temperature range due to the elevational gradient and with average annual rainfall ranging from less than 15 inches to over 480 inches per year, Hawai‘i displays most of the earth’s variation in climatic conditions. Finally, Hawai‘i possesses many natural wonders: the most active volcano in the world, the wettest place on earth, the tallest seacliffs, and extensive coral reefs (Mitchell et al. 2005).

Due to the large number and the varied geology of the islands, Hawai‘i has diverse marine habitats, which range from estuaries, tidepools, sandy beaches, and seagrass beds to nearshore deep waters, extensive fringing and atoll reef systems, and smaller barrier reef systems (DLNR 2015). However, introduced mangroves have altered native coastal habitats in a number of places. The distribution of marine ecosystems in Hawai‘i is a result of island age, reef growth, water depth, exposure to wave action, geography, and latitude. The marine habitats found on each island depend on the type of island: large and young, mature, or drowned islands and seamounts (DLNR 2015). Large and young islands such as the island of Hawai‘i have recent lava flows and few, living structural coral reefs. Beaches are rocky except around bays, and drowned reefs may be found in deep waters or off parts of the east coast of Maui. Mature islands, such as O‘ahu and Kaua‘i in the MHI and Nihoa and Necker in the NWHI are the most diverse, with habitat types ranging from estuaries and sandy beaches to rocky beaches and fringing and barrier reefs to lagoons with patch or pinnacle reefs. Drowned islands, such as atolls in the rest of the NWHI, are the remains of volcanic islands with habitats ranging from coral islets and benches to caves and terraces along the slope of the atoll (DLNR 2015).

4.3.1 Climate

Features of Hawai'i's climate include mild temperatures throughout the year, moderate humidity, persistence of northeasterly trade winds, significant differences in rainfall within short distances, and infrequent severe storms (Price 1983). For most of Hawai'i, there are only two seasons: "summer," between May and October, and "winter," between October and April. Hawai'i's length of day and temperature are relatively uniform throughout the year. Hawai'i's longest and shortest days are about 13.5 hours and 11 hours, respectively, compared with 14.5 and 10 hours for Southern California and 15.5 hours and 8.5 hours for Maine (Price 1983). Uniform day lengths result in small seasonal variations in incoming solar radiation and, therefore, temperature. On a clear winter day, level ground in Hawai'i receives at least 67%as much solar energy between sunrise and sunset as it does on a clear summer day. By comparison the percentages are only 33 and 20 at latitudes 40 and 50 degrees respectively (Price 1983).

Over the ocean near Hawai'i, rainfall averages between 25 and 30 inches per year. The islands receive as much as 15 times that amount in some places and less than one third of it in others. This is caused mainly by orographic or mountain rains, which form within the moist trade wind air as it moves from the sea over the steep and high terrain of the islands (Price 1983). Over the lower islands, the average rainfall distribution resembles closely the topographic contours. Amounts are greatest over upper slopes and crests and least in the leeward lowlands. On the higher mountains, the belt of maximum rainfall lies between 2,000 to 3,000 feet and amounts decrease rapidly with further elevation. As a result, the highest slopes are relatively dry (Price 1983). Another source of rainfall is the towering cumulus clouds that build up over the mountains and interiors on sunny calm afternoons. Although such convective showers may be intense, they are usually brief and localized. Hawai'i's heaviest rains are come from winter storms between October and April. On O'ahu, the Wai'anae and Ko'olau mountain ranges combine to produce distinctive windward and leeward climates, with average rainfalls exceeding 250 inches per year on the crest of the Ko'olau Range. The leeward coast of the Ko'olau Range receives less than 20 inches per year.

While the effects of terrain on storm rainfall are not as great as on trade wind showers, large differences over small distances do occur, because of topography and location of the rain clouds. Differences vary with each storm. Frequently, the heaviest rains do not occur in areas with the greatest average rainfall. Relatively dry areas may receive, within a day or a few hours, totals exceeding half of their average annual rainfall (Price 1983). The leeward and other dry areas receive their rainfall mainly from a few winter storms. Therefore, their rainfall is usually seasonal and, their summers are dry. In the wetter regions, where rainfall comes from both winter storms and trade wind showers, seasonal differences are much smaller (Price 1983).

At the opposite extreme, drought is not unknown in Hawai'i, although it rarely affects an entire island at one time. Drought may occur when there are either no winter storms or no trade winds (Price 1983). If there are no winter storms, the normally dry leeward areas are hardest hit. A dry winter, followed by a normally dry summer and another dry winter, can have serious effects. The absence of trade winds affects mostly the windward and upland regions, which receive a smaller proportion of their rain from winter storms (Price 1983).

The waters surrounding Hawai‘i are affected by seasonal variations in climate and ocean circulation. The surface temperature of the oceans around Hawai‘i follow a north-south gradient and range from 75˚F in the MHI to 68˚F to 72˚F in the NWHI in winter and spring to 79˚F to 81˚F throughout all the islands in the late summer and fall (DLNR 2015). The depth of the thermocline, where water temperature reaches 50˚F, is 1,500 feet northwest of the islands and 1,000 feet off the island of O’ahu. Surface currents generally move east to west and increase in strength moving southward (DLNR 2015). The seas are rougher between islands than in the open ocean, because wind and water are funneled through the channels. Waves generated by north Pacific low-pressure systems are larger in the winter months than in the spring and are generally bigger on the northern shores of the islands than the southern shores. Marine organisms have adapted to these general climatological and oceanographic conditions (DLNR 2015).

Climate and oceanographic indicators highlight long-term trends and recent anomalous conditions in Hawai‘i’s natural environment. The El Niño Southern Oscillation (ENSO), an irregular, large-scale climate phenomenon that drives changes in regional oceanic and atmospheric conditions, has shifted over the last four decades towards increased frequency and severity in El Niño conditions, with the recent 2015 El Niño as one of the strongest on record (Gove et al. 2016). Rainfall, which can influence salinity, temperature, sediment load, and nutrient concentrations in the marine environment, has been at or below the long-term average over the past 15 years while the intensity of short-term events has increased over the same time period. Long-term sea level, an important indicator for coastal erosion and flooding, is rising by an estimated 0.15 inch per year and is expected to reach 1.6 feet higher than present day levels by 2100. Sea surface temperature, an indicator of regional and climatic forcing that is highly influential to a myriad of ecological processes, was anomalously warm in recent years and reached a record level of thermal stress in September 2015, resulting in widespread and severe coral reef bleaching in West Hawai‘i (Gove et al. 2016).

4.3.2 Physical Aspects of the Commercial Aquarium Fishery

O’ahu’s commercial aquarium fish collectors typically leave from one of four ports of entry: Hawai’i Kai, Sand Island, Waianae, or Haleiwa. Most collectors go out with partners and have boats that range in size between 17 to 26 feet. These boats are equipped with dive gear, scuba tanks, collecting buckets, nets, and containers to hold the fish. Before leaving the harbor, the collector is given instructions by their supplier on which fish to target for that particular day.

Most collectors leave in the morning and travel to their collecting sites, which range from 1-5 miles away. Although divers average 3-4 scuba bottles/day, typically, most collection sites are rotated every dive. Average dives are conducted in the 30-50 foot range, although some rarer fish are collected in the 150 foot range. A typical collector has between 150-250 dive sites on the island from which to choose, depending on surf, wind, and currents.

Collection is done primarily with the use of two hand nets, a fence net, and a collecting bucket, from which the targeted fish are placed upon capture. Most collectors chase the fish into the fence net, where they are corralled long enough so that the collector can use their hand nets to capture the fish. Fence nets range in length between 12-30 feet and are 4-6 feet tall. At the end of the dive, the fish in the collection bucket are brought back to the boat and placed between 20-25 feet on a decompression line hung from the boat. At this level, most fish can be safety decompressed within 30-40 minutes. If a fish cannot be decompressed correctly, they are released. Most experienced collectors can collect 10-40 fish per dive.

Once the dives are completed, the collector returns to the harbor and takes their catch to the wholesaler's facility.

Per the DAR, in lieu of collection with fine mesh nets, other gear types that were previously allowed are still legal to use for commercial aquarium collection[4].

4.4 BIOLOGICAL RESOURCES

Because of Hawai'i's geographical isolation, many of its coastal and marine species are endemic (i.e., native or restricted to a certain country or area). Approximately 15 to 25% of Hawai'i's marine species are endemic to the Hawaiian Archipelago (including Johnston Atoll), one of the largest proportions of marine endemism for any island chain in the world (DLNR 2015). Of the 612 known nearshore fish species in Hawai'i, 25% are endemic to the Hawaiian Archipelago (including Johnston Atoll) (Randall 2007). Yet because of the isolation, Hawai'i has relatively low marine species richness (i.e., diversity), with approximately 580 shallow reef fish species in contrast to areas of the Pacific further west with thousands of species. In total though, Hawai'i still has over 6,000 marine species (DLNR 2015).

Toonen et al. (2011) conclude that the Hawaiian Archipelago is not a single, well-mixed marine community, but rather there are at least four significant multi-species barriers to dispersal along the length of the island chain, and that species that appear capable of extensive dispersal, such as Yellow Tang and Kole, show significant population differentiation within the Hawaiian Archipelago. In addition, there are significant consensus genetic breaks that restrict gene flow between islands, including a barrier between the island of Hawai'i and the rest of the Main Hawaiian Islands (MHI). Conversely, around the island of Hawai'i, there is connectivity between adjacent reefs (up to 184 km), with fish from protected FRAs being documented to seed unprotected areas, highlighting the effectiveness of protected areas (Christie et al. 2010). It is assumed that this would also be applicable to the smaller island of O'ahu.

4.4.1 Wildlife Species

Marine species in Hawai'i include over 1,200 species of fishes, with around 500 species adapted to live on coral reefs, and the rest adapted to the pelagic open surface waters, mesopelagic or bathypelagic zones (middle or deep waters), estuaries, or sandy bottoms (DLNR 2015). At the top of the food chain are the apex predators such as sharks and large predatory reef and pelagic fishes. Approximately 4,100 marine invertebrates are known from Hawai'i and include over 100 species of hard, soft, and precious corals as well as hundreds of types of snails, crabs, shrimps and small numbers of worms, jellyfish, sponges, starfish, and tunicates (DLNR 2015). Five marine turtles occur in Hawai'i: two are common residents that nest on Hawai'i's beaches and three are more occasional visitors. All sea turtles are listed as threatened or endangered under the federal Endangered Species Act (ESA) of 1973, as amended. Approximately 26 species of marine mammals, mostly cetaceans, are considered resident or occasional visitors to Hawai'i. These include the Humpback Whale or *koholā* (*Megaptera noveangliae*), False Killer Whale (*Pseudorca*

[4] https://dlnr.hawaii.gov/dar/files/2017/11/aquarium_permit_faq_rev4.pdf

crassidens), Spinner Dolphin (*Stenella longirostris*), and Bottlenose Dolphin (*Tursiops truncatus*). Humpback Whales and Hawaiian Monk Seals (*Monachus schauinslandi*) are common marine mammals in Hawaiʻi and are listed as endangered under the ESA (DLNR 2015). All marine mammals are protected by the Marine Mammal Protection Act. Many of the resident whales and dolphins feed on fishes and squids that occur in the moderately deep waters off Hawaiʻi's coasts.

4.4.2 Hawai'i Species of Greatest Conservation Need

Species of Greatest Conservation Need (SGCN) are identified in Hawai'i's State Wildlife Action Plan (SWAP) but are not threatened, endangered, or otherwise legislatively protected species. However, recognizing the need to take action to protect endemic species, the DLNR identified Hawaiʻi's indigenous SGCN in Exhibit 1 of Hawaiʻi Administrative Rules Chapter 124. This list includes terrestrial mammals, marine mammals, and marine reptiles only. Additional native species were identified and added based on their presence on the following lists (DLNR 2018):

- The Federal list of threatened, endangered, candidate and concern species;
- Species protected by the U.S. Marine Mammal Protection Act;
- The State list of threatened and endangered species;
- The Checklist of the Birds of Hawaiʻi; and
- Species identified as present in Hawaiʻi by groups or organizations with significant experience or expertise (e.g., Audubon Watch List; national and regional Bird Plans, such as the U.S. Shorebird Conservation Plan, Waterbird Conservation for the Americas; Regional Seabird Conservation Plan).

For any terrestrial indigenous species not represented by any of the lists, their status as indigenous automatically included them as Hawaiʻi's SGCN. For aquatic fishes and invertebrates only, endemic species were added to the list (DLNR 2018). In addition, the DAR also included native species on the International Union for the Conservation of Nature and Natural Resources' (IUCN) Threatened Red List, and the Convention on International Trade in Endangered Species (CITES) list. The IUCN Red List is a comprehensive inventory of the global conservation status of biological species, which uses a set of criteria to evaluate the extinction risk of many species, whereas CITES is an international agreement between governments, and includes appendices which group species according to how threatened they are by international trade. A Statewide Aquatic Wildlife Conservation Strategy (SAWCS) Advisory Council was developed to advise on additional species that were at risk due to specific threats. The SAWCS Advisory Council is a panel with representatives from federal and state agencies, resource user groups, and non-profit organizations that helps the DAR develop its CWCS (DLNR 2018).

Additional species considered must meet one or more of the following biological criteria (DLNR 2018):

- Species with low or declining populations;
- Species indicative of the diversity and health of the state's wildlife;
- Species with small, localized "at-risk" populations;

- Keystone species;
- Indicator species;
- Species with limited dispersal;
- Disjunct species;
- Vulnerable species;
- Species of conservation concern;
- "Responsibility" species, (i.e., species that have their center of range within a state); and,
- Species with fragmented or isolated populations.

Currently nearly 25% of fish, 20% of mollusks, 18% of algae, and 20% of the corals are considered endemic to Hawai'i and listed as SGCN species (Randall 2007, DLNR 2015).

Three of the SGCN fish species that have been reported as being collected by commercial aquarium collectors on O'ahu between 2000 and 2017 are analyzed in this EIS:

1. Psychedelic Wrasse [see Section 4.4.4.16]
2. Fisher's Angelfish [see Section 4.4.4.20]
3. Bandit Angelfish [see Section 4.4.5.2]

Additional SGCN fish species that have been reported as being collected by commercial aquarium collectors on O'ahu between 2000 and 2017 include the Spotted Cardinalfish (*Apogon maculiferus*), Hawaiian Orbicular Velvetfish (*Caracanthus typicus*), Hawaiian Flame Angelfish (*Centropyge loricula*), Bluestriped Butterflyfish (*Chaetodon fremblii*), Tinker's Butterflyfish (*Chaetodon tinkeri*), Hawaiian Morwong (*Cheilodactylus vittatus*), Chocolate-dip Chromis (*Chromis hanui*), Oval Chromis (*Chromis ovalis*), Yellowstripe Coris (*Coris flavovittata*), Elegant Coris (*Coris venusta*), Hawaiian Knifefish (*Cymolutes lecluse*), Redstripe Pipefish (*Doryrhamphus baldwini*), Marbled Blenny (*Entomacrodus marmoratus*), Masked Angelfish (*Genicanthus personatus*), Steindachner's Moray (*Gymnothorax steindachneri*), Blackside Razorfish (*Iniistius umbrilatus*), Hawaiian Flagtail (*Kuhlia xenura*), Sunset Bass (*Liopropoma aurora*), Whitesaddle Goatfish (*Parupeneus porphyreus*), Hawaiian Rock Damselfish (*Plectroglyphidodon sindonis*), Hawaiian Anthias (*Pseudanthias thompsoni*), Hawaiian Turkeyfish (*Pterois sphex*), and Titan Scorpionfish (*Scorpaenopsis cacopsis*). Additional SGCN fish may have been collected and reported under broader category names such as frogfish, parrotfishes, pipefishes, gobies, moray eels, seahorses, blennies, snake eels and worm eels, boxfish, bigeyes, scorpionfishes, lizardfishes, pufferfishes or butterflyfish, among others, but specific species identification cannot be made.

The SWAP (2015) addresses these species and identifies the following actions to ensure the species conservation and sustainability:

1. Conservation Actions: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. Commercial licenses are required for aquarium collectors. In addition to common statewide and island conservation actions, specific actions include:
   - Restoration of habitat; and,

- Maintaining healthy populations with appropriate fishing regulations and education.

2. Monitoring:

- Continue to survey for populations and distribution in known and likely habitats.

3. Research Priorities:

- Improve understanding of factors affecting the species population size and distribution; and,
- Support aquaculture research to develop captive breeding for species used in the aquarium trade.

4.4.3 Aquarium Fish

4.4.3.1 Coral Reef Ecosystems Program (CREP; now known as the Ecosystem Sciences Division) Surveys

The NOAA has been involved in a large-scale monitoring program that surveys coral reef fish assemblages and habitats, encompassing the bulk of the US-affiliated tropical Pacific. This effort, formerly known as the Coral Reef Ecosystem Program (CREP), has included over 5,500 surveys around 39 islands, including the island of O'ahu. The dataset was developed as a resource that could be used to understand how human, environmental, and oceanographic conditions influence coral reef fish community structure, providing a basis for research to support effective management outcomes (CREP 2018).

In 2010, the Pacific Reef Assessment and Monitoring Program (RAMP) developed and implemented a standardized survey methodology focusing on reef fish and paired benthic habitat-monitoring using monitoring methods specified in the National Coral Reef Monitoring Plan (NCRMP). The aim of the current systematic sampling design is to maximize survey site replication, while the overarching goal was to generate data representative of coral reef hard-bottom substrate at the islands-scale (Heenan et. al 2017).

Surveys were conducted on the island of O'ahu in 2010, 2012, 2013, 2015 and 2016. Surveys were conducted at 228 stationary point count locations with a randomized depth-stratified design, at depths from approximately 0-98 feet (0-30 meters; Figure 4). At each point count location divers conducted fish counts, estimated benthic cover, and habitat structural complexity. Typically, 3–5 days were spent at each island during each visit (generally once every 3 years), conducting 30–50 fish surveys during that time. Detailed explanations of the study sites and survey methods are found in Heenan et al. (2017). To establish survey points, a 30 meter transect is measured out along the substrate. For each point count, a pair of divers conducts simultaneous counts in adjacent, 49.2-foot (15-meter) cylindrical plots along the transect (i.e., diver 1 surveys from the 7.5 meter mark along the transect and diver 2 surveys from the 22.5 meter mark) extending from the substrate to the limits of vertical visibility (Heenan et al. 2017).

Each fish count consists of two parts, a 5-minute species enumeration in which divers generates a list of taxa observed within their cylinder to species when possible; and, a tally portion in which divers systematically work through their species list recording the number and estimated size of fish present within the cylinder. Tallying is done by conducting a series of rapid visual sweeps of the plot with one species-group (e.g., mid-water, surgeonfish, benthic butterflyfish) counted per sweep. At the end of the sweeps,

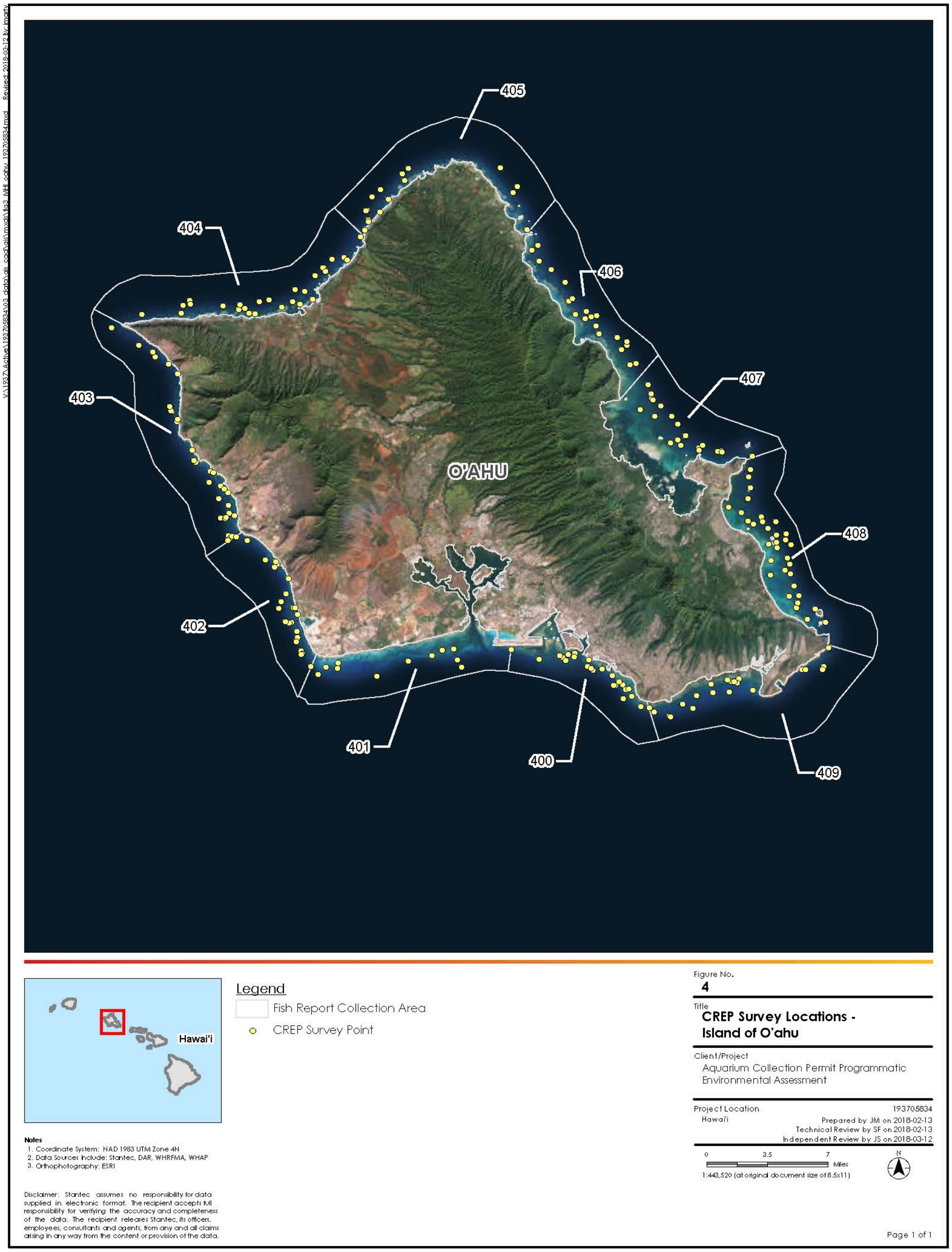


Figure 4. CREP survey locations - Island of O'ahu.

divers carefully search for small, site-attached, and semi-cryptic species. Surveys were not conducted if horizontal visibility was <25 feet (Heenan et al. 2017).

To facilitate analysis in this DEIS, estimated population size for each fish species for the island of O’ahu was calculated using CREP data by converting survey counts to abundance per unit area, and then multiplying by the estimated area of hard-bottom habitat in <30 meters of water (16,840 Ha).

Due to the large spatial coverage and range of depths surveyed by the CREP, CREP data were considered to be the best estimator of island-wide fish population size, and therefore serve as the primary basis for the impact analysis found in Section 5. Estimated population size for each of the top 20 collected species on the island of O’ahu is included in the brief overview of each species in the following sections.

Although CREP data are the most comprehensive data publicly available for the island of O’ahu, certain limitations of the surveys may lead to an underestimate of some populations of aquarium fish. Specifically, surveys are concentrated into a short period of survey effort (about one month each year) located in different locations from one year to the next, allowing for a larger coverage of the entire island, but over five years during a seven-year period. Also, population estimates may be an underestimate for certain species as surveys were only conducted at depths <30 meters (approximately 98 feet) in areas of hardbottom habitat. No data were collected from soft-bottom habitat, as these tend to not be important habitats for most aquarium species, but certain species may utilize these areas, and therefore are not represented in the population estimate. No data were collected from depths greater than 30 meters (approximately 98 feet), but certain species may utilize these areas as well, and are therefore not represented in the population estimate. In addition, divers are trained in the identification of aquarium fish; however, certain species may be cryptic, skittish, or difficult to identify in the field, which may lead to underestimates of the population of those species. All data collection methods have a range of variation, or uncertainty. For the CREP data, this results in a high and low range for population estimates, which are included in the tables in Section 5.4 for reference. For the purposes of this DEIS, we used the mean of those ranges to assess impacts.

4.4.4 Top 20 Collected Aquarium Fish Species

Since 2000, approximately 238 fish species have been collected under Aquarium Permits in O’ahu waters (204 species when analyzing just the 20 fishers); however, some of these included those species reported as a general group (e.g., squirrelfishes, soldierfishes, damselfishes) (DAR 2018a). Only 161 species were reported by enough permits (>2 permits reporting from each collection area (Figure 1) during each year of collection) to determine total number of individuals collected (Table 4-3). Collection areas with less than three permits reporting fall under the DAR confidentiality statute, in which totals are not released publicly (Section 5.1).

A total of 1,295,700 individual fish have been collected from O’ahu under Aquarium Permits since 2000, with 694,831 individuals collected by the 20 fishers who would be issued permits (53.6%; DAR 2018a, 2019) The total number of aquarium fish collected from O’ahu since 2000 has ranged from 35,811 in 2003 to 100,662 in 2012, averaging 71,983 annually for the period (Table 4-3; DAR 2018a).

The top 20 fish species collected from O’ahu from 2000-2017 made up 80.0% (1,035,272 fish) of the total number of fish collected, and 81.8% of the total fish number of fish collected by the 20 fishers (Table 4-5;

DAR 2018a). The top three collected species (Yellow Tang [273,356], Kole [175,425], and Potter's Angelfish [138,669]) from O'ahu make up 45.3% of the overall fish collection total and 46.1% of the fish collected by the 20 fishers. No other individual species had more than 60,000 individuals collected during that time. Approximately 75% of the top 20 collected species on O'ahu from 2000-2017 were collected in numbers below 30,000 individuals (DAR 2018a). Two of these are SGCN species, the Psychedelic Wrasse and Fisher's Angelfish, which collectively made up 2.4% (30,036 individuals) of the total fish catch since 2000.

Table 4-3. Total number of fish collected under Aquarium Permits from 2000-2017 on the island of O'ahu (DAR 2018a).

Fiscal Year[1]	Number of Permits Reporting	Number Individuals Kept (all fishers)	Number Individuals Kept (20 fishers)	Percent Contribution of 20 fishers
2000	47	66,896	28,848	43.1%
2001	39	43,687	22,709	52.0%
2002	28	37,470	21,319	56.9%
2003	30	35,811	24,205	67.6%
2004	39	73,911	32,746	44.3%
2005	39	70,073	42,344	60.4%
2006	46	99,143	36,099	36.4%
2007	50	81,959	33,072	40.4%
2008	52	76,304	37,446	49.1%
2009	46	75,902	46,074	60.7%
2010	45	81,464	45,006	55.2%
2011	39	81,173	49,676	61.2%
2012	41	100,662	46,495	46.2%
2013	32	65,751	42,754	65.0%
2014	32	77,016	53,905	70.0%
2015	42	91,196	53,920	59.1%
2016	39	71,223	37,278	52.3%
2017	41	66,059	40,935	62.0%
2018[2]	NA	46,174	31,759	68.8%
Average (2000-2017)	**40**	**71,983**	**38,602**	**53.6%**
Total (2000-2017)	**1,524**	**1,295,700**	**694,831**	**53.6%**

[1]Fiscal year runs from July 1 through June 30

[2] Data from 2018 were provided for the calendar year for all fishers, and for the fiscal year for the 20 fishers. However, both datasets contain 12 calendar months, and are considered comparable for analysis.

Table 4-4. Top 20 fish species collected under Aquarium Permits on the island of O'ahu from 2000-2017 (DAR 2018a).

Common Name	Scientific Name	All fishers			20 fishers		
		Number Collected	Percentage of Total Collected[1]	Average # Collected per Year	Number Collected	Percentage of Total Collected	Average # Collected per Year (20 fishers)
Yellow Tang[2]	*Zebrasoma flavescens*	273,356	21.1%	15,186	114,420	16.5%	6,357
Kole (= Goldring Surgeonfish, Yelloweye)[2]	*Ctenochaetus strigosus*	175,425	13.5%	9,746	120,792	17.4%	6,711
Potter's Angelfish[2]	*Centropyge potteri*	138,669	10.7%	7,704	84,718	12.2%	4,707
Orangespine Unicornfish (= Clown Tang)[2]	*Naso lituratus*	59,133	4.6%	3,285	28,934	4.2%	1,607
Ornate Wrasse (= Pinkface)	*Halichoeres ornatissimus*	46,113	3.6%	2,562	27,978	4.0%	1,555
Flame Wrasse	*Cirrhilabrus jordani*	28,894	2.2%	1,605	19,510	2.8%	1,084
Fourline Wrasse	*Pseudocheilinus*	28,882	2.2%	1,604	22,824	3.3%	1,268
Hawaiian Whitespotted Toby (= Puffer)	*Canthigaster jactator*	28,619	2.2%	1,590	14,261	2.1%	792
Forcepsfish	*Forcipiger flavissimus*	28,502	2.2%	1,583	17,162	2.5%	953
Milletseed Butterflyfish (= Lemon)	*Chaetodon miliaris*	25,293	2.0%	1,405	13,014	1.9%	723
Shortnose Wrasse (= Geoffroy's)	*Macropharyngodon geoffroy*	24,381	1.9%	1,355	15,711	2.3%	873
Bicolor Anthias	*Pseudanthias bicolor*	24,188	1.9%	1,343	18,771	2.7%	1,043
Orangeband Surgeonfish (= Orange shoulder)	*Acanthurus olivaceus*	24,175	1.9%	1,343	11,853	1.7%	659
Moorish Idol[2]	*Zanclus cornutus*	23,449	1.8%	1,303	9,069	1.3%	504

Common Name	Scientific Name	All fishers			20 fishers		
		Number Collected	Percentage of Total Collected[1]	Average # Collected per Year	Number Collected	Percentage of Total Collected	Average # Collected per Year (20 fishers)
Multiband Butterflyfish (= Pebbled)	*Chaetodon multicinctus*	18,118	1.4%	1,006	8,568	1.2%	476
Psychedelic Wrasse (= Redtail)[3]	*Anampses chrysocephalus*	16,426	1.3%	913	8,796	1.3%	489
Eightline Wrasse	*Pseudocheilinus octotaenia*	16,053	1.2%	892	11,002	1.6%	611
Crowned Puffer (= Saddleback Puffer)	*Canthigaster coronata*	14,558	1.1%	809	7,331	1.1%	407
Saddle Wrasse	*Thalassoma duperrey*	14,470	1.1%	804	6,038	0.9%	335
Fisher's Angelfish[3]	*Centropyge fisheri*	13,610	1.1%	756	7,506	1.1%	417
Total		**1,035,272**	**80.0%**	**2,615**	**568,831**	**81.8%**	**31,570**

[1]Percentage calculated based on total individuals reported collected on O'ahu and do not include any non-disclosure data.
[2] Regulated species (e.g., bag and/or size limits) on the island of O'ahu.
[3]Hawai'i SGCN.

The following sections provide a brief overview of the ecology of the top 20 collected fish species on O'ahu since 2000.

4.4.4.1 Yellow Tang (*Zebrasoma flavescens*)

Ecology

The Yellow Tang is one of the most popular aquarium species, growing to 8 inches, oval in shape and laterally compressed, with a small mouth and eyes set high on the head. Adults are bright yellow and have modified scales along the base of the tail which can be exposed when the fish flexes its tail. These modified scales or spines are used for defense from predators and competition for feeding areas. At night, the yellow color darkens, and a white band appears along the lateral line (University of Hawai'i 2016).

The Yellow Tang is the only solid yellow fish common throughout Hawai'i. This species is found in subtropical waters and is rare on the western extremes of its range. Flexible comb-like teeth are used to pick algae and seaweed that grow along the reefs. Young Yellow Tang are associated with finger coral (*Porites compressa*) which is abundant in the coastal waters of the island of Hawai'i, but less so on O'ahu (Dr. Bruce Carlson, pers. comm.). They spend a large amount of time feeding and aggressively protect prime feeding territories (University of Hawai'i 2016). Yellow Tang are found from shallow surge zones to a depth of 130 feet. They occur in the Pacific Ocean: Ryukyu, Mariana, Marshall, Marcus, Wake, and Hawaiian Islands. (fishbase.org 2018).

Yellow Tang are broadcast spawners. Many broadcast spawners migrate to the edge of the reef drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of O'ahu population of Yellow Tang at the 0-98 foot depth in hardbottom habitats was approximately 216,524 individuals. The species is listed as 'Least Concern' by the IUCN (McIlwein et al. 2012a).

Cultural Significance

The Yellow Tang, called *lāʻī pala* or *lauʻī pala* in Hawai'i, although small was considered a delicacy and also involved in healing rituals.

4.4.4.2 Kole (Goldring Surgeonfish, Yelloweye) (*Ctenochaetus strigosus*)

Ecology

The Kole is endemic to the Hawaiian Islands (Randall and Clements 2001) and Johnston Atoll (Lobel 2003). It is brown with light blue to yellow horizontal stripes over its body which change into spots towards the face. It also has a yellow ring surrounding the eye.

Individuals are usually solitary and mainly found in shallow water, although it has been recorded at depths of 370 feet. This species is herbivorous, grazing on diatoms and algae from the sand or reef (Randall and Clements 2001), and has also been commonly observed to clean algal growths from the shells of sea turtles (Work and Aeby 2014).

Kole are broadcast spawners. Many broadcast spawners migrate to the edge of the reef drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Oa'hu population of Kole at the 0-98 foot depth was approximately 1,144,130 individuals. Kole are listed as 'Least Concern' by the IUCN, and 80% of the species range is within the Papahānaumokuākea Marine National Monument, where fishing is prohibited (McIlwein et al. 2012b).

Cultural Significance

Kole, meaning "raw" or "red" (Pakui and Elbert 1986), are also known as *ukole* or *pākole*. The *kole makaonaona* (specifically, *Ctenochaetus strigosus),* is the more popular eating variety of *Kole*. Pukui (1983) explains that the English word "story" was Hawaiianized to "*kole*," and that this proverbial saying uses *kole* as a metaphor for describing the excitement of getting together to share stories.

Although the *kole* is known as being tough-skinned, it is considered a favorite fish to eat raw. *Kole* was also important for traditional practices and customs relating to the home, as it was believed to *hole*, or strip, the house of unwanted spiritual energy (Titcomb 1972).

4.4.4.3 Potter's Angelfish (*Centropyge potteri*)

Ecology

The bright orange and blue Potter's Angelfish is an endemic species found along Hawaiian reefs and Johnston Atoll (Lobel 2003). Like other angelfishes, this species is recognized by a heavy, curved spine on its "cheek" near the edge of the gill cover. However, because it generally only reaches approximately 5 inches, it is considered a 'pygmy' angelfish. Its slender, disc-shaped body is well-suited to life on a coral reef.

Individuals limit their movements to a well-defined area close to the shelter of finger coral branches, usually at depths of at least 15 feet. Active by day, it feeds on algae and detritus on dead coral surfaces. At night, it remains alert but inactive, protected within the coral. Angelfishes are very dependent upon the protection of coral caves and crevices and are rarely seen over sandy stretches or other areas that offer little cover. They are often territorial and spend most of their time near the bottom in search of food. They have small mouths and many flexible, comb-like teeth used for plucking or scraping food from the rocks (University of Hawai'i 2016).

Potter's Angelfish are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of O'ahu population of Potter's Angelfish at the 0-98 foot depth was approximately 297,372 individuals. The IUCN lists the Potter's Angelfish as 'Least Concern', and states that this species is usually very common with stable populations (Pyle and Myers 2010a).

Cultural Significance

The Potter's Angelfish is named after Frederick A. Potter, who was the first Director of the Honolulu Aquarium. The species is endemic, but a review of cultural-historical literature (see Appendix A) did not reveal any specific Hawaiian names or any specific cultural information related to this species.

4.4.4.4 Orangespine Unicornfish (Clown Tang) (*Naso lituratus*)

Ecology

The Orangespine Unicornfish has a black dorsal fin, with the black continuing onto the back as a pointed projection, with a pale blue line at base. The anal fin is mainly orange while the caudal fin is yellow. The caudal peduncle bears two forward-directed spines (Randall and Clements 2001). Orangespine Unicornfish are found at depths of 16 to 100 feet along coral, rock, and rubble of seaward reefs. They feed mostly on leafy brown algae and sometimes in groups (Randall and Clements 2001). Distinct pairs are formed during breeding.

The species is found throughout the Indo-Pacific from the Red Sea (except the Gulf of Oman and Persian Gulf) south to Natal and east to Hawai'i and French Polynesia. In the western Pacific from Suruga Bay to the southern Great Barrier Reef (Randall and Clements 2001).

Orangespine Unicornfish are broadcast spawners. Many broadcast spawners migrate to the edge of the reef drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of O'ahu population of Orangespine Unicornfish at the 0-98 foot depth was approximately 950,505 individuals. This species is listed as 'Least Concern' by the IUCN (McIlwain et al. 2012c).

Cultural Significance

The Orangespine Unicornfish is also known as the *umaumalei*. This species has been paired with its land counterpart the *ʻūlei* (Hawaiian Rose; *Osteomeles anthyllidifolia*) (Beckwith 1951, Liliuokalani 1978). While the *umaumalei* is a specific species within the family Acanthuridae, some traditional accounts classify it under the name *kala* or *kala umaumalei* (Ka Nupepa Kuokoa 1867; Titcomb 1972).

Kala in all of its forms was a popular Hawaiian delicacy, containing white meat and usually eaten broiled over coals and rarely eaten raw. The soft parts of the fish are described as good *palu* (fish bait). *Kala* is very abundant and easy to catch which is why it is eaten often (Titcomb 1972). The skin of the kala was also used to cover the *pūniu*, a small drum that was lashed onto the thigh of a *hula* dancer.

During the spawning seasons, certain fish were prohibited from being caught and consumed, which included *kala* (Titcomb 1972). They were traditionally caught in the *ʻie kala* (lit. *kala* basket), which has been described as the largest type of *hīnaʻi* (basket fish trap) (Manu et al. 2006). Additional methods for catching *kala* included the use of a *holoholo*, a net tied to a 12-foot-long piece of *alaheʻe* (*Canthium odoratum*) wood. The net was lowered down in an area with swift-ebbing tides with one person holding the net and the other corralling fish into it (Manu et al. 2006). *Hinaʻi pai kala*, was a method of using a plaited basket as a net. The basket was filled with *limu kala* (seaweed), *kalo* (taro) and pumpkin and then let down for the fish to feed. This process was continued until the fish became plump and accustomed to feeding in the basket, then a “catching net” was lowered down to collect *kala*.

4.4.4.5 Ornate Wrasse (Pinkface) (*Halichoeres ornatissimus*)

Ecology

This small wrasse has a pinkish head that is marked with horizontal green lines. The throat and belly are blue; scales on the sides are marked by a vertical, crescent-shaped stripe followed by blue. The dorsal fin is dark red with green spots and is traced by green and blue lines. A large dark spot on the dorsal fin and one just behind the eye are common identifiers. Males usually have more intense coloration than females (University of Hawai’i 2016).

The Ornate Wrasse has an elongate soft body that is tapered and spindle-shaped. The dorsal fin is continuous, rounded, and soft. The pectoral fins are used extensively for swimming with up and down motions. The snout has a pointed mouth, fleshy lips, and canine teeth used in plucking small crustaceans and mollusks from the reef. Special bones in the gill area called pharyngeal bones help the wrasse crush the shells of their prey. The Ornate Wrasse is diurnal, feeding during the day, and sheltering in reef crevices or burying in sand patches at night. The Ornate Wrasse, like others within this family (Labridae) undergo sex changes as they develop (University of Hawai’i 2016).

Ornate Wrasse are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of O’ahu population of Ornate Wrasse at the 0-98 foot depth was approximately 668,852 individuals. The species is listed as ‘Least Concern’ by the IUCN, and most of the species' range falls within the protected Papahānaumokuākea Marine National Monument, where fishing is prohibited (Craig et al. 2010).

Cultural Significance

The Ornate Wrasse is also referred to as *lāʻō* (Titcomb 1972). A review of cultural-historical literature (see Appendix A) did not reveal any additional cultural information for the Ornate Wrasse.

4.4.4.6 Flame Wrasse (*Cirrhilabrus jordani*)

Ecology

The Flame Wrasse is endemic to the Hawaiian Islands and Johnston Atoll (Lobel 2003, Lieske and Myers 1994). Females are bright red on the dorsal part of the body fading to a light pink on the ventral side. The fins are opaque with some yellow features on the face. Females grow to about 3 inches before they begin to transform into a male. As the male matures the dorsal remains bright red fading into a vibrant yellow orange.

The Flame Wrasse utilizes seaward reefs and forms groups above large drop-offs at a depth of 15 to 600 feet, where it feeds exclusively on zooplankton along the ocean floor (Lieske and Myers 1994). During breeding males and females form pairs for mating (Breder and Rosen 1966).

Flame Wrasse are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of O'ahu population of Flame Wrasse at the 0-98 foot depth was approximately 5,683 individuals. However, a recent study by Kane and Tissot (2017) noted that the Flame Wrasse density at depths from 0-98 feet (0-30 meters; i.e., CREP survey area) was zero (<1 Flame Wrasse per 100 m^2) on the island of Hawai'i (similar data are not available for O'ahu). Below 98 feet (30 meters) they found:

- 2.58 Flame Wrasse per 100 m^2 between 98-132 feet (30-40 meters);
- 2.12 Flame Wrasse per 100 m^2 between 132-164 feet (40-50 meters); and,
- 0.27 Flame Wrasse per 100 m^2 below 164 feet (50 meters).

The density of Flame Wrasse at 98-132 feet (30-40 meters) on Hawai'i is over 1,000 times greater than the density reported from the CREP surveys on O'ahu (0.002293712 Flame Wrasse per 100 m^2). Additionally, the density of Flame Wrasse at 132-164 feet (40-50 meters) is over 900 times greater, and the density below 164 feet (50 meters) is over 100 times greater. Therefore, in all likelihood, the actual population of Flame Wrasse on O'ahu is substantially greater than that reported by the CREP data. The IUCN lists this species as 'Least Concern' and states that the species is relatively common along drop off areas (Rocha 2010). In addition, most of its range falls within the protected Papahānaumokuākea Marine National Monument, where fishing is prohibited (Rocha 2010).

Cultural Significance

Hīnālea, occasionally shortened to *ālea*, is a name broadly applied to various species known commonly as wrasses and is applied to most of the smaller wrasses that have no known Hawaiian names (Hoover 2007). There are specific traditional fishing methods associated with wrasses. *Melomelo* involved using a carefully curated stick to attract the fish (Kahāʻulelio 2006). They were also caught in basket traps woven from plant-based fibers, including a diving basket known as *hīnaʻi hoʻoluʻuluʻu* which was made from the vines of the *ʻāwikiwiki (Canvalia galeata).* Standing nets known as *kūkulu ʻupena* and 18-foot long fishing poles called *ke kāmākoi* made of bamboo or *hau* (*Hibiscus tiliaceus*) were also used to catch *hīnālea* (Manu et al. 2006). The *ke kāmākoi* were used in the nearshore reefs where the fisher could cast from shore. Yet another traditional method of catching *hīnālea* involved poison, a net called ʻ*upena holahola* was used with certain piscicidal plants (i.e., containing a substance poisonous to fish) that were crushed and placed around a fishing hole, where the toxins from the crushed plants would diffuse into the water and paralyze the trapped fish, causing the *hīnālea* to float to the surface into the *holahola* net (Manu et al. 2006).

The *hīnālea* is considered a popular fish of the Hawaiian diet, and they are referenced in many *moʻolelo*, or stories. They were also considered important for ceremonies, including as offerings for gods responsible for conceiving a child, and were also noted in several accounts of gods and goddesses.

4.4.4.7 Fourlined Wrasse (*Pseudocheilinus tetrataenia*)

Ecology

The Fourlined Wrasse is found in the tropical waters of the north and south Pacific. This species has a green body with blue and purple fins and four horizontal stripes that run across the upper half of the body. Each stripe is made up of three smaller stripes: one black, one blue and one red stripe. The eye is red with two white lines on it.

This species is secretive and inhabits seaward reefs, among coral or rubble at depths of 20 to 144 feet. This species uses the small heads of live coral to hide from predators (Myers 1991) and is thought to mainly feed on demersal eggs, copepods, amphipods, alpheid shrimp, crabs, larval shrimp, and gastropods (Myers 1999). The Fourlined Wrasse forms distinct pairing during breeding (Breder and Rosen 1966).

Fourlined Wrasse are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of O'ahu population of Fourlined Wrasse at the 0-98 foot depth was approximately 177,710 individuals, but due to its secretive behavior, visual counts usually underestimate its numbers. The IUCN lists this species as 'Least Concern' (Sadovy 2010).

Cultural Significance

See Section 4.4.4.6 for a discussion of the cultural significance of *hinālea,* which includes the Fourline Wrasse.

4.4.4.8 Hawai'i Whitespotted Toby (Puffer) (*Canthigaster jactator*)

Ecology

The Hawaiian Whitespotted Toby is endemic to Hawai'i and Johnston Atoll (Lobel 2003). This species belongs to the pufferfish family (Tetraodontidae) and reaches lengths of 4 inches. The body is brown with white spots, the eye is green.

Hawaiian Whitespotted Toby are common in lagoon and seaward reefs at depth of 3 to 290 feet (Mundy 2005). This species has also been found to utilize man-made structures (Brock 1981) and has been shown to feed on sponges, algae, detritus, tunicates, polychaetas, bryozoans, sea urchins, brittle stars, crabs, peanut worms, shrimps, zoanthids, fishes, amphipods, and foraminiferans (Randall 1985). It often is afflicted with parasitic worms (nematodes) and causing it to become inflated (Deardorff and Stanton 1983),

Breeding behavior has not been documented for the Hawaiian Whitespotted Toby; however, the Eastern Pacific Whitespotted Toby (*Canthigaster punctatissima*) has been found to be sexually dimorphic. It is likely that the toby's breeding behavior is similar. Males and females guard their territories against others of the same sex. Male areas include the smaller territories of multiple females. Males mate with a female from their harem one at a time.

CREP (2018) data indicate that the 2016 island of O'ahu population of Hawaiian Whitespotted Toby at the 0-98 foot depth was approximately 1,888,605 individuals. The IUCN states that this species is common and locally abundant and lists the species as 'Least Concern' (Shao et al 2014a).

Cultural Significance

The Hawaiian Whitespotted Toby is one of three endemic pufferfish that inhabit Hawai'i's waters (Hoover 2007). The common name "Toby" originated in Australia. A review of cultural-historical literature (see Appendix A) did not reveal any specific Hawaiian names or cultural information related to the Hawaiian Whitespotted Toby; however, tobies are sometimes referred to generally as *makimaki* (Hoover 2007). Other names traditionally used for pufferfish include *'o'opu hue*, possibly an alteration of *ōpūhue (*calabash, gourd*),* and *kēkē* (potbelly).

4.4.4.9 Forcepsfish (*Forcipiger flavissimus*)

Ecology

The Forcepsfish has a long black snout, and the head is dark brown to black above and white below. The body is yellow with a black spot on the anal fin. Adults can grow up to 8 inches. This species is widespread throughout the Hawaiian Islands and the tropical waters of the Indo-Pacific area (University of Hawai'i 2016).

The Forcepsfish typically lives along exposed outer reefs containing abundant coral growth, caves, and ledges, and occasionally within lagoon reefs. They are usually found in pairs but may also be encountered as solitary animals or in small groups. It feeds on a variety of small animals including hydroids, fish eggs, and crustaceans, but prefers tube feet of echinoderms, pedicilaria of sea urchins, and polychaete tentacles (Myers 1991).

Forcepsfish are broadcast spawners. Many broadcast spawners migrate to the edge of the reef drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of O'ahu population of Forcepsfish is at the 0-98 foot depth was approximately 192,505 individuals. The species is listed as 'Least Concern' by the IUCN (Myers and Pratchett 2010).

Cultural Significance

The Forcepsfish is also known as the *lauwiliwili nuku ʻoiʻoi*. A review of cultural-historical literature (see Appendix A) did not reveal any additional cultural information related to this species.

4.4.4.10 Milletseed (Lemon) Butterflyfish (*Chaetodon miliaris*)

Ecology

The Milletseed Butterflyfish is endemic to Hawai'i and the most common species of butterflyfish in Hawai'i including Johnston Atoll (Lobel 2003). The species is named for the seed-sized black specks that are distributed in vertical rows on its lemon-yellow body. Other distinctive features are a black mask through the eye and a black spot near the tail. Adults reach lengths of 6.5 inches (University of Hawai'i 2016).

Habitat for this species includes coastal fringing reefs, lagoons, and outer reefs, with juveniles found on shallow inner reefs from April to June (Pyle and Craig 2010). The Milletseed Butterflyfish feeds primarily on zooplankton above the reef, but sometimes cleans other fishes and is also known to feed on nests of damselfish eggs if left unprotected.

Milletseed Butterflyfish are broadcast spawners. Many broadcast spawners migrate to the edge of the reef drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of O'ahu population of Milletseed Butterfly fish at the 0-98 foot depth was approximately 603,563 individuals. However, much of the Milletseed Butterflyfish population occurs below the 98-foot depth surveyed by the CREP, and therefore the population is underestimated by the survey. Additionally, according to Pyle and Craig (2010), range-wide approximately two-thirds of the species range is protected by the Papahānaumokuākea Marine National Monument, the species is abundant throughout its range with a stable population trend, and the species is thus listed as "Least Concern" by the IUCN.

Cultural Significance

The name *kīkākapu* is used to describe a number of butterflyfish species and were considered sacred (Titcomb 1972). Fornander (1916) reported the name is used in many chants. The Milletseed Butterflyfish is called *lau wiliwili* or *lauhau wiliwili*, meaning “*wiliwili* leaf,” because its shape is believed to resemble the endemic *wiliwili* tree (*Erythrina sandwicensis*).

4.4.4.11 Shortnose (Geoffroy’s) Wrasse (*Macropharyngodon geoffroy*)

Ecology

The Shortnose Wrasse is endemic throughout the Hawaiian Islands and Johnston Atoll (Lobel 2003) and is found at depths between 20 and 100 feet. It has dark blue spots on a yellow to orange background. Research suggests that the Shortnose Wrasse is common throughout its range (Craig 2010). This species inhabits mixed sand, rubble patches, and coral reefs where it feeds on mollusks (Lieske and Myers 1994). Distinct pairs are formed during breeding (Breder and Rosen 1966).

Shortnose Wrasse are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of O’ahu population of Shortnose Wrasse at the 0-98 foot depth was approximately 746,227 individuals. The species is listed as ‘Least Concern’ by the IUCN, and approximately two-thirds of its range is within the boundaries of the protected Papahānaumokuākea Marine National Monument, where fishing is prohibited (Craig 2010).

Cultural Significance

See Section 4.4.4.6 for a discussion of the cultural significance of *hinālea,* which includes the Shortnose Wrasse.

4.4.4.12 Bicolor Anthias (*Pseudanthias bicolor*)

Ecology

The Bicolor Anthias is a small (5 inch) Indo-Pacific Ocean fish found from Maldives to the Hawaiian Islands and south to northeastern Australia, typically at water depths between 30–210 feet. The upper half is a yellow orange color while the lower half is a lavender pink. They typically inhabit lagoon patch reef slopes and can be found in deep coastal to outer reef slopes in current prone areas. Small groups are found above coral outcrops or near crevices or ledges (Mundy 2005).

Bicolor Anthias are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984). In Pacific coral reef areas surveyed by NOAA, the highest density of this species was in the MHI, with 0.2 to 50.9 individuals per 2.5 acres (NOAA unpublished data as described in Heenan et al. 2014, as cited in Williams et al. 2016).

CREP (2018) data indicate that the 2016 island of O'ahu population of Bicolor Anthias at the 0-98 foot depth was approximately 300,208 individuals. The species is listed as 'Least Concern' by the IUCN (Williams et al. 2016).

Cultural Significance

A review of cultural-historical literature (see Appendix A) did not reveal any specific Hawaiian names or cultural information for the Bicolor Anthias.

4.4.4.13 Orangeband (Shoulder) Surgeonfish (*Acanthurus olivaceus*)

Ecology

The Orangeband Surgeonfish occurs in tropic waters of the Indo-west Pacific. The head and anterior half of the Orangeband Surgeonfish are distinctly paler than that of the dark grayish brown posterior. Juveniles are bright yellow. Orangeband Surgeonfish are commonly found in small groups near reefs at depths of 30 to 150 feet (Randall and Clements 2001) where they feed on detritus, diatoms, and algae (Myers 1991).

Orangeband Surgeonfish are broadcast spawners. Many broadcast spawners migrate to the edge of the reef drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of O'ahu population of Orangeband Surgeonfish at the 0-98 foot depth was approximately 1,380,451 individuals. The species is listed as 'Least Concern' by the IUCN, and is concerned common in most of its range with a stable population trend (Russell et al. 2012).

Cultural Significance

The Orangeband Surgeonfish is commonly referred to as *na'ena'e* ("quick, alert") (Pukui and Elbert 1986). The name *na'ena'e* is also applied to a native daisy known for its small yellow, orange, purple, or white flower (Pukui and Elbert 1986). A review of cultural-historical literature (see Appendix A) did not reveal any additional cultural information for the Orangeband Surgeonfish.

4.4.4.14 Moorish Idol (*Zanclus cornutus*)

Ecology

The Moorish Idol is a small (8 inch) fish that are vertically flattened, with black, yellow, and white vertical stripes, and a very long white sickle-shaped extension off the dorsal fin. It has a protruding, tubular snout with a yellow saddle across the top, and long, bristle-like teeth.

It has a long pelagic larval stage, which is the dispersal mechanism used in the widely-found species. They are found throughout the tropical pacific, from the coast of East Africa and the Indian Ocean to Mexico and the Galapagos Island. It inhabits mostly reefs in shallow waters where it feed on corals, sponges, and other small invertebrates. They mate for life, found individually, in pairs, or sometimes groups of up to 100, especially as juveniles (Randall 2005).

CREP (2018) data indicate that the 2016 island of O’ahu population of Moorish Idol at the 0-98 foot depth was approximately 285,667 individuals. The actual population may be larger, as the species is found at depths up to 590 feet (Carpenter et al. 2016). This species is listed as ‘Least Concern’ by the IUCN (Carpenter et al. 2016).

Cultural Significance

The Moorish Idol is known in Hawai’i as *kihikihi,* which translates as “corners, curves, angular” (Pukui and Elbert 1986). Titcomb (1972) also noted that other varieties of *kihikihi* were known by the terms “*kihikihi launui* (big-leafed), or *mane‘one‘o* (irritating), *k. alo-‘ula* (red breast), silvery, *k. pohaka* (big spot), and *k. halena* (yellowish)”.

4.4.4.15 Multiband (Pebbled) Butterflyfish (*Chaetodon multicinctus*)

Ecology

The Multiband Butterflyfish is endemic to the Hawaiian Islands and Johnston Atoll (Lobel 2003). The body is white with five or six brown vertical bands. A dark vertical bar runs along the eye and a black band along the tail fin. The distinguishing feature is an overall covering of small spots which create a pattern of horizontal and vertical lines along the body.

The Multiband Butterflyfish inhabits heavy coral areas of lagoon and seaward reefs at depths of 15 to 100 feet. This species mainly feeds on the polyps of small corals but also supplement their diet with worms, shrimps, hydroids, and algae fragments. This species is often seen in monogamous pairs and defending an established territory (Breder and Rosen 1966).

Multiband Butterflyfish are broadcast spawners. Many broadcast spawners migrate to the edge of the reef drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of O’ahu population of Multiband Butterflyfish at the 0-98 foot depth was approximately 806,937 individuals. The species is listed as ‘Least Concern’ by the IUCN, and two-thirds of its range is enclosed by the protected Papahānaumokuākea Marine National Monument, where fishing is prohibited (Pyle et al. 2010a)

Cultural Significance

The name *kīkākapu* is used to describe a number of butterflyfish species and were considered sacred (Titcomb 1972). A review of cultural-historical literature (see Appendix A) did not reveal any additional cultural information for the Multiband Butterflyfish.

4.4.4.16 Psychedelic Wrasse (Redtail Wrasse) (*Anampses chrysocephalus*)

Ecology

The Psychedelic Wrasse is endemic to the Hawaiian Islands and is found among seaweed coral reefs at depths from 40 to 450 feet (Lieske and Myers 1994). This species is dark brown with white spots and a red tail. However, like others in the wrasse family, as the females mature they undergo a color and sexual transition to the “terminal phase” male. These males have a bright orange head covered in blue spots and radiating lines. Psychedelic Wrasse terminal phase males are usually only found in depths greater than 50 feet (DLNR 2015). The main prey for the Psychedelic Wrasse are macro-invertebrates found among the rocks and corals it inhabits. Females usually form small groups with a single male (Lieske and Myers 1994).

Psychedelic Wrasse are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of O’ahu population of Psychedelic Wrasse at the 0-98 foot depth was approximately 146,521 individuals. However, the Psychedelic Wrasse occupies habitat below the 98 foot depth surveyed by the CREP study. As such, this is likely a low estimate, because much of the population is not observable by the methods of the study. Support for this conclusion is provided by Kane and Tissot (2017) who report that the Psychedelic Wrasse density at depths from 0-98 feet (0-30 meters; i.e., CREP survey area) was 0.16 psychedelic wrasse per 100 m^2 on the island of Hawai’i (similar data are not available for O’ahu). Below 98 feet (30 meters) they found:

- 0.16 Psychedelic Wrasse per 100 m^2 between 98-132 feet (30-40 meters);
- 0.15 Psychedelic Wrasse per 100 m^2 between 132-164 feet (40-50 meters); and,
- 0.67 Psychedelic Wrasse per 100 m^2 below 164 feet (50 meters).

These data clearly illustrate that the vast majority of the Psychedelic Wrasse population occurs at depths below those for which accurate population estimates are available; therefore, leading to an underestimation of population size using the CREP surveys. The density of Psychedelic Wrasse is over 4 times greater at depths below 164 feet (50 meters) than within the 0-98 feet (0-30 meter) range surveyed by CREP, and they are equally abundant at depths from 98 to 164 feet (30-50 meters). Therefore, in all likelihood, the actual population of Psychedelic Wrasse on O’ahu is substantially greater than that reported by the CREP data.

The Psychedelic Wrasse is a DLNR SGCN (Section 4.4.2) but is considered a species of ‘Least Concern’ by the IUCN (Pollard et al. 2010). This is partially because more than two-thirds of its range is enclosed by the protected Papahānaumokuākea Marine National Monument, where fishing is prohibited (Pollard et al. 2010).

Cultural Significance

See Section 4.4.4.6 for a discussion of the cultural significance of *hinālea,* which includes the Psychedelic Wrasse.

4.4.4.17 Eightline Wrasse (*Pseudocheilinus octotaenia*)

Ecology

The Eightline Wrasse is widespread from east Africa to the Hawaiian Islands. This species has variable color patterns from yellowish/orange to a pink/reddish body. The distinguishing feature of this species are the eight horizontal stripes, ranging from orange to a maroon red. They have a pointed head and mouth which enable them to feed on coral reef invertebrates such as, mollusks, sea urchins, fish eggs, and crab larvae (Myers 1991, 1999).

The Eightline Wrasse inhabits corals and seaward reefs at depths of 6 to 164 feet (Myers 1991) and forms distinct mating pairs (Breder and Rosen 1966). This species is diurnal, feeding during the day and resting at night.

Eightline Wrasse are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of O’ahu population of Eightline Wrasse at the 0-98 foot depth was approximately 206,014 individuals. This species is listed as ‘Least Concern’ by the IUCN (Sadovy and Rocha 2010).

Cultural Significance

See Section 4.4.4.6 for a discussion of the cultural significance of *hinālea,* which includes the Eightline Wrasse.

4.4.4.18 Crowned (Saddleback) Puffer (*Canthigaster coronata*)

Ecology

The Crowned Puffer is a small marine fish approximately 3–5 inches in length. It is light blue ventrally, and the darker dorsal portion is divided by light blue stripes. The head and body have many small pale spots, faint or absent on paler portions of the body, but very evident within the dark saddle like bars on the dorsal portion of the body (University of Hawai’i 2016).

It is endemic to Hawai’i including the Midway Islands and Johnston Atoll, inhabiting coral reefs about 15 to 450 feet deep, but mainly in depths below 70 feet. It is mostly found on sand or sand and rubble bottom or algal flats (University of Hawai’i 2016).

Crowned Puffers are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of O'ahu population of Crowned Puffer at the 0-98 foot depth was approximately 285,677 individuals. However, this is a low estimate because most of the Crowned Puffer population occurs below the 98-foot depth surveyed by the CREP and is not observable by the methods of the survey. It is found at depths of up to 541 feet and is considered to be common and locally abundant (Shao et al. 2014b). The species is listed as 'Least Concern' by the IUCN (Shao et al. 2014).

Cultural Significance

The Crowned Puffer is commonly referred to as *puʻu ʻōlaʻi,* and Hoover (2007) suggests "may have reminded the old Hawaiians of lava flows for the Hawaiian name *[puʻu ʻōlaʻi]* means "cinder cone"". A review of cultural-historical literature (see Appendix A) did not reveal any additional cultural information for the Crowned Puffer.

4.4.4.19 Saddle Wrasse (*Thalassoma duperrey*)

Ecology

The Saddle Wrasse is a common and endemic reef fish of Hawai'i and Johnston Atoll (Lobel 2003). It is found at depths ranging from 16 to 98 feet. This species has a blue head, green body with a prominent red saddle and purple highlights around the edges of the fins (University of Hawai'i 2016).

This species is commonly observed alone, in pairs, or in small groups close to the reef where they forage for small crustaceans, mollusks, worms, urchins, and brittlestars. Canine teeth are used to pick these invertebrates from the reef. Most individuals begin life as females, when older they show the typical blue, red, and green pattern. Females that change to males, which is common in the wrasse family (Labridae) and have a white bar behind the red saddle. These sex-changed males are called "terminal phase" males and become dominant territory holders that maintain a harem of females (University of Hawai'i 2016).

Saddle Wrasse are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of O'ahu population of Saddle Wrasse at the 0-98 foot depth was approximately 11,959,153 individuals. This species is considered abundant throughout the Hawaiian Archipelago and is listed as 'Least Concern' by the IUCN (Shea et al. 2010).

Cultural Significance

The Saddle Wrasse is also known as *hinālea lauwili*, which is believed to have been named in reference to the *wiliwili* tree which has bright orange flowers. The species is often mentioned in *moʻolelo* (stories) and is referenced in traditional fishing practices as well. The fish was historically eaten, though the hard scales on the fish meant that it was usually skinned, and it was often eaten raw. See also Section 4.4.4.6 for a discussion of the cultural significance of *hinālea,* which include the Saddle Wrasse.

4.4.4.20 Fisher's Angelfish (*Centropyge fisheri*)

Ecology

The Fisher's Angelfish is mostly orange with a thin blue outline highlighting the belly and anal fin, the caudal fin is pale yellow. Adults attain a length of only 2 inches. This angelfish is found throughout Hawai'i and Johnston Atoll (Lobel 2003). Small groups have been observed feeding on algae and small shrimp associated with coral along outer reef slopes at depths between 10 and 200 feet (Pyle 2001). This species is hermaphroditic and changes sex as it matures.

Fisher's Angelfish are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of O'ahu population of Fisher's Angelfish at the 0-98 foot depth was approximately 192,591 individuals. However, this is a low estimate because much of the population occurs below the 98-foot depth surveyed by the CREP and is not observable by the methods of the survey. Support for this conclusion is provided by Kane and Tissot (2017) who report that the Fisher's Angelfish density at depths from 0-98 feet (0-30 meters; i.e., CREP survey area) was 1.33 Fisher's Angelfish per 100 m^2 on the island of Hawai'i (similar data are not available for O'ahu). Below 98 feet (30 meters) they found:

- 1.33 Fisher's Angelfish per 100 m^2 between 98-132 feet (30-40 meters);
- 0.79 Fisher's Angelfish per 100 m^2 between 132-164 feet (40-50 meters); and,
- 0.40 Fisher's Angelfish per 100 m^2 below 164 feet (50 meters).

These data clearly illustrate that the vast majority of the Fisher's Angelfish population occurs at depths below those for which accurate population estimates are available; therefore, leading to an underestimate of population size. Therefore, in all likelihood, the actual population of Fisher's Angelfish on O'ahu is substantially greater than that reported by the CREP data.

The Fisher's Angelfish is a DLNR SGCN (Section 4.4.2) but is considered a species of 'Least Concern' by the IUCN (Pyle and Myers 2010b).

Cultural Significance

A review of cultural-historical literature (see Appendix A) did not reveal any specific Hawaiian names or cultural information for the Fisher's Angelfish.

4.4.5 Other Regulated Species

The Achilles Tang, Bandit Angelfish, and Hawaiian Cleaner Wrasse are regulated by the DAR in terms of bag limits, size limits, or both (HAR §13-77; Section 1.2.3), but are not collected to the level of the top 20 collected fish species. Of the 1,295,700 individual fish collected from O'ahu under Aquarium Permits since 2000, the Hawaiian Cleaner Wrasse ranks as the 26th most collected fish making up 0.87% (11,243 individuals) of the total fish collected, averaging 625 collected each year. The Achilles Tang ranks as the 33rd most collected fish making up 0.62% (8,092 individuals) of the total fish collected, averaging 450 collected each year. The Bandit Angelfish ranks as the 47th most collected fish making up 0.38% (4,866 individuals) of the total fish collected, averaging 209 collected each year.

The following sections provide a brief overview of the ecology of the other regulated fish species collected from O'ahu since 2000.

4.4.5.1 Achilles Tang (*Acanthurus achilles*)

Ecology

A member of the surgeonfish family, the Achilles Tang grows to 10 inches, is laterally compressed, and has a small mouth and eyes set high on the head. Adults are recognized by the bright orange patch at the base of the tail, where modified scales can be exposed when the fish flexes its tail. These modified scales or spines are used for defense from predators and competition for feeding areas (University of Hawai'i 2016).

The Achilles Tang is present throughout Hawai'i and found near exposed coral reefs and rocky shores. Flexible comb-like teeth are used to pick algae and seaweed that grow along the reefs. They spend a large amount of time foraging and aggressively protecting prime feeding territories (University of Hawai'i 2016). Juvenile typically range from 20 – 45 feet in depth, while the adults are found in the very shallow surge zone to 20 feet.

Spawning occurs in groups where females deposit eggs in open water, the males swim by, release sperm, and fertilize the eggs. Initially, larvae develop among plankton and then move to reefs for protection where juveniles develop to adults (University of Hawai'i 2016).

Achilles Tang are broadcast spawners. Many broadcast spawners migrate to the edge of the reef drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of O'ahu population of Achilles Tang at the 0-98 foot depth was approximately 5,750 individuals. This species is listed as 'Least Concern' by the IUCN (Choat et al. 2012).

Cultural Significance

The Achilles Tang is commonly referred to in Hawai'i as *pāku'iku'i*. The spelling and pronunciation of the Hawaiian names, which include *pākukui*, *pākuikui*, and *pāku'iku'i*, vary. They were considered "good eating"

(Pukui and Elbert 1986) and were also noted to be correlated with the *kukui* tree (*Aleurites moluccana*) that grows on land.

4.4.5.2 Bandit Angelfish (*Apolemichthys arcuatus*)

Ecology

The Bandit Angelfish is mostly pale with a broad black bar bordered by a narrow white band running across the upper side from the front of the eye to soft dorsal fin. A similar broad black band with white border runs submarginal on the caudal and anal fins.

It is endemic to the Hawaiian archipelago and Johnston Atoll. It is generally associated with reefs at a depth of 30 to 150 feet, seldom seen at depths less than 30 feet. Juveniles may occur more frequently in deeper habitats. They inhabit rocky reefs, in ledges and caves (Endoh 2007, as cited in Pyle et al. 2010b).

Bandit Angelfish are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

Due to the deep-water habitats of the Bandit Angelfish, a reliable population estimate could not be derived for the species. Kane and Tissot (2017) also reported the deep-water habits of the Bandit Angelfish, reporting that density of the fish at depths from 0-98 feet (0-30 meters; i.e., CREP survey area) was 0.03 Bandit Angelfish per 100 m^2 on the island of Hawai'i (similar data are not available for O'ahu). Below 98 feet (30 meters) they found:

- 0.00 Bandit Angelfish per 100 m^2 between 98-132 feet (30-40 meters);
- 0.12 Bandit Angelfish per 100 m^2 between 132-164 feet (40-50 meters); and,
- 0.10 Bandit Angelfish per 100 m^2 below 164 feet (50 meters).

These data clearly illustrate that the vast majority of the Bandit Angelfish population occurs at depths below the CREP survey depth. The IUCN reports that the species is abundant, particularly in the northwestern Hawaiian Islands and on deep reefs of the MHI, but that the species is infrequently seen (Pyle et al. 2010b). While anecdotal reports suggest that the populations at scuba diving depths on O'ahu may have declined as of 2009, the overall global population is considered stable (Pyle et al. 2010b), and this anecdotal decline was noted prior to the implementation of current regulations (see Section 1.2.3), and was limited to scuba diving depths, which is generally above where this species is found, as explained above.

The Bandit Angelfish is a DLNR SGCN (Section 4.4.2) but is considered a species of 'Least Concern' by the IUCN (Pyle et al. 2010b).

Cultural Significance

A review of cultural-historical literature did not reveal any specific Hawaiian names or any specific cultural information related to this species. This may be due to the species deep-water habits, where they may likely never have been observed historically (Lilley 2020).

4.4.5.3 Hawaiian Cleaner Wrasse (*Labroides phthirophagus*)

Ecology

This brilliantly-colored wrasse is recognized by its habit of “cleaning” host fishes. The male and female phases of the Cleaner Wrasse appear identical in color, but dominant, terminal (sex-changed) males patrol a territory that may include several smaller females and their cleaning stations. If the male dies, it is believed that the dominant female changes sex and takes over the territory (Waikiki Aquarium 2018). Reproduction is year-round, and spawning occurs in pairs (Waikiki Aquarium 2018, Tinker 1978). Juveniles have a different color pattern than the adults, black with a broad blue stripe on the dorsal surface. Unlike nearly all small wrasses, this species does not bury in the sand at night. While inactive on the bottom at night, it accumulates a cocoon of mucus, similar to that observed in many parrotfishes (Waikiki Aquarium 2018, Tinker 1978). The Hawaiian Cleaner Wrasse is endemic, found only in the Hawaiian Islands, though related species occur throughout Indo-Pacific reefs (Waikiki Aquarium 2018, Tinker 1978).

Individuals establish “cleaning stations” at specific locations on the reef where a variety of “client” or host fishes assemble and await the Hawaiian Cleaner Wrasse’s services. The Hawaiian Cleaner Wrasse’s special mouth design enables it to remove crustacean ectoparasites from the host fishes, and in the process of cleaning, they also feed on mucus and some scales (Waikiki Aquarium 2018).

Hawaiian Cleaner Wrasse are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of O’ahu population of Hawaiian Cleaner Wrasse at the 0-98 foot depth was approximately 190,455 individuals. The species is listed as ‘Least Concern’ by the IUCN (Allen et al. 2010). It is considered to be relatively common, and an estimated 80% of the species range is within the protected Papahānaumokuākea Marine National Monument, where fishing is prohibited (Allen et al. 2010).

Cultural Significance

While many wrasse species are referred to as *hinalea,* a review of cultural-historical literature did not reveal any specific Hawaiian names or any specific cultural information related to this species

4.4.6 Invertebrate Species

Approximately 4,100 species of marine invertebrates are known from the state of Hawai’i. A small portion (1.6%) of these marine invertebrate species are reported under Aquarium Permits, generally those species that are colorful or aesthetically pleasing. Between 2000 and 2017, approximately 66 invertebrate species were collected under Aquarium Permits in O’ahu waters; however, some of these included those species reported as a general group (e.g., hermits, stars, crabs) (DAR 2018a). Only 44 species were reported by enough permits (>2 permits reporting from each area of collection during each year of collection) to determine total number of individuals collected. Collection areas with less than three permits reporting fall under the DAR non-disclosure agreement, in which totals are not released publicly (Section 5.1). A total of 2,971,008 individual marine invertebrates have been reported as collected under Aquarium Permits since

2000 (Table 4-5). However, it is important to note that marine invertebrate collection does not require an Aquarium Permit, but does require a CML. Therefore, while some fishers may elect to report their invertebrate collection on their Aquarium Fish Catch Report, some collection of invertebrates may be reported on the more general, and less detailed, CML catch report.

Table 4-5. Total number of invertebrates collected under Aquarium Permits from 2000-2017 on the island of O'ahu (DAR 2018a).

Fiscal Year[1]	Number Individuals Kept (all fishers)	Number Individuals Kept (20 fishers)	Percent Contribution of 20 fishers
2000	33,302	6,549	19.7%
2001	78,291	10,516	13.4%
2002	70,208	8,740	12.4%
2003	30,910	12,643	40.9%
2004	253,628	8,862	3.5%
2005	297,291	8,287	2.8%
2006	346,172	6,495	1.9%
2007	419,804	2,656	0.6%
2008	144,618	2,545	1.8%
2009	113,102	2,439	2.2%
2010	119,756	3,579	3.0%
2011	120,323	3,667	3.0%
2012	153,696	3,928	2.6%
2013	149,011	4,982	3.3%
2014	167,923	2,384	1.4%
2015	159,440	1,410	0.9%
2016	160,830	2,051	1.3%
2017	152,703	1,290	0.8%
2018[2]	76,753	685	0.9%
Average (2000-2017)	**165,056**	**5,168**	**3.1%**
Total (2000-2017)	**2,971,008**	**93,023**	**3.1%**

[1]Fiscal year runs from July 1 through June 30
[2] Data from 2018 were provided for the calendar year for all fishers, and for the fiscal year for the 20 fishers. However, both datasets contain 12 calendar months, and are considered comparable for analysis.

Of the invertebrates collected on O'ahu and reported under Aquarium Permits, 89.7% (2,664,728 individuals) reported represent just three species; hermit crabs (species not specified), Feather Duster Worms (*Sabellastarte spectabilis)*, and Zebra Hermit Crabs (*Calcinus laevimanus*; Table 4-6). An additional 41 species account for the other 10.3% of invertebrates reported collected (excluding non-disclosed data) (DAR 2018a). The 20 fishers that would be covered under Aquarium Permits under the Proposed Action collected a total of 93,023 invertebrates between 2000 and 2017, representing less than 3.5% of the total invertebrate collection.

Table 4-6. Top three marine invertebrate species collected under Aquarium Permits on the island of O'ahu from 2000-2017 DAR 2018a).

Common Name	Scientific Name	All fishers		20 fishers	
		Number Collected	Percentage of Total Invertebrates Collected[1] (2,971,008)	Number Collected	Percentage of Total Invertebrates Collected (93,023)
Hermit Crab	Various species	1,505,061	50.7%	4,230	4.5%
Zebra Hermit Crab	*Calcinus laevimanus*	694,565	23.4%	1,653	1.8%
Feather Duster Worm	*Sabellastarte spectabilis*	465,102	15.7%	54,649	58.7%
Total (top 3 species)		**2,664,728**	**89.7%**	**60,532**	**65.1%**

[1]Percentage calculated based on total number of invertebrate individuals collected (2,972,008) on O'ahu and does not include any non-disclosure totals.

The following sections provide a brief overview of the ecology of each of the top three aquarium invertebrate species collected.

4.4.6.1 Hermit Crab (various species)

Hermit crabs are known in Hawai'i as *unauna* (DAR 2015). Because specific species of hermit crabs are not reported on Aquarium Permit reporting forms, it is not possible to know which species are collected, with the exception of Zebra Hermit Crabs (Section 4.4.6.2). However, hermit crabs are one of the most common types of tide pool animals. They rely on empty snail shells for protection. Most species will scavenge the reefs consuming fish, other invertebrates, or algae. Some will display a variety of coloration and elaborate eye colors. Approximately 23 species of hermit crabs are known from Hawai'i shorelines.

No population estimates are available for hermit crabs.

4.4.6.2 Zebra Hermit Crab (*Calcinus laevimanus*)

This species of hermit crab is found in a large area of the Indo-Pacific, extending from Africa to Australia and Japan to Hawai'i. The common name comes from the coloration, black and white pincers, and white bands on dark legs. They also have orange and sky-blue eyestalks. They prefer to inhabit gastropod shells in intertidal flats, reef flats, and rock platforms, and may also be found in mangrove areas on sand mud bottoms and on rocky shores (Rahayu 2000).

No population estimates are available for Zebra Hermit Crabs.

4.4.6.3 Feather Duster Worm (*Sabellastarte spectabilis*)

Feather Duster Worms are native to the Indian Ocean and Red Sea but are a widely introduced species inhabiting the Gulf of Mexico and Hawai'i, appearing sometime after World War II. The Feather Duster Worm is known in Hawai'i as *kio po'apo'ai* (DAR 1998). It is approximately 3.1 inches in length, and 0.5 inch in width. It is buff in color with purple specks, living in a tough leathery tube covered with fine mud. Branched tentacles project from the tube and form a plum. This species can reproduce either asexually through fragmentation or sexually (Bailey-Brock 1976). They are found in holes and cracks among algae on reefs and rocky shores. It may sometimes be found growing in crevices of corals, under boulders in still water, tidal pools, or in channels exposed to heavy surf (Bailey-Brock 1976).

No population estimates are available for Feather Duster Worms, however they are considered abundant on O'ahu's south shore reefs, within Pearl Harbor, and at Kaneohe Bay at shallow depths (Hawaii Biological Survey 2001).

4.4.7 Threatened and Endangered Wildlife Species

A total of 8 federal and 10 state-listed threatened or endangered marine species, consisting of 1 seal, 4 whales, and 5 sea turtles, occur in Hawai'i (Table 6). Federal endangered species are those species that the US Fish and Wildlife Service define as being in danger of becoming extinct, while threatened species are those likely to become endangered in the foreseeable future. State endangered species are those defined by the DLNR as in danger of becoming extinct at a state level, while threatened species are those likely to become endangered in the foreseeable future at the state level. No species collected by aquarium fishers occur on the state of federal list of threatened and endangered species.

Table 4-7. Threatened and endangered marine species of Hawai'i.

Common Name	Scientific Name	State Status	Federal Status
Mammals			
Hawaiian Monk Seal	*Neomonachus schauinslandi*	E	E
Fin Whale	*Balaenoptera physalus*	E	NA
Humpback Whale	*Megaptera novaeangliae*	E	E
Sperm Whale	*Physeter catodon*	E	E
False Killer Whale	*Pseudorca crassidens*	E	NA
Reptiles			
Pacific Leatherback Sea Turtle	*Dermochelys coriacea schlegelii*	E	E
Pacific Hawksbill Sea Turtle	*Eretmochelys imbricata bissa*	E	E
Loggerhead Sea Turtle	*Caretta*	T	T
Green Sea Turtle	*Chelonia mydas*	T	T
Olive Ridley Sea Turtle	*Lepidochelys olivacea*	T	T

4.4.8 Reef Habitat

Stretching for more than 1,200 miles in the Central Pacific, Hawaiian coral reefs account for about 85% of all coral reefs in the United States. More than 500 species of algae also live in Hawai'i's coral reefs providing food for fish and oxygen for all marine life. The oceans' algae provide more oxygen than all land plants worldwide combined. There are 78 species of endemic marine algae, 24 species of endemic freshwater algae, and two aquatic plants included on Hawai'i's list of SGCN (DLNR 2015).

Hawai'i's reefs are unique among the world's reef ecosystems. Compared to coral reefs in the Indo-Pacific or Caribbean, Hawaiian reefs are relatively young. Hawai'i reefs are therefore dominated by hard corals (as opposed to sponges, tunicates, and soft corals) and are inhabited by distinctive reef fish and other marine life. Hawai'i hosts about 40 species of hard, reef building corals (MRC 2017). Due to Hawai'i's extreme isolation, an estimated 25% of the coral reef species are found nowhere else.

Stony corals are defined by Hawai'i Administrative Rule 13-95 as any species belonging to the Order Scleractinia (marine corals which generate a hard skeleton). All reef corals, including mushroom corals, belong to this order (DAR 2014b). The animals which form stony corals belong to the same major group as jellyfish and anemones. Most of them are colonial, and all secrete a hard skeleton made of calcium carbonate. The animals themselves, called polyps, form the outer living layer of a coral colony. Each polyp sits in a cup-like depression called a calyx. Some Hawaiian stony corals grow very slowly and can take hundreds of years to recover from damage. To differentiate from many west Pacific corals which can grow very rapidly, and from *Pocillopora* which rapidly recolonizes dead reefs and grows rather quickly (DAR 2014b).

The characteristic color of many living corals is due to the presence of single-celled algae, called zooxanthellae, which live inside the coral polyp. The coral and algae have a symbiotic relationship. Most stony corals produce colonial forms that are attached to the substrate, but a few are solitary and unattached (DAR 2014b).

Coral reefs surround the island of O'ahu, although active live coral growth is limited to the leeward sides of the island or in sheltered areas on the windward coasts. In 2014 and 2015, coral reefs in the main Hawaiian Islands suffered up to 90% bleaching and 50% mortality rates in some areas due to widespread prolonged warming events during each year (Rodgers et al 2017). These areas affected included portions of O'ahua.

4.4.8.1 Corals Common to Hawai'i (DAR 2014b)

Rose or Cauliflower Coral (*Pocillopora meandrina*)

The most common *Pocillopora* in Hawai'i, this coral prefers wave-agitated environments, and is found at depths to about 150 feet. Commonly called "rose coral" or "cauliflower coral," the colonies form cauliflower-shaped heads about 10 to 20 inches in diameter. Branches are heavy and leaf-like and fork bluntly near the ends. All branches have wart-like projections called verrucae that are covered with calices. Color of living colonies ranges from brown to pink.

Lace Coral (Pocillopora damicornis)

This delicate and fragile coral forms small bushy clumps up to about 6 inches in diameter. Colonies consist of fine branches covered with calices. These branches range from long and slender in calm waters to more robust forms in areas of wave action. Sometimes the skeleton will create pocket formations around a crab that lives among the branches. Usually found in protected areas and inner portions of large reef flats, this species appears to strongly depend on sunlight, as it is rarely found below about 30 feet. Colonies range in color from light brown in shallow waters to dark brown in deeper waters.

Antler Coral (Pocillopora eydouxi)

Colonies consist of thick pipe-like branches that resemble moose antlers. This species also possesses verrucae and is usually found in depths of 35 to 150 feet. Live colonies are brown in color and usually darker than other Pocilloporid corals.

Lobe Coral (Porites lobata)

This coral produces many encrusting or massive forms on the reef from the intertidal zone to depths of over 180 feet. Long narrow cracks found on the coral heads are produced by a type of alpheid shrimp. Calices have a snowflake-like appearance and are shallow and flush to the surface. Living colonies range in color from yellowish-green to brown and sometimes blue.

Finger Coral (Porites compressa)

Distinguishing features are the finger-like branching and shallow snowflake-shaped calices. This species is most common in wave-protected areas like bays or deeper reef slopes to depths of about 150 feet. It has many growth forms, but all of them show some sort of fingerlike branching. Color of live colonies ranges from light brown to light yellowish-green.

Rice Coral (Montipora capitata)

The most obvious characteristic of this coral is the nipple-like projections (papillae) that cover the surface. These papillae are smooth with no calices on them. Calices are found on the upper surface of the coral between the papillae. The image of the calices and papillae create a "rice & pepper" appearance. This species is found at depths up to about 150 feet. It has a number of growth forms ranging from plate-like to branchlike and encrusting types. Color of living colonies is usually brown. If the colony is growing in a plate form, the edges may be white.

Mushroom or Razor Coral (*Fungia scutaria*)

This solitary (single polyp), free-living (unattached) coral is most commonly found on reef flats, frequently between cracks and crevices. It has also been found at depths of over 75 feet. Its disk-like, elliptical shape resembles a mushroom cap and ranges from 1.5 to 7 inches in diameter. Some adults may form a high arch in the middle. Immature forms are attached to the substrate or an adult mushroom coral by a stalk. It grows into a disk and, when large enough, breaks off the stalk and becomes free-living. The color of live specimens ranges from pale brown in bright sunlight to dark brown in shady areas or deeper water.

Cup or Tube Coral (*Tubastraea coccinea*)

This is a common non-reef building coral found in shallow Hawaiian waters. This species forms large calices and occurs in clumps that are 2 to 4 inches in diameter. Living tissue is usually bright orange in color but may also appear pink or even black. The bright coloration is not produced by zooxanthellae. This coral is usually found on steep ledges, in caves and in shady tidepools.

4.4.9 Invasive Species

From *A Guidebook of Introduced Marine Species in Hawai'i* (DeFelice et al. 2001):

> *Through the Hawai'i Biological Survey at Bishop Museum, a count of the total number of species in the Hawai'i Archipelago has been compiled. In 1999, there were 23,150 known species of terrestrial and aquatic algae, plants, and animals, including 5,047 nonindigenous species (~ 20%). The total number of marine and brackish water alien species in the Hawaiian Islands was 343, including 287 invertebrates, 24 algae, 20 fish, and 12 flowering plants.*
>
> *The 287 alien marine invertebrate species make up about 7% of the known marine and brackish water invertebrate fauna in the Hawaiian Islands (4,099 species). Arthropods have been the most successful marine invaders, with 71 suspected alien crustacean species, while 53 alien mollusks have made it to Hawai'i. Limited information exists for these invasive species.*
>
> *The greatest number of introduced marine invertebrates have arrived to Hawai'i through hull fouling, but many have also arrived with solid ballast and in ballast water. DeFelice et al. (2001) considered 201 species (70%) to be introduced, and 86 species (30%) cryptogenic (not demonstratively native or introduced). Two hundred forty-eight (87%) have become established, 15 (5%) arrived but failed to become established, 6 (2%) were intercepted, and the population status of 18 species (6%) is unknown.*
>
> *The nonindigenous invertebrate species in the Hawaiian Islands are primarily of Indo-Pacific/Philippines Islands region origin. A surprising number of species from the tropical western Atlantic/Caribbean region have invaded Hawai'i as well.*

Invasive algae pose the largest threat to Hawai'i's reef ecosystem. The five most common algae species posing the largest threat include Smothering Seaweed (*Kappaphycus* and *Euchema* spp.), Gorilla Ogo (*Gracilaria salicornia*), Leather Mudweed (*Avrainvillea amadelpha*), Hook Weed (*Hypnea musciformis*), and Prickly Seaweed (*Acanthophora spicifera*). Marine debris arriving from other countries and regions and ballast water/biofouling are the primary threat for invasion in the Hawaiian Islands.

Invasive fish species of concern in Hawai'i include the Bluestripe Snapper (= Taape; *Lutjanus kasmira*) and Peacock Grouper (= Roi, bluespot peacock grouper; *Cephalopholis argus*). The Blacktail Snapper (*Lutjanus fulvus*) is less common and restricted to the main Hawaiian Islands. All three species were introduced from 1956-1961, mostly as game fish (Russell et al. 2016a, Russell et al. 2016b, Choat et al. 2018). The introduction of the Bluestripe Snapper into Hawai'i included at least one non-native parasite that has spread to local fishes (Gaither et al. 2013).

The Peacock Grouper prefers exposed reef front habitats with a water depth of 3 to 30 feet, while juveniles utilize thick pockets of coral (Myers 1999). Individuals use a variety of hunting techniques to capture prey. They may hover and wait, stalk prey, and follow larger predators such as eels and attack missed prey (Hoover 2008). Dierking et al. (2009) found reef fishes were the principal diet component (97.7% by %

Index of Relative Importance [IRI]) of Peacock Grouper. Crustaceans were the only other higher taxonomic group in the diet but were of minor importance (2.3% by %IRI) (Dierking et al. 2009).

The Peacock Grouper (Section 4.4.1.34) is a known carrier of Ciguatera (a foodborne illness), which is well known by the local fishermen and therefore its use as a food fish is intentionally very limited (BIAAF, pers. comm., also reviewed in Appendix A). It has become a dominant predator species in the Main Hawaiian Islands and is known to have negative ecological impacts on other endemic and culturally valued species (Dierking 2007). In recent years, efforts to minimize populations of this species have led to statewide events often dubbed “roi round-ups,” where local spear fishers are encouraged to catch and remove as many roi from the reefs as possible. However, a recently completed 5.5-year study found that removal of the Peacock Grouper did not translate into sustained increases in prey, nor to increases in total fish biomass (Giddens et al. 2017).

The Bluestripe Snapper and Peacock Grouper are well established in Hawai’i. The Blacktail Snapper occurs at low densities only in the lower Hawaiian Islands (Randall 1987, Gaither et al. 2010 as cited in Russell et al. 2016b). From 2008 through 2014, regional estimates of the density of Blacktail Snapper ranged from 1.8 to 14.1 individuals per 2.5 acres over hard bottoms to 98.5 feet depth in Pacific coral reef areas surveyed by NOAA (NOAA unpublished data as described in Heenan et al. 2014 as cited in Russell et al. 2016b). The highest recorded density was in the MHI region (0.3 to 45.1 individuals per 2.5 acres) as compared to the lowest in the Southern Mariana Islands region (0 to 4.3 individuals; Russell et al. 2016b).

5.0 ENVIRONMENTAL CONSEQUENCES

This section discusses the impacts of implementing the four alternatives on resources retained for further analysis. Aspects of the environment that may be affected by the alternatives is discussed to the level of detail commensurate with the potential effect. Those aspects of the environment that would not be affected are discussed briefly. The content, intensity, and likelihood of the impact were taken into consideration in the making of these ratings.

Direct, indirect, and cumulative impacts are evaluated for each resource. The temporal scope of the impacts analysis is five years. The HEPA does not specifically define direct and indirect impacts. As such, for the purposes of this DEIS, the National Environmental Policy Act (NEPA) definitions are used. The NEPA defines direct effects as those effects that are caused by the action and occur at the same time and place (40 Code of Federal Regulations [CFR] § 1508.8(a)). Indirect effects include effects later in time or farther removed in distance but are still reasonably foreseeable (40 CFR § 1508.8(b)). Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems (40 CFR § 1508.8).

The HEPA does not specifically define mitigation. As such, for the purposes of this DEIS, the NEPA definition is used. According to the CEQ regulations (40 CFR 15008.20), mitigation means:

- Avoiding impact altogether

- Minimizing impact
- Limiting the degree or magnitude of action
- Rectifying impact
- Repairing, rehabilitating, restoring
- Reducing or eliminating impact over time
- Preservation and maintenance activities
- Compensating for the impact
- Replacing or providing substitutes

However, the HEPA Guide (OEQC 2014) indicates that an EIS needs to consider all mitigation measures to avoid, minimize, rectify, or reduce adverse impacts. Therefore, mitigation is only considered for alternatives with a significant adverse impact.

The HEPA defines cumulative impacts as the impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (HAR Section 11-200-2).

Cumulative impacts were analyzed according to a tiered approach, which allows for a resource-specific analysis of regional and local actions and narrows the focus to those effects with direct influence on the proposed action and agency decision-making. Following this approach, the cumulative impacts analysis focused on potential impacts to socioeconomics, cultural resources, and biological resources, including the top 20 aquarium fish collected on O’ahu, SGCN fish species with a history of aquarium collection from O’ahu, 3 additional regulated fish species, and reef habitat, as these are the resources with the potential for on-going impacts due to commercial aquarium fish collection. The spatial analysis area for cumulative effects is the nearshore waters of the island of O’ahu from the shoreline out to 3 nautical miles.

Conclusions of significance are based on the best available data as analyzed in this DEIS. The HEPA standards for a significant impact are described in Section 1.2.2. For the purposes of this DEIS, impacts were assessed on a descending scale:

1. Significant impact (HEPA standards);
2. Significant impact that is mitigable to less than significant;
3. Less than significant impact;
4. No impact; and
5. Beneficial impact.

5.1 HRS §189-3 AND DATA ANALYSIS

HRS §189-3 states:

> *(a) Upon the demand of the department, every commercial marine licensee shall furnish to the department a report or reports with respect to the marine life taken and any other information the department may require for the purposes of this section.*
>
> *(b), "Any information submitted to the department by any person in compliance with any requirement under this section shall be confidential and shall not be disclosed, except when required under court order or pursuant to subpoena issued by the department of the attorney general, or with the prior written consent of the person submitting the information, or under cooperative agreements with government agencies of the United States for exchange and use of the information specifically to manage marine life. The department, by rule, may establish procedures necessary to preserve the confidentiality, except that the department may release or make public any of the information in the aggregate or summary form which does not directly or indirectly disclose the identity of any person who submits information."*

The DAR complies with this statute by keeping confidential any catch data when less than three collectors report from an individual collection zone (Figure 1). Collection zones depicted in Figure 1 correspond to areas defined by the monthly report fishers are required to provide to DAR. Confidential data are identified as n.d. (not disclosed) in the tables in Section 5.0. The impact of this statute on data analysis is minimal but can cause confusion when numbers in the text or in the tables do not exactly match up, or do not match previously published reports for which the n.d. data were available (i.e., DAR reports). Although it is possible for 1-2 aquarium fishers to collect large numbers of fish and skew the data, this concern was minimized by the manner in which data were analyzed. Data provided by the DAR for this DEIS were evaluated using many parameters, thereby minimizing bias due to confidentiality. The data were also viewed in aggregate and over extended time periods (i.e., 2000-2017) to further minimize confidentiality issues. Additionally, the 20 fishers included in the Proposed Action waived their right to confidentiality, so all data from 2000 through 2017, as well as from 2018, for these 20 fishers were released for analysis in this EIS.

5.2 SOCIOECONOMIC RESOURCES

5.2.1 Direct Effects

From 2000 to 2017, the aquarium fishery on O'ahu added an average of $540,542 (inflation-adjusted 2019 dollars) annually to the state of Hawai'i's economy, while the overall aquarium fishery within the state of Hawai'i added an average of $2,172,028 (inflation-adjusted 2019 dollars) to the economy (DAR 2018a, Table 5-1). Total ex-vessel value (i.e., price received by a fisher for the catch) for O'ahu ranged from a low of $211,246 in 2003 to a high of $778,491 in 2012 (inflation-adjusted 2019 dollars), with an average value over the 18-year period of $540,542. During the period from 2000 through 2017, the 20 fishers made up from 31.9% to 71.5% of the total economic value of the O'ahu commercial aquarium fishery.

As described in Section 4.1.1, on average, 16.7% of this value is attributable to invertebrate species and 79.4% is attributable to fishes, with the remaining percentages attributable to non-disclosure data, unknown species, and miscellaneous species. Assuming that the average percentages can be applied to the average inflation-adjusted total ex-vessel value of $506,251, approximately $401,963 can be attributed to fish collection, and $84,544 can be attributed to invertebrate collection, on average. It should be noted that the dollar value of these fisheries represents only the ex-vessel value and does not include the value which would be generated by additional dealer, retail sales, and shipping costs. The actual economic value of the catch is thus substantially greater than the ex-vessel value and is discussed in further detail in the indirect impacts section below.

Table 5-1. Minimum, maximum and average market values of the commercial aquarium fishery from 2000 through 2017 (inflation-adjusted 2019 values). See Table 4-1 and Table 4-2 for additional data by year.

		Minimum	Maximum	Average
O'ahu	All Fishers	$211,246	$778,491	$540,542
	20 Fishers	$100,951	$486,891	$286,174
State of Hawai'i	All Fishers	$1,333,497	$2,708,609	$2,172,028

Based on data provided by the DAR (2018a), the market value of the O'ahu commercial aquarium fishery has increased by 212%, growing from a value of $242,856 in 2000 to a value of $513,723 in 2017 (Table 4-2), representing a 4.5% annual growth rate[5].

All commercial aquarium collectors must obtain the state Aquarium Permit and the CML, which allows them to offer the collected fish for sale. The Aquarium Fish Catch Report requirement is triggered by the CML. Some collectors participate in a dive team. To avoid duplicate fish catch reporting, only a principal diver is required to report the catch and effort for the dive team (DAR, pers. comm., 2018). This process ensures that reported catch data are not duplicated in the State's system. However, this reporting mechanism can lead to confusion by outside observers, as the total number of permit holders is higher than the number of permit holders reporting data (Table 7), giving the appearance of under reporting. Analysis by the DAR (2019a) has shown that actual underreporting of catch is small, with a 3.5% difference between the number of animals reported caught and sold in 2010 and a 0.4% difference in 2014, which likely represent live releases and mortality. For the period of 2000 to 2017, the total number of permit holders in O'ahu ranged from 66 to 126 (average = 85), while the number of permit holders reporting ranged from 28 to 52 (average = 40). In 2017, it is estimated that up to 126 individuals were directly employed in the commercial aquarium fishery in O'ahu (up to 226 employed in the state of Hawai'i).

5.2.1.1 No Action Alternative

Under the No Action Alternative, collection of aquarium fish using fine mesh nets would not occur, though collection of fish and invertebrates may continue using methods not requiring an Aquarium Permit. Commercial aquarium fishers may no longer find it feasible to target aquarium fish and may begin to participate in other fisheries, but this is not possible to quantify at this time.

[5] $Annual\ Percent\ Growth = \left[\frac{2017\ value}{2000\ Value}^{1/17} - 1\right] * 100$

Under the No Action Alternative, some aquarium collection may continue using legal gear or methods other than fine mesh nets. Since the ban on Aquarium Permits went into effect in October 2017, based on data disclosed by the DAR, O'ahu has reported sales of $387,852 during the 2018 calendar year (inflation-adjusted 2019 values, Table 4-2; DAR 2019b). Therefore, under the No Action Alternative, it is estimated that the commercial aquarium fishery would add approximately $387,852 to the state of Hawai'i's economy in the first year of the 5-year analysis period based on 2018 data (DAR 2019b). Assuming a 4.5% annual growth rate, this would total approximately $2.1 million over the 5-year analysis period (average of $424,365 per year) and an unknown number of jobs (assumed to be <126) under the No Action Alternative. This would represent a loss on O'ahu of approximately $835,323 over the 5-year analysis period compared to the Pre-Aquarium Collection Ban Alternative (average of $167,065 per year), which represents an annual loss of less than 0.01% of the $8.6 billion ocean economy in Hawai'i, and an even lesser percentage of the overall Hawai'i economy.

The No Action Alternative would have a ***less than significant beneficial direct impact*** on Hawai'i's overall and ocean-based socioeconomic resources, and a ***less than significant impact*** compared to the Pre-Aquarium Collection Ban Alternative.

5.2.1.2 Pre-Aquarium Collection Ban Alternative

Under the Pre-Aquarium Collection Ban Alternative, an unlimited number of Aquarium Permits would be issued for the use of fine-mesh nets on O'ahu, and it is assumed for this analysis that collection, including the value and sales of fish, would follow historic collection rates (see Table 4-2). Based on historic data collected prior to the October 2017 ban on commercial aquarium collection, under the Pre-Aquarium Collection Ban Alternative the commercial aquarium fishery is estimated to create approximately 126 jobs, and add an average of $540,542 (inflation-adjusted 2019 dollars) to the state of Hawai'i's economy during the first year of the 5-year analysis period. Assuming an annual growth rate of 4.5%, this would total over $2.9 million over the 5-year analysis period (average of $591,430 per year). This represents less than 0.01% of the $8.6 billion ocean economy in Hawai'i, and even less of Hawai'i's economy overall.

The Pre-Aquarium Collection Ban Alternative would have a ***less than significant beneficial direct impact*** on Hawai'i's overall and ocean socioeconomic resources.

5.2.1.3 Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative

The Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative would include issuance of an unlimited number of Aquarium Permits for O'ahu, a 740-acre (299.5-hectare) expansion of the Waikiki MLCD (Figure 2), and creation of a daily bag limit of 10 Flame Wrasse per day for the O'ahu commercial aquarium fishery. Within the expanded Waikiki MLCD, no commercial aquarium fish collection would occur; however, no restrictions would be placed upon other fisheries.

The expanded areas of the Waikiki MLCD fall within O'ahu collection zone 400. However, the data available for this DEIS cannot be used to quantify the number of fish collected or the species collected from this area. It is expected that any socioeconomic impacts would be tempered either by market forces (limited supply = increase value) or through redirection of effort and resources by commercial aquarium fishers to other areas of O'ahu open to commercial aquarium collection.

The 10 individual Flame Wrasse bag limit is an estimated 60% reduction in the number of Flame Wrasse taken by the commercial aquarium fishery. Since 2012, a total of 15,743 Flame Wrasse have been collected on O'ahu during 625 trips[6]. This results in an average of 25.2 Flame Wrasse per trip. The 10 individual Flame Wrasse bag limit is an estimated 60% reduction in the number of Flame Wrasse taken by the commercial aquarium fishery on O'ahu. Estimated value of the Flame Wrasse on O'ahu since 2012 has averaged $48,169 per year. The worst-case scenario under this Alternative would be that the income from Flame Wrasse will be cut by approximately 60% ($28,901). This represents approximately 5.3% of the $540,542 O'ahu commercial aquarium fishery, or 1.3% of the annual economic impact of the $2,172,028 (average, inflation-adjusted value) aquarium fishery in the State of Hawaii. This impact may be buffered however, as the cost per fish may increase as the supply of Flame Wrasse decreases, negating any socioeconomic impact to the fishers. If this were to be case, the socioeconomic impact of the bag limit would be seen on the consumer side (i.e., those purchasing aquarium fish, who would have to pay a higher premium due to decreased supply).

However, assuming the impact is 5.3% of the O'ahu commercial aquarium fishery value, the Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative would add approximately $511,641 in the first year of analysis, and assuming an annual growth rate of approximately 4.5%, a total of approximately $2.8 million would be added over the 5-year analysis period (average of $559,808 per year). This represents less than 0.01% of the $8.6 billion ocean economy in Hawai'i, and even less of Hawai'i's economy overall.

The Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative would have a ***less than significant beneficial direct impact*** on Hawai'i's overall and ocean socioeconomic resources, and a ***less than significant impact*** on Hawai'i's overall and ocean socioeconomic resources compared to the Pre-Aquarium Collection Ban Alternative.

5.2.1.4 Limited Permit Issuance (Preferred) Alternative

Under the Limited Permit Issuance (Preferred) Alternative, Aquarium Permits would be issued to 20 fishers for the use of fine-mesh nets on O'ahu. Other commercial aquarium fishers would not be permitted to use fine mesh nets, though collection of aquarium fish would still be permitted using other legal means. This would create a minimum of 20 jobs for the 20 fishers who would have permits.

The 20 fishers averaged $286,174 per year on O'ahu between 2000 and 2017, up to a maximum of $486,891 (based on the maximum from 2015) (inflation-adjusted 2019 dollars; see Table 4-2). Assuming that the first year of the 5-year analysis period would have a market value for the 20 fishers of $286,174 to $486,891 and applying a 4.5% annual growth rate, the Limited Permit Issuance (Preferred) Alternative would add from $1.5 to $2.6 million over the 5-year analysis period (average of $313,115 to $532,728 per year).

For the remaining fishers, based on data from 2018 (see Table 4-2), it is estimated that the first year of the 5-year analysis period would have a market value of approximately $100,076 (the difference between the 2018 value for all of O'ahu, minus the 20 fishers, in inflation-adjusted 2019 dollars). Assuming a 4.5% annual growth rate, a total of approximately $547,487 would be added over the 5-year analysis period (average of $109,497 per year). This would be in addition to the market value of the 20 fishers, for a total

[6] For the purposes of this analysis, it was assumed that one trip is equal to one day fished under a single permit.

of $422,612 to $642,225 per year ($2.1 million to $3.2 million over the 5-year analysis period), which represents less than 0.01% of the $8.6 billion ocean economy in Hawai'i, and even less of Hawai'i's economy overall.

The Limited Permit Issuance (Preferred) Alternative would have a ***less than significant beneficial direct impact*** on Hawai'i's overall and ocean socioeconomic resources compared to the No Action Alternative, and a ***less than significant impact*** compared to the Pre-Aquarium Collection Ban Alternative.

5.2.2 Indirect Effects

Indirect socioeconomic impacts of the commercial aquarium fishery would primarily involve the additional profits from the aquarium fish market (including freight and packaging), as well as other tourist businesses such as snorkel and dive operations that rely on seeing and interacting with a healthy reef ecosystem. The presence of a healthy reef ecosystem may also impact overall land/home values on the island of O'ahu.

As described in Section 4.1.1, the total sales of the Hawaiian aquarium fishery (including freight and packaging) is nearly six times the ex-vessel value (Walsh et al. 2003). Therefore, it is estimated that the commercial aquarium fishery indirectly adds approximately five times the direct socioeconomic costs described in Section 5.2.1 to the economy.

5.2.2.1 No Action Alternative

Under the No Action Alternative, commercial aquarium fishing on O'ahu would continue using methods other than fine mesh nets.

The commercial aquarium fishery is expected to add approximately $2.1 million over the 5-year analysis period to the economy under the No Action Alternative, for an indirect economic benefit (e.g., export of fish, freight, packaging, etc.) of approximately $10.6 million over the 5-year analysis period, or an average of $2.1 million per year, representing less than 0.01% of the annual $84.9 billion gross domestic product of Hawai'i.

Based on the direct economic loss of approximately $835,323 over the 5-year analysis period compared to the Pre-Aquarium Collection Ban Alternative (this loss is described in Section 5.2.1.1), approximately $20.8 million in indirect economic benefits of this fishery would not occur over the 5-year analysis period, or an average of $4.1 million per year, representing less than 0.01% of the annual $84.9 billion gross domestic product of Hawai'i.

Under the No Action Alternative, a portion of the direct and indirect income from this fishery (total of $12.7 million over the 5-year analysis period) would continue to be put back into Hawai'i's economy through re-investment efforts in terms of equipment, maintenance, supplies, and personnel, which would be $5 million less under the No Action Alternative compared to the Pre-Aquarium Collection Ban Alternative due to the lower fishery value under this alternative.

In addition, while the aquarium fishery directly employs the collectors, these collectors hire staff/assistants, sell their catch to wholesalers, who in turn get the fish to the market, which includes pet stores and their customers (Dierking 2002). This economic value is represented in the $10.6 million indirect economic benefit, but there are also jobs, which cannot be quantified at this time. Given the $5 million loss compared to the Pre-Aquarium Collection Ban Alternative, it is possible that the No Action Alternative would result in fewer jobs than the Pre-Aquarium Collection Ban Alternative.

No scientific data exist to suggest that in the absence of the commercial aquarium fishery an increase in other tourist operations would occur. Nevertheless, the No Action Alternative would have ***less than significant indirect impact*** on Hawai'i's overall and ocean socioeconomic resources.

5.2.2.2 Pre-Aquarium Collection Ban Alternative

Under the Pre-Aquarium Collection Ban Alternative, commercial aquarium fishing would occur on O'ahu using fine mesh nets, and it is assumed for this analysis that collection rates, including the value and sales of fish, would follow those prior to the October 2017 commercial aquarium collection ban (see Table 4-2). Based on the direct economic value of $2.9 million over the 5-year analysis period, the commercial aquarium fishery would indirectly (e.g., export of fish, freight, packaging, etc.) add an additional $14.7 million under the Pre-Aquarium Collection Ban Alternative to the economy of Hawai'i, or an average of $2.9 million per year, representing <0.01% of the annual $84.9 billion gross domestic product of Hawai'i.

Indirect socioeconomic impacts between commercial aquarium fishers, dive tour operators and subsistence/cultural fishers are possible if the commercial aquarium fishing leads to a decrease in demand for snorkel and scuba tours or a decrease in availability of species of fish targeted for subsistence/cultural fishing activities. However, the average amount of fish collected for 17 of the 20 top collected species is at or below 1% of their overall O'ahu populations and as discussed in several sections of this DEIS, it is very likely that Flame Wrasse is collected below 1% of its overall population. Approximately 10.6% of the Yellow Tang population is collected and 2.2% of the Potter's Angelfish population is collected. The small percentage of fish collected over multiple areas would be imperceptible to the average observer.

Available data do not suggest that the Pre-Aquarium Collection Ban Alternative has impacted the tourism industry or land values in Hawai'i. Hawai'i's tourism industry achieved new records in total visitor spending and visitor arrivals in 2017, marking the sixth consecutive year of record growth in both categories. Total spending by visitors to the Hawaiian Islands increased 5.6% to a new high of $16.81 billion (HTA 2018). When adjusted for inflation, total visitor spending was up 3.5% from 2016 (Figure 3). A total of 9,404,346 visitors came by air or by cruise ship to the state, up 5.3% from the previous record of 8,934,277 visitors in 2016. Total visitor days rose 4.8% compared to 2016. The average spending per day by these visitors ($198 per person) was also higher than 2016 ($197 per person; HTA 2018).

Despite the housing crisis and recent recession, the average sale price of homes steadily increased in Hawai'i from 2011 to 2014 after a few years of year-to-year fluctuation. The average sale price of homes in 2014 was $594,440, which was 26.4% higher than the average sale price in 2011. A rapid price increase was observed particularly in 2013 and 2014. The average sale price in 2013 and 2014 was about 10% higher than the price in the prior year. In 2015, the total number of home sales increased by 9.3%, but the average sale price was 0.3% lower than the previous year (HDBEDT 2016). These price increases occurred while commercial aquarium collection was also occurring, suggesting that collection is not impacting home values.

Under the Pre-Aquarium Collection Ban Alternative, a portion of the direct and indirect income from this fishery (total of $17.7 million over the 5-year analysis period) would continue to be put back into Hawai'i's economy through re-investment efforts in terms of equipment, maintenance, supplies, and personnel, which would be greater under the Pre-Aquarium Collection Ban Alternative than under the No Action Alternative due to the higher value of the fishery under this alternative.

In addition, while the aquarium fishery directly employs permitted collectors, these collectors hire staff/assistants, sell their catch to wholesalers, who in turn get the fish to the market, which includes pet stores and their customers (Dierking 2002). This economic value is represented in the $14.7 million indirect economic benefit, but there are also jobs, which cannot be quantified at this time.

The Pre-Aquarium Collection Ban Alternative would have ***less than significant impact*** on Hawai'i's tourist industry, and a minimal, but ***beneficial indirect impact*** on Hawai'i's overall economy through re-investment efforts in terms of equipment, maintenance, supplies, and personnel.

5.2.2.3 Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative

The indirect impacts of the Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative would be similar to those of the Pre-Aquarium Collection Ban Alternative. Based on the direct economic benefit of $2.8 million over the 5-year analysis period, an indirect economic benefit of nearly $14 million would be added to the economy (e.g., export of fish, freight, packaging, etc.) , representing less than 0.02% of the $84.9 billion annual gross domestic product of Hawai'i.

The expanded Waikiki MLCD is located near Waikiki and Honolulu, an area used quite extensively by tourists and tour operators. Within the expanded Waikiki MLCD, no commercial aquarium fish collection would occur; however, no restrictions would be placed upon other fisheries. Exclusion of commercial aquarium fishers from this area would eliminate any user conflict there and potentially serve as a refuge for fish populations, though other consumptive users would still be able to fish in this area.

Under the Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative, a portion of the direct and indirect income from this fishery (total of nearly $16.8 million over the 5-year analysis period) would continue to be put back into Hawai'i's economy through re-investment efforts in terms of equipment, maintenance, supplies, and personnel, which would be almost $1 million less under the Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative compared to the Pre-Aquarium Collection Ban Alternative due to the lower fishery value under this alternative.

In addition, while the aquarium fishery directly employs the collectors, these collectors hire staff/assistants, sell their catch to wholesalers, who in turn get the fish to the market, which includes pet stores and their customers (Dierking 2002). This economic value is represented in the $14 million indirect economic benefit, but there are also jobs, which cannot be quantified at this time. Given the $1 million loss compared to the Pre-Aquarium Collection Ban Alternative, it is possible that this alternative would result in fewer jobs than the Pre-Aquarium Collection Ban Alternative.

Therefore, the socioeconomic impacts of creating the expanded Waikiki MLCD would have a ***less than significant indirect impact*** on tourism. The reduction in the Flame Wrasse bag limit may make the species more visible to divers, but the impact would be ***less than significant***. A minimal, but ***beneficial indirect impact*** on Hawai'i's overall economy would occur under the Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative. The Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative would have a ***less than significant indirect impact*** on socioeconomics compared to the Pre-Aquarium Collection Ban Alternative.

5.2.2.4 Limited Permit Issuance (Preferred) Alternative

Under the Limited Permit Issuance (Preferred) Alternative, Aquarium Permits would be issued for 20 fishers for the use of fine-mesh nets on O'ahu. Based on the direct economic benefit of $2.1 to $3.2 million over the 5-year analysis period, an indirect economic benefit of $10.5 to $16 million would be added to the economy (e.g., export of fish, freight, packaging, etc.) , representing less than 0.02% of the $84.9 billion annual gross domestic product of Hawai'i.

Other indirect impacts of the Limited Permit Issuance (Preferred) Alternative would be similar to those of the Pre-Aquarium Collection Ban Alternative (see Section 5.2.2.2) and the Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative (see Section 5.2.2.3).

Under the Preferred Alternative, a portion of the direct and indirect income from this fishery (total of $12.6-$19.2 million over the 5-year analysis period) would continue to be put back into Hawai'i's economy through re-investment efforts in terms of equipment, maintenance, supplies, and personnel. Given this range, this could be a loss of $5 million when compared to the Pre-Aquarium Collection Ban Alternative, or could represent an additional $1.5 million, depending on whether fish collection and sales follow the average or maximum ex-vessel values for the 20 fishers over the 5-year analysis period.

While the aquarium fishery directly employs the collectors, these collectors hire staff/assistants, sell their catch to wholesalers, who in turn get the fish to the market, which includes pet stores and their customers (Dierking 2002). This economic value is represented in the $10.5 to $16 million indirect economic benefit, but there are also jobs, which cannot be quantified at this time. If a loss of $5 million compared to the Pre-Aquarium Collection Ban is seen, it is anticipated that the Preferred Alternative could result in fewer jobs, but if a gain of $1.5 million is seen, then more jobs could potentially be created under the Preferred Alternative compared to the Pre-Aquarium Collection Ban Alternative.

The Limited Permit Issuance (Preferred) Alternative would have a ***less than significant impact*** on Hawai'i's tourist industry, and a ***less than significant beneficial indirect impact*** on Hawai'i's overall economy through re-investment efforts in terms of equipment, maintenance, supplies, and personnel. The reduction in the Flame Wrasse bag limit may make the species more visible to divers, but the impact would be ***less than significant***. The Limited Permit Issuance (Preferred) Alternative would have a ***less than significant indirect impact*** on socioeconomics compared to the Pre-Aquarium Collection Ban Alternative.

5.2.3 Cumulative Impacts

For the period 2000 to 2017, the commercial aquarium fishery on O'ahu added an average of $540,542 (inflation-adjusted 2019 dollars) annually to the state of Hawai'i's economy, while the overall aquarium fishery within the state of Hawai'i added an average of $2,172,028 (inflation-adjusted 2019 dollars) (Table

4-1 and Table 4-2). The O'ahu aquarium fishery accounts for approximately 25% of the overall commercial aquarium fishery within Hawai'i. In 2016, the overall Gross Domestic Product (GDP) of Hawai'i was $84.9 billion, of which, the aquarium fishery contributed $2,257,021 (0.003%), of which $563,418 was from the O'ahu landings. Over the 5-year analysis period, it is estimated that the commercial aquarium fishery on O'ahu would directly add an estimated $2.1 million (under the No Action Alternative or the Limited Permit Issuance Alternative) to $2.9 million (under the Pre-Aquarium Collection Ban Alternative) to the state's economy.

All alternatives under consideration would have a ***less than significant beneficial cumulative impact*** on Hawai'i's overall and ocean socioeconomic resources. The Expanded Waikiki MLCD under the Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative and the Limited Permit Issuance (Preferred) Alternative may reduce user conflict. Implementing the Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative or the Preferred Alternative may have a ***less than significant cumulative beneficial impact*** on tourism by increasing viewing opportunities and reducing user conflicts.

5.2.4 Mitigation

No significant adverse socioeconomic impacts are anticipated under any of the four alternatives under consideration. Therefore, no mitigation is required or proposed.

5.3 CULTURAL RESOURCES

5.3.1 Direct and Indirect Impacts

A full analysis of the cultural impacts of commercial aquarium collection is found in the Cultural Impact Assessment (CIA) included in Appendix A. As part of the CIA, extensive oral interviews were conducted with numerous individuals from multiple user groups (including cultural practitioners, aquarium collectors, subsistence and commercial fishers, charter boat operators, and researchers) who represent various communities within Hawai'i. While some of the consulted individuals expressed specific cultural concerns with respect to fish , others stressed the ecological importance of the fish, and the need for them to live out their life cycles in their natural habitats. As evident in the statements made by multiple individuals, the take of fishes for commercial aquarium purposes from O'ahu has a long and contentious history, and it remains a point of conflict. As discussed in Section 4.2, and detailed in the CIA, many of the fish species collected by commercial aquarium fishers have a cultural significance in Hawai'i, and there are distinct differences between the traditional Native Hawaiian approach to fish harvest and management and the western model approach.

As concluded in the CIA, cultural impacts would occur if issuance of Aquarium Permits under an alternative would cause a significant decline in the population of a species considered to be a cultural resource, either directly through the collection of fish or indirectly through habitat impacts. However, some interviewees expressed the belief that collection for aquarium purposes, regardless of impact or sustainability, is a violation of traditional beliefs (see Appendix A). A total of 20 fish species were evaluated for their cultural importance. Table 4-5 lists the 20 most commonly collected species on O'ahu, and Section 4.4.4 includes a brief summary of known cultural significance by species. Three additional species, and their cultural significance, are discussed in Section 4.4.5. While not all species have a known Hawaiian cultural significance, for this analysis, it was assumed that the 19 species identified in Section 4.4.4 and 4.4.5 as having a cultural use for food, medicinal, religious or ceremonial purposes could have a cultural impact if populations of those species were impacted.

As detailed in Section 5.4, populations of the 23 fish species analyzed are not anticipated to significantly decline under any of the four alternatives under consideration. Therefore, direct and indirect impacts to cultural resources as a result of commercial aquarium collection under any of the four alternatives under consideration would be ***less than significant***.

5.3.2 Cumulative Impacts

It is acknowledged that cultural resources, including traditional practices specific to both species and places, have been impacted by past and current actions, and will continue to be impacted by reasonably foreseeable future actions. The cumulative impacts of the four alternatives under consideration are addressed in this section.

It is not possible to fully quantify the cumulative effects of past and ongoing actions on cultural practices and beliefs. Many users and user groups have collected fish in the waters around the island of O'ahu for various purposes for centuries. The commercial aquarium fishery has existed on O'ahu since the late 1940s and in the past the fishery has impacted cultural resources by virtue of the fact that commercial aquarium collection occurs in a culturally significant area (the ocean) and, in some instances involves culturally significant species. However, commercial aquarium collection is not the only fishery occurring in the ocean and affecting some of these species, including those with cultural significance (e.g., Achilles Tang) (see Section 5.4.3). Harvest of some of these species by other non-regulated users (e.g., subsistence fishers, non-aquarium commercial and recreational fishers) occurs and is anticipated to continue under any of the four alternatives under consideration. In addition, other ocean users may indirectly affect reef fish and the reefs they depend on, such as beachgoers using sunscreen, scuba divers and snorkelers affecting fish behavior, and boaters anchoring on top of reefs (see Section 5.4.3.4). Beach and shoreline development may also have effects on reefs and reef fish. In addition to effects on culturally significant species by the various user groups discussed above, climate change resulting in warming ocean temperatures and habitat loss due coral bleaching also affects reef fishes including population effects (see Section 5.4.3.5).

As concluded in the CIA (Appendix A), cultural impacts would occur if a significant decline in the population of a species considered to be a cultural resource occurs. While no historic population trend data are available, the projected level of collection of the 22 species with population estimates analyzed in this DEIS is below 1% for many of the species and is below 5% for 19 of the species under all four alternatives. The Achilles Tang collection is below 2% for the No Action and Preferred Alternatives and is 5.2% to 5.5% under the Pre-Aquarium Collection Ban Alternative and the Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative. For the two remaining species (Yellow Tang and Flame Wrasse), collection is below 25% for the majority of alternatives, and may therefore still be sustainable (i.e., not result in population declines). In addition, impacts to both these species may potentially be even lower due to uncertainty in the population estimates and is estimated to be below 1% of the actual Flame Wrasse population due to their deep-water habits. While collection of the Yellow Tang may be above 5% of the population, this species displays high fecundity (see Section 5.4.1.1), and collection under the three action alternatives is a lower impact compared to the No Action Alternative. Impacts under the three action alternatives all fall within the 5%-25% sustainable threshold. Therefore, collection of the 23 fish species analyzed in this EIS under any of the three action alternatives is not anticipated to result in significant population declines.

Additionally, measures included in the Preferred Alternative are designed to mitigate potential impacts to cultural resources by expanding the Waikiki MLCD and by reducing the amount of Flame Wrasse that commercial collectors are allowed to collect each day, as well as limiting the number of Aquarium Permits. These measures may increase the number of Flame Wrasse available for cultural practices and traditional subsistence fishers, and potentially decrease user conflict between commercial collectors and subsistence fishers or cultural practitioners.

Cumulative impacts to the 23 fish species analyzed in this EIS are described in detail in Section 5.4.3. Depending on the magnitude of the impacts of these other cumulative factors, the cumulative impact of commercial aquarium collection may be significant for the Yellow Tang. However, the cumulative impact under the Preferred Alternative is less than the No Action Alternative, resulting in a benefit to the Yellow Tang compared to continuing a total ban on the use of fine mesh nets. This is likely due to several factors, including the regulations in HAR §13-77, which are only in place when using a fine mesh net, as well as differences in species composition when collecting aquarium fish using other methods, as illustrated by the differences in species composition between the No Action Alternative and the other three alternatives. In addition, as described in Section 5.4.1, there is uncertainty related to the population estimate of the Yellow Tang, therefore, the cumulative impact of commercial aquarium collection may be lower if the actual population is larger than estimated by CREP (2018).

Based on the analysis in this section and below in Section 5.4.3, while commercial aquarium collection does contribute to the cumulative impact on populations of aquarium fish, it is a ***less than significant*** factor for 22 of the 23 species analyzed under all four alternatives, and thus a ***less than significant*** contributor to cultural impacts related to those species. For the Yellow Tang, all alternatives under consideration may have a ***significant negative cumulative impact*** if the magnitude of the other cumulative impacts, which cannot be quantified at this time, when added to commercial aquarium collection, results in a significant population decline. However, implementing the Pre-Aquarium Collection Ban Alternative, the Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative, or the Limited Permit Issuance (Preferred) Alternative would all have a ***beneficial impact*** on Yellow Tang populations (and thus the cultural impact associated with this species) when compared to the No Action Alternative.

5.3.3 Mitigation

No significant adverse direct or indirect cultural resource impacts are anticipated under any of the four alternatives under consideration. Significant cumulative impacts are anticipated; however, commercial aquarium collection is a less than significant factor in the cumulative impact. Therefore, no mitigation is required or proposed.

5.4 BIOLOGICAL RESOURCES

5.4.1 Direct Effects

No evidence exists of consistent growth in the number of fish collected on O'ahu, with 66,896 fish collected in 2000 compared to a collection of 66,059 fish in 2017 (Table 4-4, DAR 2018a). Therefore, the analysis in this section uses as a baseline (i.e., pre-aquarium collection ban conditions) the average collection of aquarium fish on O'ahu from 2000 to 2017 (71,983 fish per year) as the most likely scenario, and the maximum collection (100,662 fish, collected in 2012) as a reasonable worst case scenario for a predicted range of the annual take for the 5-year analysis period, with no annual growth applied. It is acknowledged that, in addition to the number of fish collected, incidental mortality may occur in fish that are released. However, there are no data available to analyze these impacts, and it is therefore assumed that the magnitude of these impacts would not change from what has historically occurred.

5.4.1.1 No Action Alternative

Under the No Action Alternative, collection of aquarium fish using fine mesh nets would not occur, though collection of fish and invertebrates may continue using methods not requiring an Aquarium Permit. Under the No Action Alternative, the size and daily bag limits under HAR §13-77 would not apply (see Section 1.2.3).

Since the ban on the use of fine mesh nets in October 2017, commercial aquarium collectors on O'ahu collected 46,174 fish in the 2018 calendar year (based on data provided by the DAR), and an additional 68,497 fish to-date in 2019 (data provided on October 21, 2019, DAR 2019b). These values are considered to be the best predictor of the amount of collection that would occur if the ban on Aquarium Permits continues. Both values (2018 and 2019 to-date) fall within the range of historic aquarium collection from 2000 to 2017 (Table 4-5) and suggest that collection may continue to follow historic rates, even without the use of fine mesh nets. Assuming that between 46,174 fish (the number collected in 2018 without fine mesh nets) and 100,662 fish (the maximum number collected in a given year since 2000) would be collected annually, a total of 230,870 to 503,310 fish would be collected over the 5-year analysis period. It is assumed for this analysis that the species composition of collection under the No Action Alternative would follow that shown in 2018 and 2019, rather than historic species composition, since the collection methods have changed (i.e., no use of fine mesh nets).

Top 20 Collected Fish Species

As stated above, under the No Action Alternative, the size and daily bag limits under HAR §13-77 would not apply (see Section 1.2.3), including regulations related to Yellow Tang, Kole, Potter's Angelfish, Orangespine Unicornfish, and Moorish Idol. Of the 114,671 fish collected on O'ahu in 2018 and 2019, the species was disclosed for 105,230 individuals (91.8%). Of the 65 species of fish reported, Yellow Tang and Kole made up 80.4% of the collection (Table 5-2).

Ochavillo and Hodgson (2006) suggest collection of between 5% and 25% is sustainable for various reef species in the Philippines that are similar to those found on O'ahu (e.g., tang, wrasse, butterflyfish, angelfish, triggerfish). Similar data for the species collected on O'ahu are not available to determine species-specific sustainable thresholds; therefore, this research represents the best available science. Sixteen of the 20 top collected species would be collected at a rate of less than 1% of their population annually (Table 5-2). Of the remaining four species, the Potter's Angelfish and Kole would both be collected at less than 2% of their population annually (Table 5-2). In addition, the IUCN has noted that, while popular, commercial aquarium collection is not considered a major threat to the Kole, and there is no evidence of declines from harvesting (McIlwain et al. 2012b), and that the collection of Potter's Angelfish for the aquarium trade is not considered to be impacting the global population (Pyle and Myers 2010a). The Flame Wrasse would be collected at a rate of 4.1% to 8.9% of the CREP population estimate; however, as described in Section 4.4.4.6, Kane and Tissot (2007) found densities of Flame Wrasse to be up to 1,000 times greater at depths below the CREP survey limits. Therefore, it is not possible to know the exact proportion of the population that would be collected for this species, though it is assumed to be less than 1% of its overall population.

The last species, the Yellow Tang, would be collected at a rate of 12.6% to 27.5% of the CREP population estimates (Table 5-2), in large part due to the higher proportion of the collection that this species represents under the No Action Alternative when compared to conditions prior to the October 2017 ban on Aquarium Permits (59.2% of the collection without the use of fine mesh nets, compared to 7.0% under the Pre-Aquarium Collection Ban Alternative).

However, there is uncertainty about the percent of the population that would be collected due to uncertainty in the population estimate. A recent study (Heenan et al. 2017) found that CREP data may underestimate some population estimates due to species' behavior; specifically, the SCUBA gear used by CREP surveyors leads to significantly lower counts of target fish species by divers when compared to divers using closed-circuit re-breathers (CCR), which do not emit noisy and conspicuous bubbles. Therefore, it is conceivable that many of the impacts calculated in this DEIS are overestimates, as the populations of reef fish may be higher than CREP surveys report. Lindfield et al. (2014) found that, within areas open to fishing (e.g., not MPAs), bubble-free survey methods may record up to 260% higher fish abundance. If this estimate were applied to the Yellow Tang, the actual population could be as large as 562,962 Yellow Tang, in which case the collection of 27,335 to 59,592 per year would represent 4.9% to 10.6%, which falls within the 5% to 25% sustainable threshold (Ochavillo and Hodgson 2006).

Table 5-2. Summary of the 2018-2019 collection of the top 20 fish species collected on the island of O'ahu from 2000-2017 (DAR 2018, 2019b), O'ahu population estimates (CREP 2018), and the projected annual collection under the No Action Alternative and the impact on populations.

Common Name	Scientific Name	Mean O'ahu Population Estimate[1] (lower-upper estimation limit)	Total Number Collected (2018-2019)	% of all identified fish collected (2018-2019)	Projected Annual Collection	% of Mean Population Collected [5]
Yellow Tang[6]	*Zebrasoma flavescens*	216,524 (121,812-311,235)	62,341	59.2%	27,335 - 59,592	12.6% - 27.5%

Common Name	Scientific Name	Mean O'ahu Population Estimate[1] (lower-upper estimation limit)	Total Number Collected (2018-2019)	% of all identified fish collected (2018-2019)	Projected Annual Collection	% of Mean Population Collected [5]
Kole[6]	*Ctenochaetus strigosus*	1,144,130 (612,330-1,675,931)	22,299	21.2%	9,789 - 21,340	0.9% - 1.9%
Potter's Angelfish[6]	*Centropyge potteri*	297,372 (186,004-408,741)	4,731	4.5%	2,078 - 4,530	0.7% - 1.5%
Orangespine Unicornfish[6]	*Naso lituratus*	950,505 (653,970-1,247,039)	1,901	1.8%	831 - 1,812	<0.1% - 0.2%
Ornate Wrasse	*Halichoeres ornatissimus*	668,852 (520,688-817,016)	520	0.5%	231 - 503	<0.1%
Flame Wrasse[7]	*Cirrhilabrus jordani*	5,683 (-2,628-13,993)	530	0.5%	231 - 503	4.1% - 8.9%
Fourline Wrasse	*Pseudocheilinus tetrataenia*	177,710 (107,567-247,854)	324	0.3%	139 - 302	<0.1% - 0.2%
Hawaiian Whitespotted Toby	*Canthigaster jactator*	1,888,605 (1,659,139-2,118,071)	433	0.4%	185 - 403	<0.1%
Forcepsfish	*Forcipiger flavissimus*	192,505 (124,654-260,356)	849	0.8%	369 - 805	0.2% - 0.4%
Milletseed Butterflyfish	*Chaetodon miliaris*	603,563 (226,322-980,804)	458	0.4%	185 - 403	<0.1%
Shortnose (Geoffroy's) Wrasse	*Macropharyngodon geoffroy*	746,227 (556,603-935,851)	868	0.8%	369 - 805	<0.1% - 0.1%
Bicolor Anthias	*Pseudanthias bicolor*	300,208 (5,441-594,975)	975	0.9%	416 - 906	0.1% - 0.3%
Orangeband Surgeonfish	*Acanthurus olivaceus*	1,380,451 (1,090,335-1,670,566)	715	0.7%	323 - 705	<0.1%
Moorish Idol[6]	*Zanclus cornutus*	285,677 (215,366-355,988)	733	0.7%	323 - 705	0.1% - 0.3%
Multiband Butterflyfish	*Chaetodon multicinctus*	806,937 (620,190-993,684)	401	0.4%	185 - 403	<0.1%
Psychedelic Wrasse	*Anampses chrysocephalus*	146,521 (76,566-216,476)	615	0.6%	277 - 604	0.2% - 0.4%
Eightline Wrasse	*Pseudocheilinus octotaenia*	206,014 (103,155-308,873)	101	0.1%	46 - 101	<0.1%
Crowned Puffer	*Canthigaster coronata*	285,677 (221,068-350,286)	135	0.1%	46 - 101	<0.1%

Common Name	Scientific Name	Mean O'ahu Population Estimate[1] (lower-upper estimation limit)	Total Number Collected (2018-2019)	% of all identified fish collected (2018-2019)	Projected Annual Collection	% of Mean Population Collected [5]
Saddle Wrasse	*Thalassoma duperrey*	11,959,153 (9,368,942-14,549,363)	33	<0.1%	<46 - <101	<0.1%
Fisher's Angelfish[8]	*Centropyge fisheri*	192,591 (-37,283-422,465)	407	0.4%	185 - 403	<0.1% - 0.2%

[1]Estimated population derived from NOAA data collected between 2010 and 2016 (CREP 2018).
[2]Average calculated from collection reports from 2000 to 2017 (DAR 2018a).
[3]Maximum calculated from collection reports from 2000 to 2017 (DAR 2018a).
[4]Calculated from average collected for each species between 2000 and 2017 and CREP population estimates.
[5]Calculated from the maximum collected for each species between 2000 and 2017 and CREP population estimates.
[6]Regulated species (e.g., bag or size limits) on the island of O'ahu.
[7] See paragraph above this table. Percent of population collected is likely below 1%.
[8]SGCN.

Based on the analysis presented in this section, the No Action Alternative would have ***less than significant*** direct impacts on the top 20 fish species collected on O'ahu.

Other Regulated Species Collected

The Achilles Tang, Bandit Angelfish, and Hawaiian Cleaner Wrasse are regulated by the DAR in terms of bag limits, size limits, or both. However, under the No Action Alternative, these regulations would not apply, since they are tied to the use of fine mesh nets (see Section 1.2.3). This includes a daily bag limit of 6 Hawaiian Cleaner Wrasse of any size, 10 Achilles Tang of any size, and 2 Bandit Angelfish greater than 5.5 inches in length. During 2018 and 2019, these 3 species accounted for 0.79% of all fish collected on the island of O'ahu.

A total of 301 Hawaiian Cleaner Wrasse were collected in 2018 and 2019, making up 0.29% of the fish collected on O'ahu. It is anticipated that approximately 134 to 292 would be collected annually over the 5-year analysis period (0.29% of the 46,174 to 100,662 fish collected annually, see Section 5.4.1.1). The CREP (2018) population estimate for the Hawaiian Cleaner Wrasse was estimated at 190,455 fish in 2016. Therefore, collection of 134 to 292 Hawaiian Cleaner Wrasse per year would result in less than 0.1% to 0.2% of the population being collected annually, which falls below the 5% to 25% sustainable threshold (Ochavillo and Hodgson 2006).

A total of 37 Achilles Tang were collected in 2018 and 2019, making up 0.04% of the fish collected on O'ahu. It is anticipated that approximately 18 to 40 Achilles Tang would be collected annually over the 5-year analysis period (0.04% of the 46,174 to 100,662 fish collected annually, see Section 5.4.1.1). The CREP (2018) population estimate for Achilles Tang on O'ahu was estimated at 5,750 fish in 2016. Therefore, collection of 18 to 40 Achilles tang would result in 0.3% to 0.7% of the population being collected annually, which falls below the 5% to 25% sustainable threshold (Ochavillo and Hodgson 2006).

A total of 489 Bandit Angelfish were collected in 2018 and 2019, making up 0.46% of the fish collected on O'ahu. It is anticipated that approximately 212 to 463 Bandit Angelfish would be collected annually over the

5-year analysis period (0.46% of the 46,174 to 100,662 fish collected annually, see Section 5.4.1.1). A population estimate for Bandit Angelfish is not available from the CREP data due to the species' deep-water habits, and as discussed in Section 4.4.5.2, Kane and Tissot (2017) also reported the deep-water habits of the Bandit Angelfish, and their research demonstrates that the vast majority of the Bandit Angelfish population occurs at depths below the CREP survey depth.

This species is generally only collected at depths at which normal recreational diving does not occur. Due to the complexity and difficulty of collecting the Bandit Angelfish, its population will likely continue to not receive significant pressure from the commercial aquarium fishery. As noted in Section 4.4.5.2, the overall global population is considered stable (Pyle et al. 2010b).

Based on the analysis presented in this section, the No Action Alternative would have ***less than significant direct impacts*** on other regulated fish species collected on O'ahu.

Hawai'i Species of Greatest Conservation Need

Impacts to Psychedelic Wrasse and Fisher's Angelfish under the No Action Alternative are discussed above in the "Top 20 Collected Fish Species" section.. Based on a predicted annual collection of 277 to 604 Psychedelic Wrasse and 185 to 403 Fisher's Angelfish, the impact to these two populations is anticipated to be 0.2% to 0.4% of the Psychedelic Wrasse population (estimated at 146,521; CREP 2018) and <0.1% to 0.2% of the Fisher's Angelfish population (estimated at 192,591; CREP 2018), which falls below the 5% to 25% sustainable threshold (Ochavillo and Hodgson 2006).

However, as described in Section 4.4.4.16 and Section 4.4.4.20, both of these species tend to occur at depths greater than those surveyed by CREP. Therefore, in all likelihood, the actual populations of Psychedelic Wrasse and Fisher's Angelfish on O'ahu are substantially greater than that reported by the CREP data, and the actual percentage of the populations removed by aquarium collection is likely lower than reported in this DEIS. Additionally, for the Fisher's Angelfish, Pyle and Myers (2010b) reported that aquarium collection is localized and is not considering to be impacting the global population.

Impacts to Bandit Angelfish are discussed above in the "Other Regulated Species" section. It is anticipated that approximately 212 to 463 Bandit Angelfish would be collected annually over the 5-year analysis period (0.46% of the 46,174 to 100,662 fish collected annually, see Section 5.4.1.1). A population estimate for Bandit Angelfish is not available from the CREP data due to the species' deep-water habits, and as discussed in Section 4.4.5.2, Kane and Tissot (2017) also reported the deep-water habits of the Bandit Angelfish, and their research demonstrates that the vast majority of the Bandit Angelfish population occurs at depths below the CREP survey depth. This species is generally only collected at depths at which normal recreational diving does not occur. Due to the complexity and difficulty of collecting the Bandit Angelfish, its population will likely continue to not receive significant pressure from the commercial aquarium fishery. As noted in Section 4.4.5.2, the overall global population is considered stable (Pyle et al. 2010b).

Historic collection data on an additional 23 SGCN fish species are included in Appendix B. Collection data from 2018, potentially due to data confidentiality (see Section 5.1), is only available for two of these SGCN species, the Bluestripe Butterflyfish (82 collected) and Flame Angelfish (34 collected). Based on the analysis presented in this section, the No Action Alternative would have ***less than significant*** direct impact on SGCN species collected from O'ahu.

Invertebrate Species

As noted in Section 4.4.6, marine invertebrate collection does not require an Aquarium Permit. Because it is assumed that collection would occur regardless of the alternative chosen, it is assumed that invertebrate collection under any of the four alternatives under consideration would follow historic rates.

Between 2000 and 2017, only 44 species were reported by enough permits (>2 permits reporting from each area of collection during each year of collection) to determine total number of individuals collected. Collection areas with less than three permits reporting fall under the DAR non-disclosure agreement, in which totals are not released publicly (Section 5.1). A total of 2,971,008 individual marine invertebrates have been reported under Aquarium Permits since 2000 on the island of O'ahu, which is an average of 165,056 invertebrates per year, and a maximum of 419,804 (Table 4-5). Of the invertebrates collected from O'ahu, 89.7% (2,664,728 individuals) reported represent just three species; hermit crabs (species not specified), Feather Duster Worms, and Zebra Hermit Crabs (Table 4-5). An additional 41 species account for the other 10.3% of invertebrates reported collected (excluding non-disclosed data) (DAR 2018a). While data from 2018 (Table 4-5) show a decrease in collection of invertebrates, it is unclear whether this decrease is related to the ban on fine mesh nets. The decrease in reported collection of invertebrates could be an artifact of data confidentiality rules, or due to reporting of invertebrates via a CML Catch Report rather than the Aquarium Catch Report (see Section 4.4.6). Data on CML Catch Reports are not available at this time.

Given that collection of invertebrates is not an activity governed by Aquarium Permits, the issuance or non-issuance of Aquarium Permits is not anticipated to affect the number of individuals or the species of invertebrates collected over the 5-year analysis period. Therefore, it is anticipated that these historic collection levels would continue annually over the 5-year analysis period under any of the four alternatives under consideration, for a total of 825,280 to 2,099,020 invertebrates collected over the 5-year analysis period.

Based on the analysis presented in this section, all alternatives under consideration are anticipated to have ***less than significant direct impacts*** on invertebrate collection.

Reef Habitat

Herbivores, which feed on marine algae, and especially coral scraping herbivores such as parrotfish (Scaridae), are widely considered to play a key role in the overall health and subsequent recovery of coral reefs after disturbances such as bleaching. The four largest groups of herbivorous coral reef fishes are the parrotfishes, damselfishes (Pomacentridae), rabbitfishes (Siganidae), and surgeonfishes (Acanthuridae). No parrotfishes, damselfishes, or rabbitfishes (do not occur in Hawai'i) occur in the top 20 list of fish species collected on O'ahu.

Herbivores collected by the aquarium fishery typically consist of the smaller size classes due to market demand (i.e., minimal market for large adult fish in the aquarium trade). However, in the absence of fine mesh nets, some regulations (e.g., HAR 13-77 prohibits the collection of more than 6 Yellow Tang/day larger than 5 inches) including bag limits and prohibitions for several herbivorous species on O'ahu (e.g., Yellow Tang, Kole and Potter's Angelfish, see Section 1.2.3 for details on regulations), no longer apply. These three species make up 84.9% of all individuals collected by commercial aquarium fishers on O'ahu since the ban on small mesh nets in October 2017 (compared to 45.3% pre-ban, see Table 4-4). However, even with making up the highest proportion of the catch, analysis based on CREP population estimates indicates the average annual collection of Kole and Fishers Angelfish would make up less than 2% of the overall island of O'ahu population estimates (Table 5-2), which falls below the sustainable take threshold of 5% to 25% (Ochavillo and Hodgson 2006). While the Yellow Tang would be collected at a rate of 12.6% to 27.5% of the CREP population estimates (Table 5-2), as detailed above, the CREP population estimate may be an underestimate, and the actual population could be as large as 562,962 Yellow Tang, in which case the collection of 27,335 to 59,592 per year would represent 4.9% to 10.6%, which falls within the 5% to 25% sustainable threshold (Ochavillo and Hodgson 2006). Therefore, it is not anticipated that a significant reduction in herbivores as a result of commercial aquarium collection would occur under the Pre-Aquarium Collection Ban Alternative.

Similar to any other boat user group, it is possible that coral could be inadvertently damaged by an anchor. In addition, similar to other user groups who interact with the reefs, the activities of aquarium collectors could inadvertently damage coral. However, in a study analyzing the effects of aquarium collectors on coral reef fishes in Kona, Hawai'i, Tissot and Hallacher (2003) concluded that there were no significant differences in damaged coral between control and collected sites (i.e., sites where aquarium collection occurs) to indicate the presence of destructive fishing practices. In addition, they found no increases in the abundance of macroalgae where the abundance of herbivores was reduced by aquarium collecting.

The DAR has been conducting related observations since 2003 (DAR 2018c). Monitoring of coral reef benthic cover is conducted approximately every four years at 25 permanent monitoring sites. Monitoring is conducted more frequently if substantial benthic change occurs between regular sampling years (e.g. after a coral bleaching event). The analysis compares the presence or absence of commercial aquarium collecting in West Hawaiʻi relative to overall coral cover and changes in coral cover. Major results of the study are summarized below:

- Coral cover was slightly higher within areas closed to the commercial aquarium fishery compared to open areas, but the difference was not statistically significant for any year of monitoring (2003: $p = 0.276$; 2007: $p = 0.275$; 2011: $p = 0.496$; 2014: $p = 0.554$; 2016: $p = 0.673$; 2017: $p = 0.782$). Additionally, there was no apparent trend of declining coral cover in the open areas over time.

- From 2003 to 2017, overall mean coral cover declined less within open areas compared to areas closed to commercial aquarium collection (Closed areas: -22.5% ± 3.4%; Open areas: -15.5% ± 2.3%), but this difference in change in coral cover was not significant ($p = 0.093$).

- From 2014 to 2016, West Hawaiʻi experienced a severe coral bleaching and mortality event, which peaked in the fall of 2015. Over this time-period, overall mean coral cover decline was slightly less in the areas open to commercial aquarium collection, but again, the difference was not significant (Closed areas: -19.6 % ± 6.0 %; Open areas: -17.6 % ± 1.3 %; p = 0.605).

- From 2016 to 2017, approximately one year after coral post-bleaching mortality subsided, minimal change in coral cover was documented within areas open to commercial aquarium collection (Open areas: 0.07 % ± 2.1 %), compared to a slight decline in mean coral cover in areas closed to collection (Closed: -1.94 % ± 2.3 %), and this difference was statistically significant (p = 0.038).

Based on the analysis presented in this section, the No Action Alternative would have a ***less than significant direct impact*** on reef habitat or the resilience of corals to respond to widespread bleaching events.

Invasive Species

It is anticipated that implementation of No Action Alternative would have a minor effect on invasive fish species over the 5-year analysis period. No Bluestripe Snapper, Peacock Grouper or Blacktail Snapper were reported during 2018 or 2019, though this could be due to confidentiality (see Section 5.1).

Based on the low level of collection of these species, the Pre-Aquarium Collection Ban Alternative would have a ***less than significant direct impact*** on invasive fish species.

Impact of Aquarium Collection on Overall Fish Populations and Recruitment

While research into the reproductive biology and fecundity (i.e., ability to produce offspring) of specific species of reef fish is limited in availability, some generalities can be derived from available research, and most reef species are long-lived and highly productive. For reef fishes in general, the relationship between size and fecundity is well documented, with larger fish producing exponentially more eggs (Thresher 1984, Berkeley et al. 2004). Moreover, evidence from a diverse set of species indicates that older individuals produce larger, faster growing, and more starvation-resistant larvae (Thresher 1984, Bobko and Berkeley 2004). For these reasons, Birkeland and Dayton (2005) recommend protecting larger or older individuals. Under the No Action Alternative, without the use of fine-mesh nets, it is assumed that the individuals collected will tend to be larger than those that would be collected under the other three alternatives under consideration (which all include the use of fine mesh nets).

Yellow Tang is a species which provides a good example of high fecundity, as well as the relationship between size and fecundity. Bushnell et al. (2010) studied Yellow Tang and found large individual variation in batch fecundity, with a range from 44 to >24,000 eggs per female produced on a single sampling date. Smaller females (3.1-4.75-inch standard length [LS]), produced limited numbers of eggs, while larger females (≥4.75-inch LS) were capable of maximal egg production (>20,000 eggs per batch). Bushnell et al. (2010) estimated the annual fecundity of Yellow Tang to average 1,055,628 eggs per female (with a standard error of 120,596 eggs). Another example of high fecundity is the Saddle Wrasse, which has a documented population doubling time of less than 15 months (Froese and Pauly 2008 as cited in Shea et al. 2010).

In addition to high levels of fecundity, many reef fish are long-lived. Choat and Axe (1996) studied four *Naso* species in the Great Barrier Reef, and found life spans of 35 to 40 years, with rapid growth during the first

3 to 4 years of life. Eble et al. (2009) found that the Hawaiian kala (*Naso unicornis*) is also long-lived, with rapid initial growth. Sampled kala ranged in age from 1 to 58 years with the majority of growth occurring within the first 15% of the life span. These two studies indicate that *Naso* species in general exhibit lifespans in excess of 40 years (Eble et al. 2009). While studying habitat- and sex-specific life history patterns of Yellow Tang, Claisse et al. (2009) found a 41-year-old individual. In addition, they found median size and age at the transition between deeper coral-rich and shallow turf dominated habitat use were about 0.75 inch longer and about 2 years older for males than females and coincided with an increase in reproductive output. The sexual difference in size at habitat transition, combined with sexual size dimorphism results in differences in the size distributions of both sexes in the two habitats (Claisse et al. 2009).

Due to the combination of a high fecundity and long life-span, reef fish can likely sustain fairly high levels of continuous harvest. While specific research into sustainable levels of take has not been conducted for the majority of reef fishes, as discussed previously, Ochavillo and Hodgson (2006) suggest collection of between 5% and 25% is sustainable for various reef species in the Philippines that are similar to those found on O'ahu (e.g., tang, wrasse, butterflyfish, angelfish, triggerfish).

Of the 23 fish species analyzed in this EIS (including the top 20 collected species and 3 additional regulated species), population estimates were available for 22 (96%). The one species without a population estimate is the Bandit Angelfish, which is discussed above.

Of the 22 species with populations estimates, 18 species would be collected at numbers below 1% of their overall population under the No Action Alternative. Two of the remaining four species would be collected at numbers below 2% of their overall population. For the remaining two species, the Flame Wrasse is estimated to be collected at 4.1% to 8.9% of the CREP population estimates, however, as described in Section 5.4.1.1, this species is typically found at depths greater than the CREP surveys, and therefore, the population estimates are likely low, leading to an inflated estimate of the impacts. The last species, the Yellow Tang, would be collected at a rate of 12.6% to 27.5% of the CREP population estimates, however, as detailed above, the actual population could be as large as 562,962 Yellow Tang, in which case the collection of 27,335 to 59,592 per year would represent 4.9% to 10.6%, which falls within the 5% to 25% sustainable threshold (Ochavillo and Hodgson 2006).

In addition to the low percentage of the populations which are harvested each year for most species, commercial aquarium fishing has a distinct advantage over other types of fishing because it is targeted to specific species, and within those species, it primarily targets specific size-classes which minimizes the impact to the brood stock. Because commercial aquarium fishers target the smaller individuals in populations, the larger individuals with higher fecundity are left within the population.

Based on the low percentage of the overall populations collected annually by commercial aquarium fishers, which is spread throughout the year and across multiple areas, commercial aquarium collection under the No Action Alternative would have less than significant direct impact on reef fish populations and the reefs in which they occur.

5.4.1.2 Pre-Aquarium Collection Ban Alternative

Under the Pre-Aquarium Collection Ban Alternative, issuance of an unlimited number of Aquarium Permits would occur, and commercial aquarium fish collection would take place. It is likely that annual fishing pressure on the species collected in the past would remain relatively the same over the 15-year analysis period, resulting in an estimated 71,983 (18-year average) individual fish and 165,056 invertebrates collected from the island of O'ahu's populations each year, up to a maximum of 100,662 fish per year (Tables 4-3 and 4-5). Collection numbers of fish for the island of O'ahu have ranged from 35,811 individuals in 2003, to 100,662 in 2012 (Table 4-3). Collection numbers of invertebrates for the island of O'ahu have ranged from 30,910 individuals in 2003, to 419,804 in 2007 (Table 4-5). As described in Section 5.4.1, there is no evidence for a growth in the number of fish collected annually on O'ahu, and therefore similar collection numbers of individual species would be expected annually over the 5-year analysis period. Based on the average and maximum fish annual fish collection rates, a total of 359,915 to 503,310 fish would be collected over the 5-year analysis period.

Top 20 Collected Fish Species

Since 2000, a total of 238 fish species have been collected on the island of O'ahu under Aquarium Permits. Of these 238 species, 124 species account for less than 1% each of the total aquarium fish catch from 2000-2017. An additional 94 species do not have data available due to the DAR confidentiality requirements (Section 5.1). The remaining 20 aquarium fish species collected on the island of O'ahu under Aquarium Permits make up 80% of all fish collected, and these species are summarized in Table 5-3. The top 3 collected species account for 45.3% of all aquarium fish collected (1,295,700) on O'ahu since 2000 and are described in detail below. The other 17 species that make up the top 20 species account for 33.6% of all aquarium fish collected from O'ahu. Since 2000, collection of these 17 species ranged from 4 to 12,666 individuals per year, with most species averaging below 2,000 individuals annually over the 18-year period.

The Yellow Tang has been the most collected species every year since 2004. In 2000, 2001, and 2003, more individual Potter's Angelfish and Kole were collected, followed by Yellow Tang. In 2002, Potter's Angelfish was the most collected species, followed by Yellow Tang, then Potter's Angelfish. In recent years (2014–2017) Yellow Tang were collected nearly twice as much as the next highest collected aquarium fish (Kole).

Since 2000, 273,356 Yellow Tang were collected on the island of O'ahu. The average number of Yellow Tang collected each year since 2000 was 15,186 individuals, ranging from a minimum catch of 2,546 individuals (2001) to a maximum of 38,344 individuals (2015). However, in July 2015, the regulations in HAR §13-77 were put into place (see Section 1.2.3), limiting the collection of Yellow Tang to no more than 100 individuals a day, as well as imposing additional regulations on size. Therefore, it is anticipated that under the Pre-Aquarium Collection Ban Alternative, collection would follow the rates seen in 2016 and 2017, when these bag limits were in place, for an average collection of 22,997 Yellow Tang per year, and a maximum collection of 23,524 per year. This represents 10.6% to 10.9% of the estimated O'ahu Yellow Tang population based on CREP data (Table 5-3), which falls within the 5% to 25% threshold (Ochavillo and Hodgson 2006). However, as explained in Section 5.4.1.1.1, the actual population of Yellow Tang may be larger than estimated due to the data collection, and if the actual Yellow Tang population is 562,962, then the collection under the Pre-Aquarium Collection Ban Alternative would be anticipated to be 4.1% to 4.2% of the population, which falls below the 5% to 25% threshold (Ochavillo and Hodgson 2006).

Since 2000, 175,425 Kole were collected on the island of O'ahu. The average number of Kole collected each year since 2000 was 9,746, ranging from a minimum catch of 2,917 individuals (2002) to a maximum of 17,748 individuals (2015). However, in July 2015, the regulations in HAR §13-77 were put into place (see Section 1.2.3), limiting the collection of Kole to no more than 75 individuals a day, as well as imposing additional regulations on size. Therefore, it is anticipated that under the Pre-Aquarium Collection Ban Alternative, collection would follow the rates seen in 2016 and 2017, when these bag limits were in place, for an average collection of 11,916 Kole per year, and a maximum collection of 11,983 per year. This represents 1.0% of the estimated O'ahu Kole population based on CREP data (Table 5-3), which falls below the 5% to 25% threshold (Ochavillo and Hodgson 2006).

Since 2000, 138,669 Potter's Angelfish were collected on the island of O'ahu. The average number of Potter's Angelfish collected each year since 2000 was 7,704 individuals, ranging from a minimum catch of 4,698 individuals (2003) and maximum of 10,940 individuals (2010). However, in July 2015, the regulations in HAR §13-77 were put into place (see Section 1.2.3), limiting the collection of Potter's Angelfish to no more than 50 individuals a day. Therefore, it is anticipated that under the Pre-Aquarium Collection Ban Alternative, collection would follow the rates seen in 2016 and 2017, when these bag limits were in place, for an average collection of 6,602 Potter's Angelfish per year, and a maximum collection of 7,321 per year. This represents 2.2% to 2.5% of the estimated O'ahu Potter's Angelfish population based on CREP data (Table 5-3), which falls below the 5% to 25% threshold (Ochavillo and Hodgson 2006).

For the 17 remaining species, based on CREP (2018) population estimates and the average collection over the past 18 years (or from 2016/2017 for regulated species, which include the Orangespine Unicornfish and Moorish Idol), 16 species would be collected at numbers below 1% of their overall population if an average collection occurs annually, and below 2% if the maximum collection were to occur during a single year (Table 5-3). For the 1 remaining species, the Flame Wrasse, it is estimated that approximately 28% to 61% of the known Flame Wrasse population would be collected annually. However, as described in Section 4.4.4.6, Kane and Tissot (2007) found densities of Flame Wrasse to be up to 1,000 times greater at depths below the CREP survey limits. Therefore, it is not possible to know the exact proportion of the population that would be collected for this species, though it is assumed to be less than 1% of its overall population.

Table 5-3. Top 20 fish species collected on the island of O'ahu from 2000 to 2017 (DAR 2018a), O'ahu population estimates (CREP 2018), and predicted impact of collection under the Pre-Aquarium Collection Ban Alternative based on historic collection rates (DAR 2018a).

Common Name	Scientific Name	Mean O'ahu Population Estimate[1] (lower-upper estimation limit)	Average Number Collected per Year[2]	Maximum Number Collected per Year[3]	Average % of Mean Population Collected [4]	Max % of Mean Population Collected [5]
Yellow Tang[6]	*Zebrasoma flavescens*	216,524 (121,812-311,235)	22,997	23,524	10.6%	10.9%

Common Name	Scientific Name	Mean O'ahu Population Estimate[1] (lower-upper estimation limit)	Average Number Collected per Year[2]	Maximum Number Collected per Year[3]	Average % of Mean Population Collected [4]	Max % of Mean Population Collected [5]
Kole[6]	*Ctenochaetus strigosus*	1,144,130 (612,330-1,675,931)	11,916	11,983	1.0%	1.0%
Potter's Angelfish[6]	*Centropyge potteri*	297,372 (186,004-408,741)	6,602	7,321	2.2%	2.5%
Orangespine Unicornfish[6]	*Naso lituratus*	950,505 (653,970-1,247,039)	2,128	2,432	0.2%	0.3%
Ornate Wrasse	*Halichoeres ornatissimus*	668,852 (520,688-817,016)	2,562	4,066	0.4%	0.6%
Flame Wrasse[7]	*Cirrhilabrus jordani*	5,683 (-2,628-13,993)	1,605	3,480	28.3%	61.2%
Fourline Wrasse	*Pseudocheilinus tetrataenia*	177,710 (107,567-247,854)	1,605	2,722	0.9%	1.5%
Hawaiian Whitespotted Toby	*Canthigaster jactator*	1,888,605 (1,659,139-2,118,071)	1,590	3,382	0.1%	0.2%
Forcepsfish	*Forcipiger flavissimus*	192,505 (124,654-260,356)	1,583	2,817	0.8%	1.5%
Milletseed Butterflyfish	*Chaetodon miliaris*	603,563 (226,322-980,804)	1,405	3,154	0.2%	0.5%
Shortnose (Geoffroy's) Wrasse	*Macropharyngodon geoffroy*	746,227 (556,603-935,851)	1,355	2,592	0.2%	0.4%
Bicolor Anthias	*Pseudanthias bicolor*	300,208 (5,441-594,975)	1,344	3,407	<0.1%	<0.1%
Orangeband Surgeonfish	*Acanthurus olivaceus*	1,380,451 (1,090,335-1,670,566)	1,343	3,875	0.1%	0.3%
Moorish Idol[6]	*Zanclus cornutus*	285,677 (215,366-355,988)	952	1,067	<0.1%	<0.1%
Multiband Butterflyfish	*Chaetodon multicinctus*	806,937 (620,190-993,684)	1,007	2,296	0.1%	0.3%
Psychedelic Wrasse	*Anampses chrysocephalus*	146,521 (76,566-216,476)	913	1,182	0.6%	0.8%
Eightline Wrasse	*Pseudocheilinus octotaenia*	206,014 (103,155-308,873)	892	1,905	0.4%	0.9%
Crowned Puffer	*Canthigaster coronata*	285,677 (221,068-350,286)	809	1,848	<0.1%	<0.1%

Common Name	Scientific Name	Mean O'ahu Population Estimate[1] (lower-upper estimation limit)	Average Number Collected per Year[2]	Maximum Number Collected per Year[3]	Average % of Mean Population Collected [4]	Max % of Mean Population Collected [5]
Saddle Wrasse	*Thalassoma duperrey*	11,959,153 (9,368,942-14,549,363)	804	1,597	<0.1%	<0.1%
Fisher's Angelfish[8]	*Centropyge fisheri*	192,591 (-37,283-422,465)	756	1,627	0.4%	0.8%

[1]Estimated population derived from NOAA data collected between 2010 and 2016 (CREP 2018).
[2]Average calculated from collection reports from 2000 to 2017 (DAR 2018a).
[3]Maximum calculated from collection reports from 2000 to 2017 (DAR 2018a).
[4]Calculated from average collected for each species between 2000 and 2017 and CREP population estimates.
[5]Calculated from the maximum collected for each species between 2000 and 2017 and CREP population estimates.
[6]Regulated species (e.g., bag or size limits) on the island of O'ahu. The average and maximum collection values for these species is based off of data from 2016 and 2017, which reflect collection rates under the current bag limits.
[7] See paragraph above this table. Percent of population collected is likely below 1%.
[8]SGCN.

Based on the analysis presented in this section, the Pre-Aquarium Collection Ban Alternative would have ***less than significant*** direct impacts on the top 20 fish species collected from O'ahu.

Other Regulated Species Collected

The Achilles Tang, Bandit Angelfish, and Hawaiian Cleaner Wrasse are regulated by the DAR in terms of bag limits, size limits, or both. Under the Pre-Aquarium Collection Ban Alternative, since collection of these species would be under an Aquarium Permit, the regulations described in HAR §13-77 (Section 1.2.3) would be in place. Since 2000, these 3 species account for 1.87% of all fish collected on the island of O'ahu.

The Hawaiian Cleaner Wrasse ranks as the 26th most collected fish since 2000, making up 0.87% (11,243 individuals) of the total fish collection, averaging 625 collected each year. Collection numbers have ranged from a high of 1,060 in 2000 to a low of 287 in 2015 (DAR 2018a). However, in July 2015, the regulations in HAR §13-77 were put into place (see Section 1.2.3), limiting the collection of Hawaiian Cleaner Wrasse to no more than six individuals a day. Therefore, it is anticipated that under the Pre-Aquarium Collection Ban Alternative, collection would follow the rates seen in 2016 and 2017, when these bag limits were in place, for an average collection of 422 Hawaiian Cleaner Wrasse per year, and a maximum collection of 517 per year. The CREP (2018) population estimate for the Hawaiian Cleaner Wrasse was estimated at 190,455 fish in 2016. Therefore, collection of Hawaiian Cleaner Wrasse under the Pre-Aqwuarium Collection Ban Alternative would represent 0.2% to 0.3% of the O'ahu population estimate, which falls below the 5% to 25% sustainable threshold (Ochavillo and Hodgson 2006).

The Achilles Tang ranks as the 33rd most collected fish since 2000, making up 0.62% (8,092 individuals) of the total fish collection, averaging 450 collected each year. Collection numbers have ranged from a high of 1,266 in 2004 to a low 169 in 2002 (DAR 2018a). However, in July 2015, the regulations in HAR §13-77 were put into place (see Section 1.2.3), limiting the collection of Achilles Tang to no more than 10 individuals a day. Therefore, it is anticipated that under the Pre-Aquarium Collection Ban Alternative, collection would follow the rates seen in 2016 and 2017, when these bag limits were in place, for an average collection of

297 Achilles Tang per year, and a maximum collection of 318 per year. The CREP (2018) population estimate for the Achilles Tang was estimated at 5,750 fish in 2016. Therefore, collection of Achilles Tang under the Pre-Aquarium Collection Ban Alternative would represent 5.2% to 5.5% of the O'ahu population estimate, which falls near the lower end of the 5% to 25% sustainable threshold (Ochavillo and Hodgson 2006).

The Bandit Angelfish ranks as the 47th most collected fish since 2000, making up 0.38% (4,866 individuals) of the total fish collection, averaging 209 collected each year. Collection numbers have ranged from a high of 638 in 2015 to a low of 15 in 2004. It is anticipated that approximately 209 to 638 would be collected annually over the 5-year analysis period. While there are regulations pertaining to this species in HAR §13-77, they only restrict the number of fish greater than 5.5 inches in length, and not the overall collection. A population estimate for Bandit Angelfish is not available from the CREP data due to the species'' deep-water habits, and as discussed in Section 4.4.5.2, Kane and Tissot (2017) also reported the deep-water habits of the Bandit Angelfish, and their research illustrates that the vast majority of the Bandit Angelfish population occurs at depths below the CREP survey depth.

This species is generally only collected at depths at which normal recreational diving does not occur. Due to the complexity and difficulty of collecting the Bandit Angelfish, its population will likely continue to not receive significant pressure from the commercial aquarium fishery. As noted in Section 4.4.5.2, the overall global population is considered stable (Pyle et al. 2010b).

Based on the analysis presented in this section, the Pre-Aquarium Collection Ban Alternative would have ***less than significant*** direct impacts on other regulated fish species collected from O'ahu.

Hawai'i Species of Greatest Conservation Need

Impacts to Psychedelic Wrasse and Fisher's Angelfish under the Pre-Aquarium Collection Ban Alternative are discussed above under the "Top 20 Collected Fish Species" in Section 5.4.1.2. Based on a predicted annual collection of 913 to 1,182 Psychedelic Wrasse and 756 to 1,627 Fisher's Angelfish, the impact to these 2 populations is anticipated to be 0.6% to 0.8% of the Psychedelic Wrasse population (estimated at 146,521; CREP 2018) and 0.4% to 0.8% of the Fisher's Angelfish population (estimated at 192,591; CREP 2018), which falls below the 5% to 25% sustainable threshold (Ochavillo and Hodgson 2006). However, as described in Section 4.4.4.16 and Section 4.4.4.20, both of these species tend to occur at depths greater than those surveyed by CREP. Therefore, in all likelihood, the actual populations of Psychedelic Wrasse and Fisher's Angelfish on O'ahu are substantially greater than that reported by the CREP data, and the actual percentage of the populations removed by aquarium collection is likely lower than reported in this DEIS. Additionally, for the Fisher's Angelfish, Pyle and Myers (2010b) reported that aquarium collection is localized and is not considering to be impacting the global population.

Impacts to Bandit Angelfish are discussed above in the "Other Regulated Species" section. It is anticipated that approximately 209 to 638 would be collected annually over the 5-year analysis period. While there are regulations pertaining to this species in HAR §13-77, they only restrict the number of fish greater than 5.5 inches in length, and not the overall collection. A population estimate for Bandit Angelfish is not available from the CREP data due to the species'' deep-water habits, and as discussed in Section 4.4.5.2, Kane and Tissot (2017) also reported the deep-water habits of the Bandit Angelfish, and their research illustrates that the vast majority of the Bandit Angelfish population occurs at depths below the CREP survey depth. This species is generally only collected at depths at which normal recreational diving does not occur. Due to the complexity and difficulty of collecting the Bandit Angelfish, its population will likely continue to not receive significant pressure from the commercial aquarium fishery. As noted in Section 4.4.5.2, the overall global population is considered stable (Pyle et al. 2010b).

Historic collection data on an additional 23 SGCN fish species are included in Appendix B. Of the 23 species, 11 (48%) were collected in less than 50% of the years between 2000 and 2017. Ten of the species were always collected by fewer than three collectors, and therefore no average or maximum collection values are available due to data confidentiality (see Section 5.1). For the remaining 13 species, average collection (from years with available data, i.e., excluding years with data confidentiality issues) was below 100 per year for 8 of the species, and ranged from 6 per year for the Blackside Razorfish to 538 per year for the Hawaiian Anthias (Appendix B).

Based on the analysis presented in this section, the Pre-Aquarium Collection Ban Alternative would have ***less than significant direct impacts*** on SGCN species collected on O'ahu.

Invertebrate Species

Based on the analysis presented in Section 5.4.1.1, all alternatives under consideration are anticipated to have ***less than significant direct impacts*** on invertebrate collection.

Reef Habitat

Impacts to reef habitat and herbivores would be similar to those described for the No Action Alternative (see Section 5.4.1.1.5). However, under the Pre-Aquarium Collection Ban Alternative, bag limits and prohibitions would be in place for several herbivorous species on O'ahu, including Yellow Tang (100 total daily, 6 individuals <1.5 inches and 6 individuals >5 inches), Kole (75 total daily, 6 >5 inches) and Potter's Angelfish (50 total daily]). While these 3 species made up 60.5% of all individuals collected by commercial aquarium fishers from O'ahu in 2016 and 2017 (when the bag limits were in place), analysis based on CREP population estimates indicates the predicted annual collection of these 3 species represents approximately 10.3% to 10.5% of the overall island of O'ahu population of Yellow Tang, approximately 2.2% to 2.5% of the overall island of O'ahu population of Potter's Angelfish, and approximately 1% of the overall island of O'ahu population of Kole (Table 5-3). Therefore, it is not anticipated that a significant reduction in herbivores as a result of commercial aquarium collection would occur under the Pre-Aquarium Collection Ban Alternative, as all of these values fall within or below the 5% to 25% sustainable threshold (Ochavillo and Hodgson 206).

Based on the analysis presented in this section, the Pre-Aquarium Collection Ban Alternative would have a ***less than significant direct impact*** on reef habitat or the resilience of corals to respond to widespread bleaching events.

Invasive Species

It is anticipated that implementation of the Pre-Aquarium Collection Ban Alternative would have a minor effect on invasive fish species over the 5-year analysis period. A total of 2,621 individual Bluestripe Snappers and 175 Peacock Grouper, have been reported collected from O'ahu since 2000. The Blacktail Snapper has not been reported as caught from O'ahu over the 18-year analysis period.

Based on the low level of collection of these species, the Pre-Aquarium Collection Ban Alternative would have a ***less than significant direct impact*** on invasive fish species.

Impact of Aquarium Collection on Overall Fish Populations and Recruitment

As discussed in Section 5.4.1.1, Ochavillo and Hodgson (2006) suggest collection of between 5% and 25% is sustainable for various reef species in the Philippines that are similar to those found on O'ahu (e.g., tang, wrasse, butterflyfish, angelfish, triggerfish).

Of the 23 fish species analyzed in this EIS (including the top 20 collected species and 3 additional regulated species), population estimates were available for 22 (96%). The one species without a population estimate is the Bandit Angelfish, which isi discussed above.

Of the 22 species with populations estimates, 19 species would be collected at numbers below the lower end of the 5% to 25% sustainable threshold (Ochavillo and Hodgson 2006). For the remaining three species, the Flame Wrasse is estimated to be collected at 21.3% to 68.2% of the CREP population estimates, however, as described in Section 5.4.1.1, this species is typically found at depths greater than the CREP surveys, and therefore, the population estimates are likely low, leading to an inflated estimate of the impacts. The Achilles Tang would be collected at 5.2% to 5.5% of the O'ahu population estimate, which falls near the lower end of the 5% to 25% sustainable threshold (Ochavillo and Hodgson 2006). The last species, the Yellow Tang, would be collected at a rate of 10.6% to 10.9% of the CREP population estimates, which falls within the 5% to 25% sustainable threshold (Ochavillo and Hodgson 2006). Wowever, as detailed above, the actual population could be as large as 562,962 Yellow Tang, in which case the collection would represent an even smaller portion of the population (4.1% to 4.2%), falling below the 5% to 25% sustainable threshold (Ochavillo and Hodgson 2006). Additionally, as described in Section 5.4.1.1, the Yellow Tang has a relationship between size and fecundity. Therefore, the Pre-Aquarium Collection Ban Alternative, with its limits on collection of large (> 5.5 inches) individuals, is more protective of the brood stock than the No Action Alternative.

In addition to the low percentage of the populations which are harvested each year for most species, commercial aquarium fishing has a distinct advantage over other types of fishing because it is targeted to specific species, and within those species, it primarily targets specific size-classes which minimizes the impact to the brood stock. Because commercial aquarium fishers target the smaller individuals in populations, the larger individuals with higher fecundity are left within the population. This is particularly true of all alternatives that would include the issuance of Aquarium Permits, as the regulations set forth in HAR §13-77 (Section 1.2.3) would be in place, which place bag and/or size limits on several species, including the Yellow Tang, Kole, Orangespine Unicornfish, Potter's Angelfish and Moorish Idol.

Based on the low percentage of the overall populations collected annually by commercial aquarium fishers, which is spread throughout the year and across multiple areas, as well as the targeted take of smaller, less fecund individuals, commercial aquarium collection under the Pre-Aquarium Collection Ban Alternative would have ***less than significant direct impact*** on reef fish populations and the reefs in which they occur.

5.4.1.3 Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative

The Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative would include issuance of an unlimited number of Aquarium Permits for O’ahu, a 740-acre (299.5-hectare) expansion of the Waikiki MLCD (Figure 2), and impose a daily bag limit of 10 Flame Wrasse per day for the O’ahu commercial aquarium fishery. Within the expanded Waikiki MLCD, no commercial aquarium fish collection would occur; however, no restrictions would be placed upon other fisheries.

Under the Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative, direct impacts would be the same as those described in Section 5.4.1.2 for the Pre-Aquarium Collection Ban Alternative for all fish, invertebrate, and coral species/reef with the exception of the Flame Wrasse. While the Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative includes expansion of the Waikiki MLCD, the data analyzed for this DEIS cannot be used to quantify the number of fish collected or the species collected from this area. It is expected that any reduced collection of aquarium fish within this area would be offset by redirection of effort and resources by commercial aquarium fishers to other areas of O’ahu open to commercial aquarium collection. However, even if no change in the overall fish collection rates is predicted, there are still potential benefits to expanding the existing MLCD. Friedlander et al. (2007) found that biomass within the existing Waikiki MLCD was 2.5 times higher than adjacent control sites. While the expanded area of the Waikiki MLCD would only be closed to commercial aquarium collection, similar areas in West Hawai’i have shown that fish from protected Fish Replenishment Areas (where only commercial and recreational fishing is banned, and other forms of fishing can continue) will seed unprotected areas (Christie et al. 2010). The use of areas closed to aquarium collection in West Hawai’i was implemented in 1999, and the DAR has determined that it has been “very successful” at driving increases in Yellow Tang populations (the most heavily targeted aquarium fish in West Hawai’i; DAR 2019a). It is assumed that the expanded Waikiki MLCD would have similar benefits as the Fish Replenishment Areas on Hawai’i Island.

Despite the low percentage of the overall Flame Wrasse population being collected by commercial aquarium fishers, the Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative would include a conservation measure imposing a bag limit of 10 Flame Wrasse per day. It is anticipated that this will result in a 60% reduction in the number of Flame Wrasse taken by the commercial aquarium fishery on O’ahu. Therefore, under the Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative, catch of Flame Wrasse over the 5-year analysis period is estimated to be reduced by 60% from that under the Pre-Aquarium Collection Ban Alternative, to 642 to 1,392 Flame Wrasse per year (40% of the 1,605 to 3,480 Flame Wrasse that would be collected under the Pre-Aquarium Collection Ban Alternative). This would represent 11.3% to 24.5% of the O’ahu population estimate of 5,683 Flame Wrasse, though as discussed in Section 5.4.1.1.1 and Section 5.4.1.2.1, this population estimate is likely low.

The Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative would have ***less than significant direct impacts*** on fish, invertebrate, and coral species/reef but would have minor ***beneficial impacts*** for the Flame Wrasse when compared to the Pre-Aquarium Collection Ban Alternative.

5.4.1.4 Limited Permit Issuance (Preferred) Alternative

Under the Limited Permit Issuance (Preferred) Alternative, Aquarium Permits would be issued to 20 fishers for the use of fine-mesh nets on O'ahu. Other commercial aquarium fishers would not be permitted to use fine mesh nets, though collection of aquarium fish would still be permitted using other legal means.

The 20 fishers who would be issued Aquarium Permits collected an average of 38,602 fish per year up to a maximum of 53,920 fish from O'ahu in a single year during the period from 2000 to 2017 (see Table 4-2). Assuming collection is between these values, a total of 193,010 to 269,600 fish would be collected over the 5-year analysis period.

In addition, collection by other fishers would be anticipated to follow the rates seen in the No Action Alternative (see Section 5.4.1.1). As shown in Table 4-3, collection by fishers who would not receive Aquarium Permits under this Proposed Action was approximately 31.2% of the total collection in 2018 when no fine mesh nets were allowed. Therefore, for this analysis, it is assumed that collection by other fishers under the Limited Permit Issuance (Preferred) Alternative would be approximately 31.2% of the impacts seen under the No Action Alternative, for an additional 72,031 to 157,033 fish over the 5-year analysis period. Combined with the collection from the 20 fishers, this results in a total of 265,041 to 426,633 fish over the 5-year analysis period.

Top 20 Collected Fish Species

Based on CREP (2018) population estimates, the average collection over the past 18 years from the 20 fishers, and an additional 31.2% of the No Action Alternative collection of each species (to account for additional collection from other fishers without Aquarium Permits), 18 of the top 20 collected species would be collected at numbers at or below 1% of their overall population if an average collection occurs over each year (Table 5-4). Even at their maximum collection rates, 15 of the 20 species would be collected at numbers at or below 1% of their overall population (Table 5-4). Of the remaining five species, three would be collected at levels below 3% even at the maximum collection rates (Table 5-4), which falls below the sustainable collection threshold of 5% to 25% (Ochavillo and Hodgson 2006).

Of the remaining two species, Yellow Tang would be collected at 7.7% to 13.7% of the population per year, and Flame Wrasse would be collected at 9.4% to 24.5% of the population per year, both of which fall within the 5% to 25% sustainable threshold (Ochavillo and Hodgson 2006). The contribution of the 20 fishers who would be issued Aquarium Permits is only a portion of this, representing 4.0% to 5.1% of the Yellow Yang population and 7.6% to 20.6% of the Flame Wrasse population. However, as explained in Section 5.4.1.1, the actual population of Yellow Tang may be larger than estimated due to the data collection, and if the actual Yellow Tang population is 562,962, then the collection under the Limited Permit Issuance (Preferred) Alternative would be anticipated to be 3.0% to 5.3% of the population, which falls below or at the lower end of the 5% to 25% threshold (Ochavillo and Hodgson 2006). As described in Section 4.4.4.6, Kane and Tissot (2007) found densities of Flame Wrasse to be up to 1,000 times greater at depths below the CREP

Table 5-4. Top 20 fish species collected on the island of O'ahu from 2000 to 2017 (DAR 2018a), O'ahu population estimates (CREP 2018), and the predicted impact of collection under the Limited Permit Issuance Alternative based on historic collection by the 20 fishers and the additive collection of other fishers (31.2% of the No Action Alternative collection).

Common Name	Scientific Name	O'ahu Population Estimate – Mean (lower-upper estimation limit) (CREP 2018)[1]	Average Number Collected per Year by 20 fishers	Maximum Number Collected per Year by 20 fishers	% of Mean Population Collected (20 fishers)	Collection by other commercial aquarium fishers	Total Annual Collection Anticipated under Limited Permit Issuance Alternative	% of Mean Population Collected (total collection)
Yellow Tang[2]	*Zebrasoma flavescens*	216,524 (121,812-311,235)	8,212	11,075	4.0% - 5.1%	8,529 – 18,593	16,741 – 29,668	7.7% - 13.7%
Kole[2]	*Ctenochaetus strigosus*	1,144,130 (612,330-1,675,931)	8,143	8,417	0.7%	3,054 – 6,658	11,197 – 15,075	1.0% - 1.3%
Potter's Angelfish[2]	*Centropyge potteri*	297,372 (186,004-408,741)	4,740	4,812	1.6%	648– 1,413	5,388 – 6,225	1.8% - 2.1%
Orangespine Unicornfish[2]	*Naso lituratus*	950,505 (653,970-1,247,039)	253	306	<0.1%	259 – 565	512 -	<0.1%
Ornate Wrasse	*Halichoeres ornatissimus*	668,852 (520,688-817,016)	1,554	1,934	0.2% - 0.3%	72 – 157	1,626 – 2,091	0.2% - 0.3%
Flame Wrasse[3]	*Cirrhilabrus jordani*	5,683 (-2,628-13,993)	1,084 (40% = 434)	2,927 (40% = 1,171)	7.6% - 20.6%	72 – 157	534 – 1,391 (40% of 1084 – 2,927, due to new bag limit, plus other fishers)	9.4% - 24.5%
Fourline Wrasse	*Pseudocheilinus tetrataenia*	177,710 (107,567-247,854)	1,268	2,419	0.7% - 1.4%	43 – 94	1,311 – 2,513	0.7% - 1.4%

Common Name	Scientific Name	O'ahu Population Estimate – Mean (lower-upper estimation limit) (CREP 2018)[1]	Average Number Collected per Year by 20 fishers	Maximum Number Collected per Year by 20 fishers	% of Mean Population Collected (20 fishers)	Collection by other commercial aquarium fishers	Total Annual Collection Anticipated under Limited Permit Issuance Alternative	% of Mean Population Collected (total collection)
Hawaiian Whitespotted Toby	*Canthigaster jactator*	1,888,605 (1,659,139-2,118,071)	792	1,377	<0.1%	58 – 126	850 – 1,503	<0.1%
Forcepsfish	*Forcipiger flavissimus*	192,505 (124,654-260,356)	953	1,409	0.5% - 0.7%	115 – 251	1,068 – 1,660	0.6% - 0.9%
Milletseed Butterflyfish	*Chaetodon miliaris*	603,563 (226,322-980,804)	723	1,399	0.1% - 0.2%	58 – 126	781 – 1,525	0.1% - 0.3%
Shortnose (Geoffroy's) Wrasse	*Macropharyngodon geoffroy*	746,227 (556,603-935,851)	873	1,716	0.1% - 0.2%	115 – 251	988 – 1,967	0.1% - 0.3%
Bicolor Anthias	*Pseudanthias bicolor*	300,208 (5,441-594,975)	1,043	2,728	0.3% - 0.9%	130– 283	1,173 – 3,011	0.4% - 1.0%
Orangeband Surgeonfish	*Acanthurus olivaceus*	1,380,451 (1,090,335-1,670,566)	659	1,241	<0.1%	101 – 220	760 – 1,461	0.1%
Moorish Idol[2]	*Zanclus cornutus*	285,677 (215,366-355,988)	207	217	<0.1%	101 – 220	308 - 437	0.1% - 0.2%
Multiband Butterflyfish	*Chaetodon multicinctus*	806,937 (620,190-993,684)	476	1,074	<0.1% - 0.1%	58 – 126	534 – 1,200	0.1%
Psychedelic Wrasse	*Anampses chrysocephalus*	146,521 (76,566-216,476)	489	657	0.3% - 0.4%	86 - 188	575 - 845	0.4% - 0.6%
Eightline Wrasse	*Pseudocheilinus octotaenia*	206,014 (103,155-308,873)	611	1,358	0.3% - 0.7%	14 – 32	625 – 1,390	0.3% - 0.7%
Crowned Puffer	*Canthigaster coronata*	285,677 (221,068-350,286)	407	1,078	0.1% - 0.4%	14 – 32	421 – 1,110	0.1% - 0.4%

Common Name	Scientific Name	O'ahu Population Estimate – Mean (lower-upper estimation limit) (CREP 2018)[1]	Average Number Collected per Year by 20 fishers	Maximum Number Collected per Year by 20 fishers	% of Mean Population Collected (20 fishers)	Collection by other commercial aquarium fishers	Total Annual Collection Anticipated under Limited Permit Issuance Alternative	% of Mean Population Collected (total collection)
Saddle Wrasse	*Thalassoma duperrey*	11,959,153 (9,368,942-14,549,363)	335	1,391	<0.1%	14 – 32	349 – 1,423	<0.1%
Fisher's Angelfish[4]	*Centropyge fisheri*	192,591 (-37,283-422,465)	417	986	0.2% - 0.5%	58 – 126	475 – 1,112	0.2% - 0.6%

[1]Estimated population derived from NOAA data collected between 2010 and 2016 (CREP 2018).
[2]Regulated species (e.g., bag or size limits) on the island of O'ahu. The average and maximum collection values for these species is based off of data from 2016 and 2017, which reflect collection rates under the current bag limits.
[3] See paragraph above this table. Percent of population collected is likely below 1%.
[4]SGCN.

survey limits. Therefore, it is not possible to know the exact proportion of the population that would be collected for this species, though it is assumed to be less than 1% of its overall population.

Based on the analysis presented in this section, the Limited Permit Issuance (Preferred) Alternative would have ***less than significant*** direct impacts on the top 20 fish species collected on O’ahu.

Other Regulated Species Collected

The Achilles Tang, Bandit Angelfish, and Hawaiian Cleaner Wrasse are regulated by the DAR in terms of bag limits, size limits, or both. During 2018 and 2019, these 3 species accounted for 0.79% of all fish collected on the island of O’ahu, and from 2000 through 2017 they accounted for 1.7% of the fish collected by the 20 fishers who would be issued Aquarium Permits.

A total of 5,334 Hawaiian Cleaner Wrasse were collected by the 20 fishers between 2000 and 2017, for an average annual collection of 296. However, in July 2015, the regulations in HAR §13-77 were put into place (see Section 1.2.3), limiting the collection of Hawaiian Cleaner Wrasse to no more than six individuals a day. Therefore, it is anticipated that under the Limited Permit Issuance (Preferred) Alternative, collection would follow the rates seen in 2016 and 2017, when these bag limits were in place, for an average collection of 114 Hawaiian Cleaner Wrasse per year, and a maximum collection of 153 per year. It is anticipated that an additional 15 Hawaiian Cleaner Wrasse may be collected annually by other commercial aquarium collections (without the use of fine mesh nets) based on an estimated collection of 31.2% of the 2018 collection rate (the only full year of data we have since the ban on Aquarium Permits took effect in October 2017) of 48 Hawaiian Cleaner Wrasse. Therefore, it is anticipated that approximately 129 to 168 Hawaiian Cleaner Wrasse would be collected annually over the 5-year analysis period, which represents less than 0.1% of the O’ahu population estimate of 190,455 individuals (CREP 2018). This falls below the 5% to 25% sustainable threshold (Ochavillo and Hodgson 2006).

A total of 3,103 Achilles Tang were collected by the 20 fishers between 2000 and 2017, for an average annual collection of 172. However, in July 2015, the regulations in HAR §13-77 were put into place (see Section 1.2.3), limiting the collection of Achilles Tang to no more than 10 individuals a day. Therefore, it is anticipated that under the Limited Permit Issuance (Preferred) Alternative, collection would follow the rates seen in 2016 and 2017, when these bag limits were in place, for an average collection of 72 Achilles Tang per year, and a maximum collection of 78 per year, which represents 1.3% to 1.4% of the O’ahu population estimate of 5,750 individuals (CREP 2018), which falls below the 5% to 25% sustainable threshold (Ochavillo and Hodgson 2006). However, it is anticipated that an additional 4 Achilles Tang may be collected annually by other commercial aquarium collections (without the use of fine mesh nets) based on an estimated collection of 31.2% of the 2018 collection rate (the only full year of data we have since the ban on Aquarium Permits took effect in October 2017) of 12 Achilles Tang. Therefore, it is anticipated that approximately 84 to 90 Achilles Tang would be collected annually over the 5-year analysis period, which represents 1.5% to 1.6% of the O’ahu population estimate of 5,750 individuals (CREP 2018), which falls below the 5% to 25% sustainable threshold (Ochavillo and Hodgson 2006).

A total of 3,606 Bandit Angelfish were collected by the 20 fishers between 2000 and 2017, for an average annual collection of 200, ranging from a minimum of 2 individuals (in 2002, 2003, 2004 and 2005) to a maximum of 589 (in 2014). While there are regulations pertaining to this species in HAR §13-77, they only restrict the number of fish greater than 5.5 inches in length, and not the overall collection. It is anticipated that an additional 91 Bandit Angelfish may be collected annually by other commercial aquarium collectors (without the use of fine mesh nets) based on an estimated collection of 31.2% of the 2018 collection rate (the only full year of data we have since the ban on Aquarium Permits took effect in October 2017) of 293 Bandit Angelfish. Therefore, it is anticipated that approximately 291 to 680 Bandit Angelfish would be collected annually over the 5-year analysis period. A population estimate for Bandit Angelfish is not available from the CREP data due to the species' deep-water habits, and as discussed in Section 4.4.5.2, Kane and Tissot (2017) also reported the deep-water habits of the Bandit Angelfish, and their research illustrates that the vast majority of the Bandit Angelfish population occurs at depths below the CREP survey depth. This species is generally only collected at depths at which normal recreational diving does not occur. Due to the complexity and difficulty of collecting the Bandit Angelfish, its population will likely continue to not receive significant pressure from the commercial aquarium fishery. As noted in Section 4.4.5.2, the overall global population is considered stable (Pyle et al. 2010b).

Based on the analysis presented in this section, the Limited Permit Issuance (Preferred) Alternative would have ***less than significant*** direct impacts on other regulated fish species collected on O'ahu.

Hawai'i Species of Greatest Conservation Need

Impacts to Psychedelic Wrasse and Fisher's Angelfish under the Limited Permit Issuance (Preferred) Alternative are discussed in the "Top 20 Collected Fish Species" section above in this section. Based on a predicted annual collection of 575 to 845 Psychedelic Wrasse and 475 to 1,112 Fisher's Angelfish, the impact to these two populations is anticipated to be 0.4% to 0.6% of the Psychedelic Wrasse population (estimated at 146,521; CREP 2018) and 0.2% to 0.6% of the Fisher's Angelfish population (estimated at 192,591; CREP 2018). However, as described in Section 4.4.4.16 and Section 4.4.4.20, both of these species tend to occur at depths greater than those surveyed by CREP. Therefore, in all likelihood, the actual populations of Psychedelic Wrasse and Fisher's Angelfish on O'ahu are substantially greater than that reported by the CREP data, and the actual percentage of the populations removed by aquarium collection is likely lower than reported in this DEIS.

Impacts to Bandit Angelfish are discussed above in the "Other Regulated Species" section. It is anticipated that approximately 291 to 680 Bandit Angelfish would be collected annually over the 5-year analysis period. A population estimate for Bandit Angelfish is not available from the CREP data due to the species' deep-water habits, and as discussed in Section 4.4.5.2, Kane and Tissot (2017) also reported the deep-water habits of the Bandit Angelfish, and their research illustrates that the vast majority of the Bandit Angelfish population occurs at depths below the CREP survey depth. This species is generally only collected at depths at which normal recreational diving does not occur. Due to the complexity and difficulty of collecting the Bandit Angelfish, its population will likely continue to not receive significant pressure from the commercial aquarium fishery. As noted in Section 4.4.5.2, the overall global population is considered stable (Pyle et al. 2010b).

Historic collection data on an additional 23 SGCN fish species are included in Appendix B. Of the 23 species, only 18 (78%) have been collected by the 20 fishers between 2000 and 2017. Of those 18 species, 8 (44%) were collected in less than 50% of the years between 2000 and 2017. Average collection of 7 species was less than 10 per year, with average collection ranging from 1 (Hawaiian Knifefish, Hawaiian Morwong and Sunset Bass) to 229 (Hawaiian Anthias; see Appendix B).

Based on the analysis presented in this section, the Limited Permit Issuance (Preferred) Alternative would have ***less than significant direct impacts*** on SGCN species collected on O'ahu.

Invertebrate Species

Based on the analysis presented in Section 5.4.1.1, all alternatives under consideration are anticipated to have ***less than significant direct impacts*** on invertebrate collection.

Reef Habitat

Impacts to reef habitat and herbivores would be similar to those described for the No Action Alternative (see Section 5.4.1.1), however, with the added benefits of the bag limits described for the Pre-Aquarium Collection Ban Alternative (see Section 5.4.1.2). In addition, under the Limited Permit Issuance (Preferred) Alternative, the number of Aquarium Permits would be limited to 20 fishers. The bag limits include the Yellow Tang (100 total daily, 6 individuals <1.5 inches and 6 individuals >5 inches), Kole (75 total daily, 6 >5 inches) and Potter's Angelfish (50 total daily]). Analysis based on CREP population estimates indicates the predicted annual collection of these 3 species represents approximately 7.7% to 13.7% of the overall island of O'ahu population of Yellow Tang, approximately 1.8% to 2.1% of the overall island of O'ahu population of Potter's Angelfish, and approximately 1.0% to 1.3% of the overall island of O'ahu population of Kole (Table 5-3). Therefore, it is not anticipated that a significant reduction in herbivores as a result of commercial aquarium collection would occur under the Limited Permit Issuance (Preferred) Alternative, as all of these values fall within or below the 5% to 25% sustainable threshold (Ochavillo and Hodgson 206).

Based on the analysis presented in this section, Limited Permit Issuance (Preferred) Alternative would have a ***less than significant direct impact*** on reef habitat or the resilience of corals to respond to widespread bleaching events.

Invasive Species

It is anticipated that implementation of the Pre-Aquarium Collection Ban Alternative would have a minor effect on invasive fish species over the 5-year analysis period.

The 20 fishers have reported a total of 504 individual Bluestripe Snappers and 59 Peacock Grouper collected from O'ahu between 2000 and 2017. The Blacktail Snapper has not been reported as caught from O'ahu over the 18-year analysis period. As stated in Section 5.4.1.1, no Bluestripe Snapper, Peacock Grouper or Blacktail Snapper were reported during 2018 or 2019, though this could be due to confidentiality (see Section 5.1).

Based on the low level of collection of these species, the Pre-Aquarium Collection Ban Alternative would have a ***less than significant direct impact*** on invasive fish species.

Impact of Aquarium Collection on Overall Fish Populations and Recruitment

As discussed in Section 5.4.1.1, Ochavillo and Hodgson (2006) suggest collection of between 5% and 25% is sustainable for various reef species in the Philippines that are similar to those found on O'ahu (e.g., tang, wrasse, butterflyfish, angelfish, triggerfish).

Of the 23 fish species analyzed in this EIS (including the top 20 collected species and 3 additional regulated species), population estimates were available for 22 (96%). The one species without a population estimate is the Bandit Angelfish, which is discussed above.

Of the 22 species with populations estimates, 20 species would be collected at numbers below the lower end of the 5% to 25% sustainable threshold (Ochavillo and Hodgson 2006).

For the remaining two species, the Flame Wrasse is estimated to be collected at 9.4% to 24.5% of the CREP population estimates (the 20 fishers would be collected an estimated 7.6% to 20.6% of the population), however, as described in Section 5.4.1.1, this species is typically found at depths greater than the CREP surveys, and therefore, the population estimates are likely low, leading to an inflated estimate of the impacts. The last species, the Yellow Tang, would be collected at a rate of 7.7% to 13.7% of the CREP population estimates (the 20 fishers would be collecting 4.0% to 5.1% of the population), which falls within the 5% to 25% sustainable threshold (Ochavillo and Hodgson 2006). However, as detailed above, the actual population could be as large as 562,962 Yellow Tang, in which case the collection would represent an even smaller portion of the population (3.0% to 5.3%), falling below or at the lower end of the 5% to 25% sustainable threshold (Ochavillo and Hodgson 2006). Additionally, as described in Section 5.4.1.1, the Yellow Tang has a relationship between size and fecundity. Therefore, the Limited Permit Issuance (Preferred) Alternative, with its limits on collection of large (> 5.5 inches) individuals, is more protective of the brood stock than the No Action Alternative.

In addition to the low percentage of the populations which are harvested each year for most species, commercial aquarium fishing has a distinct advantage over other types of fishing because it is targeted to specific species, and within those species, it primarily targets specific size-classes which minimizes the impact to the brood stock. Because commercial aquarium fishers target the smaller individuals in populations, the larger individuals with higher fecundity are left within the population. This is particularly true of all alternatives that would include the issuance of Aquarium Permits, as the regulations set forth in HAR §13-77 (Section 1.2.3) would be in place, which place bag and/or size limits on several species, including the Yellow Tang, Kole, Orangespine Unicornfish, Potter's Angelfish and Moorish Idol.

Based on the low percentage of the overall populations collected annually by commercial aquarium fishers, which is spread throughout the year and across multiple areas, as well as the targeted take of smaller, less fecund individuals, commercial aquarium collection under the Limited Permit Issuance (Preferred) Alternative would have ***less than significant direct impact*** on reef fish populations and the reefs in which they occur.

5.4.2 Indirect Effects

Under all alternatives, mortality of fish post-harvest will occur. As described in Munday et al. (2015), after a fish has been collected from the reef, they are brought to the surface, transported to an export facility, shipped to import facilities, and then transported to a retail store and eventually to a hobbyist aquarium. Mortality can occur at any point in this supply chain, though immediate mortality is less than 1% (Stevenson et al. 2011, as cited in Munday et al. 2015).

When bringing the fish to the surface, there are two methods commonly used in the Hawai'i fishery for avoiding barotrauma to collected fish (either ascent without decompression stops, or ascent with one decompression stop, followed by venting), and neither method resulted in any immediate or delayed mortality (Munday et al. 2015). Furthermore, the stress levels of vented fish versus fish brought to the surface using decompression (multiple stops along the way to the surface, with no venting) were not statistically different (Munday et al. 2015). While this study included limitations, including the lack of additional stressors, since fish were kept for 21 days for observations, and did not have to undergo additional shipment and handling, it does suggest that the collection methods used in Hawai'i minimize the post-collection mortality of fish compared to other methods (e.g., no decompression, or use of cyanide). Munday et al. (2015) stated that while venting has been controversial in this industry due to criticism from animal rights groups, other fishing groups are often encouraged to vent fish before returning them to the ocean.

Additional mortality may occur during transportation, shipping, or once the fish has reached its final destination. No post-collection data are available for fish collected in Hawai'i; however, cyanide-free net-caught fish in the Philippines have been found to have mortality rates of less than 10% through the chain from the reef to retailer (Rubec et al. 2001). This is compared to rates of 14.12% to 21.69% (depending on the experience of the final aquarist) found by Cartwright et al. (2012), which included fish collected using cyanide or other methods. While it is possible that higher post-collection mortality rates could result in the need to collect more fish from the reef, it is not expected that mortality rates will increase over what has previously occurred under historic collection rates. Therefore, because post-collection mortality is not expected to increase under any of the alternatives, it is not anticipated that collection rates will need to increase as a result of increased mortality.

5.4.2.1 No Action Alternative

Under the No Action Alternative, collection of aquarium fish using fine mesh nets would not occur, though collection of fish and invertebrates may continue using methods not requiring an Aquarium Permit, and without the use of fine mesh nets and the regulations that accompany their use (see Section 1.2.3), the size class of fish collected may increase over that which is caught with fine mesh nets (i.e., the smaller fish would escape the larger mesh), but this impact cannot be quantified at this time. With only a few exceptions for certain species where fishers classify fish as "small", "medium" or "large", the size of fish collected under CMLs is not required to be reported to the DAR, and thus these data are not available. If the size class of fish collected is larger, these larger fish may represent the brood stock.

As shown in Section 5.4.1.1, the species composition of collection appears to have changed in the absence of Aquarium Permits. Collection of fish and invertebrates under the No Action Alternative would result in temporary and localized decreases in the number of fish (including the top 20 species, other regulated species, and SGCN) and invertebrates over the 5-year analysis period (occurring only at the time and place where collection is occurring), which may provide fewer viewing opportunities for tourists, a decrease in the prey base, and reduced competition between species for available resources. However, given the low proportion of the island populations of the species that would be removed annually (Section 5.4.1.2), and the geographic area over which the removal would occur (i.e., the island of O'ahu), it is anticipated that indirect impacts on viewing opportunities, prey base, and competition would be minor or nonexistent. At the population level, based on the analysis provided in Section 5.4.1.2, no impacts to any population of the 23 fish species analyzed are anticipated. Therefore, no indirect impacts due to commercial aquarium collection on the biological function of herbivore populations are anticipated.

Based on the Tissot and Hallacher (2003) study and the 15 years of coral reef data collected and analyzed by the DAR (2018b) as described in Section 5.4.1.1, it is not anticipated that any significant indirect impacts to reef habitat would occur under the No Action Alternative.

Therefore, it is anticipated that the No Action Alternative would have a ***less than significant indirect impact*** on tourists, as well as on collected fish populations and the reefs in which they occur on O'ahu.

5.4.2.2 Pre-Aquarium Collection Ban Alternative

Under the Pre-Aquarium Collection Ban Alternative issuance of an unlimited number of Aquarium Permits would occur and commercial aquarium fish collection using fine mesh nets would take place. An estimated 71,983 (18-year average) to 100,662 (maximum) primarily juvenile fish would be collected from O'ahu and an estimated 165,056 invertebrates (18-year average) would be collected from O'ahu. Collection of 71,983 to 100,662 primarily juvenile fish and over 150,000 invertebrates would result in a temporary and localized decreases in the individual number of fish (including top 20 species, other regulated species, and SGCN) and invertebrates over the 5-year analysis period (occurring only at the time and place where collection is occurring), which may provide fewer viewing opportunities for tourists, a decrease in the prey base, and reduced competition between species for available resources. However, adequate data do not exist that would allow for a thorough analysis of the potential effects. Given the low proportion of the island populations of the species that would be removed (Section 5.4.1.2), and the geographic area over which the removal would occur (i.e., island of O'ahu), it is anticipated that indirect impacts on viewing opportunities, prey base, and competition would be minor or nonexistent.

Based on the Tissot and Hallacher (2003) study and the 15 years of coral reef data collected and analyzed by the DAR (2018b) as described in Section 5.4.1.1, it is not anticipated that any significant indirect impacts to reef habitat would occur under the Pre-Aquarium Collection Ban Alternative.

Based on the analysis in this section, the Pre-Aquarium Collection Ban Alternative would have ***less than significant indirect impact*** on tourists, as well as on collected fish populations and the reefs in which they occur.

5.4.2.3 Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative

Indirect impacts under the Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative would be similar to those of the Pre-Aquarium Collection Ban Alternative. The implementation of the 10 per day bag limit on Flame Wrasse may provide increased viewing opportunities for tourists, but this cannot be quantified at this time. Expansion of the Waikiki MLCD may decrease user conflict within that area, and provide increased viewing opportunities in that area, but again, this cannot be quantified at this time.

Based on the analysis in this section, the Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative would have ***less than significant indirect impact*** on tourists, as well as on collected fish populations and the reefs in which they occur.

5.4.2.4 Limited Permit Issuance (Preferred) Alternative

Indirect impacts under the Limited Permit Issuance (Preferred) Alternative would be similar to those of the Pre-Aquarium Collection Ban Alternative. The implementation of the 10 per day bag limit on Flame Wrasse may provide increased viewing opportunities for tourists, but this cannot be quantified at this time. Expansion of the Waikiki MLCD may decrease user conflict within that area, and provide increased viewing opportunities in that area, but again, this cannot be quantified at this time. The limited issuance of permits to 20 fishers may decrease user conflict in areas open to aquarium collection, though it is anticipated that some additional fishers may continue to collect aquarium fish without the use of fine mesh nets, and this cannot be quantified at this time.

Based on the analysis in this section, the Limited Permit Issuance (Preferred) Alternative would have ***less than significant indirect impact*** on tourists, as well as on collected fish populations and the reefs in which they occur.

5.4.3 Cumulative Impacts

As stated in Section 4.4, Toonen et al. (2011) conclude that the Hawaiian Archipelago is not a single, well-mixed marine community, but rather there are at least four significant multi-species barriers to dispersal along the length of the island chain, and that species that appear capable of extensive dispersal, such as Yellow Tang and Kole, show significant population differentiation within the Hawaiian Archipelago. In addition, there are significant consensus genetic breaks that restrict gene flow between islands. Therefore, the geographic boundary for analysis of cumulative effects is the island of O'ahu.

Honolulu, on the island of O'ahu, is the largest population center in Hawai'i, and is in close proximity to reefs, which brings even more humans into contact with the coral reefs, which can increase the risk of anthropogenic stressors (Gorstein 2018).

5.4.3.1 Recreational Aquarium Fish Collection

As of April 2018, all recreational permits for collection of aquarium species with fine mesh nets were voided, and no collection with fine mesh nets is currently legally allowed, pending environmental review (DAR 2019a). Given the five-year analysis period, it cannot currently be predicted when or if these permits will be reinstated, therefore, the following discussion focuses on the cumulative impacts if the permits were to be reinstated, and pressure remained similar to historic rates.

Recreational aquarium fish collection is governed by state law and regulations. Under HRS 188-31, individuals may use fine mesh nets (< 2-inch mesh) to collect aquatic life for an aquarium. A permit is not required if:

- The net has large mesh (more than two-inch mesh);
- The net has small mesh but is less than three feet in length, height, or width, including the handle; or,
- Using a slurp gun.

A recreational aquarium permit is required if using a small mesh net other than a hand net, or a small mesh hand net larger than the dimensions indicated above. Small mesh throw nets are always prohibited. Regardless of whether a permit is required, regulations that impose bag limits, seasons, and limit the size of fish that can be collected apply to all recreational fish collection. The aquarium permit only exempts a person from the small mesh restriction. The recreational aquarium permit rules apply everywhere in the state.

Under a recreational aquarium permit, individuals are authorized to collect up to five aquatic animals per day (1,825 per year) (HAR 13.60.4). Since 2000, the number of recreational permits issued for the state (island-specific numbers not available) has averaged 159 annually (DAR 2018a). The DAR collected recreational aquarium fish catch information from 1975 until 1985, after which, data collection was discontinued, and currently no reporting of catch is required for recreational aquarium permit holders. Historic recreational collection data were not digitized or processed into a database, and therefore, are not available for analysis (DAR 2018a).

Because reporting of recreational aquarium catch is not required, the impact of recreational collection on species collected on O’ahu cannot be quantified. It is likely that not all recreational permit holders collect the maximum allowable number (1,825); however, if each of the average 159 statewide permit holders were to collect 50% of the allowable catch (913), it would result in the collection of 145,088 aquatic animals annually. These estimates are likely high based on results from Harding (2017), which found that 57% of recreational aquarium permit holders surveyed had not utilized their permit in the previous 12-month period. Of the 43% who had used their permits, their average yearly catch was 45 fish per permit (Harding 2017), which is below the maximum allowable number of 1,825 fish or the 50% used to estimate impacts above.

Because reporting of recreational aquarium catch is not required, the impact of the collection on SGCN, including the Psychedlic Wrasse, Fisher’s Angelfish, and Bandit Angelfish, cannot be quantified. Nevertheless, it is likely that SGCN are occasionally collection by recreational aquarium permit holders. However, given the low number of SGCN individuals collected by commercial aquarium collectors (average 913 Psychedelic Wrasse/year; average 756 Fisher’s Angelfish/year; average 209 Bandit Angelfish/year) it is estimated that recreational collectors are collecting fewer individuals of these species.

Because reporting of interactions (e.g., damage from contact with collection equipment) with corals resulting from recreational aquarium collecting and recreational aquarium catch is not required, the impact of the interaction with reef habitat cannot be quantified. However, studies conducted by Tissot and Hallacher (2003) found that aquarium collecting had no significant impact (beneficial nor detrimental) on reef habitat. In addition, 15 years of coral reef data collected and analyzed by the DAR (2018b) found no significant difference in coral cover in areas open to commercial aquarium fish collection. It is assumed that recreational aquarium collection would likewise not have a significant impact.

Recreational aquarium collection impacts to biological resources cannot be fully quantified. However, data presented by DAR (2014a, 2019a) for West Hawai'i indicate that some species may be declining in various management areas (i.e., both within areas open to commercial aquarium collection as well as within areas closed to collection) due to factors other than commercial aquarium collecting which may include recreational aquarium collection. This may be the case on O'ahu as well.

5.4.3.2 Non-Aquarium Commercial and Non-Commercial Fishing (Non-Aquarium Fish)

Coral reef species are targeted by non-aquarium commercial fishers using numerous fishing gears including nets, traps, hook and line, spear, hand, and other methods. Commercial fish industry landings in Hawai'i have increased annually since 2006 and the NOAA reported total landings in 2013 were valued near $108 million dollars (DLNR 2015). Akule (coastal pelagic scads) dominate nearshore commercial landings and are typically collected using surround or fence nets, gillnets or hook and line (WPRFMC 2018). Other top species by weight and value include soldierfishes, parrotfish, surgeonfishes, and goatfishes, which may be targeted because they may bring a high price in some seasons (WPRFMC 2018). The Bluestripe Snapper is one of the principal species in the Hawaiian offshore handline fishery, mainly being caught via handlines, traps and gill nets (Russell et al. 2016).

Non-commercial fishing includes subsistence/consumptive, recreational, and cultural fishing and gathering activities that occur in ocean and coastal zones. The State of Hawai'i has the most developed recreational fishing infrastructure in the U.S. Pacific and is a substantial economic contributor to the State (WPRFMC 2017). The State of Hawai'i does not track non-commercial fish collection. However, creel surveys suggest that the total inshore non-commercial catch from reef areas could be as high as the reported commercial catch (WPRFMC 2017).

The most recent DAR summary report available on the West Hawai'i aquarium fishery (DAR 2019a) analyzed data collected since 2003 by the Hawai'i Marine Recreational Marine Fishing Survey (HMRFS) and subsequently since 2007 by NOAA's Marine Recreational Information Program (MRIP) to gain perspective on the generalized impact on reef fishes by aquarium collecting versus other types of reef fishing activities. Statewide, looking at the period from 2008 to 2011, the number of reef fishes caught by the recreational and commercial sectors was found to be comparable, averaging 1,511,025 per year for recreational fishers and 1,554,010 per year for commercial (i.e., non-aquarium) fishers.

McCoy et al. (2018) found that 5.6% of households on O'ahu participate in recreational (non-aquarium) fishing. Most of this fishing is conducted using lines from shore (66.8%), which catches an estimated 0.33 pounds of reef fish per hour fished (McCoy et al. 2018). Gorstein (2018) found that, while a smaller proportion of the population of O'ahu participates in fishing and gathering activities, due to the higher population on O’ahu, there are more fishers/gatherers on O’ahu than any other Hawaiian island. The results of McCoy et al. (2018) found that on O’ahu, non-commercial annual catch was approximately 3.3 times commercial catch when comparing the average pounds per year between 2004 and 2013 (McCoy et al. 2018).

On O’ahu, on average the aquarium fishery annually takes nearly a third (71,983/year) the number of reef fishes taken annually by recreational and other commercial fishers combined (194,674/year). However, unlike the aquarium fishery which targets mostly immature fish, the commercial and recreational fisheries selectively target the larger breeding portion of the population which has profound implications for the sustainable usage of the resource (DAR 2014a).

The non-aquarium commercial fish industry targets some coral reef species; however, non-aquarium commercial fishers do not directly target most aquarium fish species. Data evaluated for non-aquarium commercial fishing is lacking due to the DAR confidentiality regulations (HRS §189-3). Since most non-aquarium commercial fishers do not target aquarium species, there are usually less than three fishers reporting. Therefore, the data presented in Table 5-5 is underestimated.

Table 5-5. Available data on select species collected by commercial non-aquarium fishers in the State and on the island of O’ahu from 2000-2017. n.d. = Not Disclosed (DAR 2018a).

White List Species	Island of O’ahu Collection	State Collection Total
Achilles Tang	*n.d.*	10,641
Yellow Tang	*n.d.*	*n.d.*
Kole (=Goldring Surgeonfish, Yelloweye, Goldring)	2,607	103,391
Peacock Grouper (=Roi, bluespot peacock grouper)	8,452	17,892
Eyestripe Surgeon (=Palani)	132,214	202,286
Orangeband (=Shoulder) Surgeonfish	79,744	95,380
Saddle Wrasse	238	1,150
Brown Surgeonfish (=Lavender, Forktail Tang)	*n.d.*	58
Bluestripe Snapper (=Taape)	415,242	715,913
TOTAL	**638,497**	**1,146,711**

It is expected that the average number of aquarium fish collected annually by non-aquarium commercial fishers will continue at these rates (at a minimum) over the 5-year analysis period.

Because reporting of non-aquarium recreational, cultural, and subsistence/consumptive catch is not required, the impact of recreational, cultural, and subsistence/consumptive collection on reef fish and invertebrates, and SGCN cannot be quantified. However, nearshore recreational, and subsistence catch is likely at similar catch levels of non-aquarium commercial fishing (Walsh et al. 2003).

The impacts of non-aquarium commercial and non-commercial fishing on biological resources cannot be fully quantified. However, as discussed above, data presented by DAR (2019a) for West Hawai’i indicate that some species are declining in various management areas (i.e., both within areas open to commercial aquarium collection as well as within areas closed to collection) due to factors other than commercial aquarium collecting, which include non-aquarium commercial and non-commercial fishing. This may be the case on O'ahu as well. However, there is no way to fully quantify the cumulative effects of past and ongoing non-aquarium commercial and non-commercial fishing on biological resources. Given the assumed past and present impacts of non-aquarium commercial and non-commercial fishing on biological resources, foreseeable future actions would likely result in some impacts to biological resources.

5.4.3.3 Commercial Aquarium Collection

As noted in Section 1.0, the commercial aquarium collection fishery has existed in Hawai'i since the late 1940s. Commercial aquarium collection pursuant to permits issued by DLNR was only recently halted after the Supreme Court of Hawai'i's determination that DLNR's issuance of the permits required compliance with HEPA

Given the long history of commercial aquarium collection in Hawai'i and O'ahu, it is reasonably foreseeable that commercial aquarium collection will continue. Based on available data regarding species abundance and yearly commercial aquarium catch over the past 18 years, it is expected that in the reasonably foreseeable future, commercial aquarium collection will proceed generally at the same rate and have the same impacts as in the past 18 years. To the extent new data regarding the impacts of commercial aquarium collection on biological resources becomes available in the future, DLNR may consider those data and, to the extent necessary, supplement this impacts analysis.

As noted in Section 5.4.1.1:

- Reef fish have high fecundity and are long lived, and as such produce a large number of young each year over many years;
- Commercial aquarium collection targets juvenile fish leaving behind the adult brood stock; and,
- A low percentage of the overall population of each of the targeted species would be collected annually by commercial aquarium fishers, and this collection would be spread throughout the year and across multiple areas.

As such, Section 5.4.1.1 concludes that commercial aquarium collection would not have a significant impact on island of O'ahu reef fish populations. Thus, it is not anticipated that losses would accumulate over time due to the low percentage collected each year and the high fecundity of reef fishes.

5.4.3.4 Tourism

Hawai'i is a major tourist destination and the tourism industry contributes the most to the state's economy. Over time this industry has grown and reshaped the native landscapes and sensitive ecosystems through major coastal development, increased energy consumption, and tourism based recreational activities. Major coastal development for tourism (i.e., hotels, resorts, restaurants, recreational outfitters) and associated point source pollution (e.g., petroleum hydrocarbons, pharmaceuticals, heavy metals, and sediment from agriculture and development) threaten the quality of coral reef ecosystems (State of Hawai'i

2010). When coral reefs are damaged, it could potentially expose reef dependent organisms and leave them vulnerable to other threats such as disease, predation, and climate change (State of Hawai'i 2010), including the reef fishes and other aquatic animals targeted by both commercial and recreational aquarium fishers.

Human interaction with native flora and fauna is also a growing concern. Damage to sensitive ecosystems (i.e., coral reefs, tide pools, shorelines) through tourism based recreation overuse (e.g., SCUBA diving, snorkeling, etc.) has been attributed to killing many aquatic organisms that in turn may affect many more species that rely on such organisms as a food source. Damage to coral reef habitat in association with tourism (through coastal development, point source pollution, and recreational activities) threatens most reef fish and invertebrate species that are dependent on reefs for habitat and foraging in the foreseeable future (State of Hawai'i 2010).

5.4.3.5 Climate Change

Warming of the planet and rising average temperatures may produce variations in precipitation and temperature patterns, sea levels, and storm severity. This process is commonly referred to as "climate change." Increased temperatures and acidity will reduce the health and resilience of coral reefs and other ocean resources (Hawai'i Climate Change Mitigation and Adaptation Commission 2017). Changes in sea surface temperatures have been documented, with temperatures warmer than normal in recent years (increase of 0.22 °F per decade), and even reaching record levels of thermal stress in September 2015 (Casey and Cornillon 2001; Gove et al. 2016). Warmer water temperatures can result in coral bleaching. When water is too warm, corals will expel the algae living in their tissues causing the coral to turn completely white. When coral bleaches, it is not dead; corals can survive a bleaching event, but they are under more stress and are subject to mortality. The first documented large-scale coral bleaching event in Hawaii occurred on O'ahu during the summer of 1996 (Friedlander et al. 2008). In 1998, global coral bleaching and die-off was unprecedented in geographic extent, depth, and severity. Researchers predict that coral bleaching events would occur when the average sea temperatures are 33.8 °F or more above average (DLNR 2015). In the fall of 2015, leeward reefs of Hawai'i Island suffered catastrophic coral mortality due to widespread and severe coral bleaching. Survey results indicated that overall coral bleaching prevalence averaged 53.3% and resulted in an average coral cover loss of 49.7%. Regional differences in bleaching prevalence and subsequent coral mortality were not detected. High post-bleaching mortality was detected for the coral species, *Pocillopora meandrina, Porites evermanni*, and *Porites lobata* (Kramer et al. 2016). Acidification can also damage corals and marine life that depend on minerals for shell/skeletal development. The acidity of the Pacific Ocean has increased by about 25% over the last 300 years and is predicted to increase 40-50% by 2100 (EPA 2016).

Based on studies in the Great Barrier Reef, fishing pressure had minimal effect on bleaching (Hughes et al. 2017). On the island of Hawai'i, the total cover of hard coral decreased in all areas, but the decline was not more severe in areas open to commercial aquarium collection compared to areas closed to collection (DAR 2019a), and therefore, it is anticipated that commercial aquarium collection on O'ahu, which uses the same methods as those used on the island of Hawai'i, has a less than significant impact on coral declines.

Currently, it is projected that with warming of approximately 5ºF per decade, coral reefs will experience annual bleaching beginning by about 2040 in the Hawaiian Islands, though this may be delayed by approximately 11 years if the warming reductions in the 2015 Paris Agreement are met (U.S. Global Change Research Program [USGCRP] 2018). Bleaching and acidification will result in a loss of reef structure and lead to declines in fishery yields and loss of habitat (USGCRP 2018). Bleaching events in Hawai'i are tracked by NOAA, the DLNR, DAR, and other partners (found online at www.hawaiicoral.org). Changes in climate currently impact the physical resources of Hawai'i. Warming sea temperatures and acidification could result in damage, disease outbreaks, and ultimately death of coral reefs. The weakening or loss of coral reef ecosystems may threaten entire marine ecosystems in the region as many organisms, including numerous fish species, are not only dependent on these ecosystems for suitable habitat, but due to the isolation of the islands in the central pacific, are unable to move to new environments that provide suitable conditions for survival (EPA 2016).

Several reef fish and invertebrate species are endemic to the Hawaiian Archipelago (including Johnston Atoll) and therefore may be impacted when faced with changes in climate over time (e.g., warming temperatures, habitat loss due coral bleaching, etc.). The extent and severity of impacts to reef species from climate change has been ongoing for decades and are expected to increase in the foreseeable future. If environmental fluctuations resulting from climate change (e.g., tropical storms, coral bleaching episodes, acidification, etc.), or other natural or human factors, change habitat conditions, fishing mortality may present a higher risk to some reef fish and invertebrate species and SGCN.

5.4.3.6 Poaching and Underreporting

It is acknowledged that poaching of aquarium fish could occur under any of the alternatives under consideration. For example, two fishers were cited in February 2020 on the island of Hawai'i for illegal harvesting of aquarium fish offshore of Kawaihae[7]. An inspection of the vessel allegedly turned up aquarium fishing gear, including a small mesh net, and the hold contained 550 live tropical fish of various species. The two fishers were cited by DOCARE officers for violation of HAR 13-60.4.4(3). The boat, trailer, and various fishing gear were seized as evidence. While poaching does occur, there are no available data on the number of aquarium fish taken by poachers in a given year. However, we assume the impact of poaching would be the same under all alternatives under consideration.

Analysis by the DAR (2014a) has shown that actual underreporting of catch is small, with a 3.5% difference between the number of animals reported caught and sold in 2010 and a 0.4% difference in 2014, which likely represent live releases and mortality. Therefore, it is anticipated that actual collection may be 0.4% to 3.5% higher than what had been reported prior to the October 2017 ban on fine-mesh nets, or 288 to 2,519 additional reef fish from O'ahu (based on 0.4% to 3.5% of the 71,983 average fish collected in a year). It is assumed that this rate of underreporting could occur under any of the alternatives under consideration (i.e., up to a 3.5% additional collection of any species).

5.4.3.7 Cumulative Impact Conclusion

Cumulatively, all of the factors discussed above likely effect the 23 fish species analyzed in this EIS, as well as invertebrates and reef habitat. Aquarium collection would be an additive impact when combined

[7] https://www.hawaiitribune-herald.com/2020/02/22/hawaii-news/kona-men-cited-for-illegal-aquarium-fish-gear/

with these other factors, and the impact of collection by species would vary by alternative, as described in Section 5.4.1.

A cumulative impact would be considered significant if it led to population declines. For the 20 fish species with an estimated collection of less than 5% of the island-wide population, as well as for the Flame Wrasse (whose population is mostly below the CREP survey depth) and the 1 fish species without a population estimates (Bandit Angelfish, which tends to be below the normal depths of collection), this impact is not anticipated to be significant.

Depending on the magnitude of the impacts of these other cumulative factors, the cumulative impact of commercial aquarium collection may be significant for the Yellow Tang. However, the cumulative impact under the Preferred Alternative is less than the No Action Alternative, resulting in a benefit to the Yellow Tang compared to continuing a total ban on the use of fine mesh nets. This is likely due to several factors, including the regulations in HAR §13-77, which are only in place when using a fine mesh net, as well as differences in species composition when collecting aquarium fish using other methods, as illustrated by the differences in species composition between the No Action Alternative and the other three alternatives.

In addition, as described in Section 5.4.1, there is uncertainty related to the population estimate of the Yellow Tang, therefore, the cumulative impact of commercial aquarium collection may be lower if the actual population is larger than estimated by CREP (2018).

Based on the analysis in this section, while commercial aquarium collection does contribute to the cumulative impact, it is a **less than significant** factor for the majority of species analyzed under all four alternatives. For the Yellow Tang, all alternatives under consideration may have a ***significant negative cumulative impact*** if the magnitude of the other cumulative impacts, which cannot be quantified at this time, when added to commercial aquarium collection, results in a significant population decline. However, implementing the Pre-Aquarium Collection Ban Alternative, the Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative, or the Limited Permit Issuance (Preferred) Alternative would all have a ***beneficial impact*** on Yellow Tang populations when compared to the No Action Alternative.

Additionally, measures included in the Preferred Alternative (e.g., limited permit issuance, reduced Flame Wrasse bag limit, expanded Waikiki MLCD) may mitigate potential impacts to other species by expanding the existing MLCD, limiting the number of Aquarium Permits issued, and limiting the number of Flame Wrasse that can be collected by commercial aquarium collectors each day. As described above, commercial aquarium collection is not the only stressor on these species, and therefore, it is anticipated that additional conservation measures designed to address the other stressors (e.g., commercial and recreational fisheries) may need to be implemented in order to sustain the populations.

5.4.4 Mitigation

No significant adverse direct or indirect biological resource impacts are anticipated under any of the four alternatives under consideration. Significant cumulative impacts are anticipated; however, commercial aquarium collection is a less than significant factor in the cumulative impact. Therefore, no mitigation is required or proposed.

Nevertheless, the Preferred Alternative includes mitigative measures (see Section 5.0) such as a reduction in the number of Aquarium Permits that would be issued, expansion of the Waikiki MLCD, and reducing the bag limit for the Flame Wrasse, all of which would minimize impacts to biological resources.

5.5 SUMMARY OF IMPACTS

Table 5-6 summarizes the environmental consequences by alternative during the 5-year analysis period.

Table 5-6. Summary of direct and indirect impacts by alternative over the 5-year analysis period.

<table>
<tr><th rowspan="2">Alternative</th><th colspan="3">Socioeconomics</th><th>Cultural Resources</th><th colspan="3">Biological Resources</th></tr>
<tr><th>Direct</th><th>Indirect</th><th>Tourism</th><th>Direct and Indirect</th><th>Collection of Fish</th><th>Collection of invertebrates</th><th>Coral Reefs and Herbivores</th></tr>
<tr><td>**No Action**</td><td>$2.1 million added to the economy, unknown number of jobs</td><td>$10.6 million added to the economy, unknown number of indirect jobs</td><td>No known quantifiable impact on the tourism industry</td><td rowspan="4">No impact on cultural resources.</td><td>Collection of 230,870 to 503,310 fish; bag and size limits under HAR §13-77 not in effect</td><td rowspan="4">Collection of 825,280 to 2,099,020 invertebrates</td><td rowspan="4">No impact on coral. No impact on herbivore numbers.</td></tr>
<tr><td>**Pre-Aquarium Collection Ban**</td><td>$2.9 million added to the economy and 126 jobs</td><td>$14.7 million added to the economy, unknown number of indirect jobs</td><td>No known quantifiable impact on the tourism industry</td><td>Collection of 359,915 to 503,310 fish</td></tr>
<tr><td>**Expanded Waikiki MLCD and Flame Wrasse Conservation**</td><td>$2.8 million added to the economy and 126 jobs</td><td>$14 million added to the economy, unknown number of indirect jobs</td><td rowspan="2">No known quantifiable impact on the tourism industry, may increase viewing opportunities in the Expanded Waikiki MLCD or of Flame Wrasse</td><td>Collection of 359,915 to 503,310 fish; collection of Flame Wrasse reduced by 60%</td></tr>
<tr><td>**Limited Permit Issuance**</td><td>$2.1 million to $3.2 million added to the economy and at least 20 jobs</td><td>$10.5 million to $16 million added to the economy, unknown number of indirect jobs</td><td>Collection of 265,041 to 426,633 fish; collection of Flame Wrasse by 20 fishers reduced by 60%</td></tr>
</table>

5.5.1 Summary of Impacts on Fish Species Analyzed

Table 5-7 below summarizes the population impacts (based on the percent of the population collected annually) of the four alternatives on each of the 22 fish species analyzed in this EIS which had CREP (2018) population estimates available. The No Action Alternative uses the collection data from 2018 and 2019; the

Pre-Aquarium Collection Ban Alternative and the Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative are based on the historic average and maximum collection for the island of O'ahu, but with a decreased Flame Wrasse collection for the Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative; and the Limited Permit Issuance Alternative is based on the historic average and maximum collection of the 20 fishers, with a decreased Flame Wrasse collection, as well as 31.2% of the No Action Alternative to account for additional commercial aquarium collection that may continue to occur without the use of fine mesh nets.

Table 5-7. Summary of the annual impact (percent collected by commercial aquarium collectors) on populations of 22 fish species analyzed in this EIS based on CREP (2018) population estimates and the projected annual collection under each alternative (see Section 5.4.1 for additional details).

Common Name	No Action Alternative	Pre-Aquarium Collection Ban Alternative	Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative	Limited Permit Issuance (Preferred) Alternative	
				20 Fishers	All fishers (including the 20)
Yellow Tang	12.6% - 27.5%	10.6% - 10.9%		4.0% - 5.1%	7.7% - 13.7%
Kole	0.9% - 1.9%	1.0%		0.7%	1.0% - 1.3%
Potter's Angelfish	0.7% - 1.5%	2.2% - 2.5%		1.6%	1.8% - 2.1%
Orangespine Unicornfish	<0.1% - 0.2%	0.2% - 0.3%		<0.1%	<0.1%
Ornate Wrasse	<0.1%	0.4% - 0.6%		0.2% - 0.3%	0.2% - 0.3%
Flame Wrasse[1]	4.1% - 8.9%	28.3% - 61.2%	11.3% - 24.5%	7.6% - 20.6%	9.4% - 24.5%
Fourline Wrasse	<0.1% - 0.2%	0.9% - 1.5%		0.7% - 1.4%	0.7% - 1.4%
Hawaiian Whitespotted Toby	<0.1%	0.1% - 0.2%		<0.1%	<0.1%
Forcepsfish	0.2% - 0.4%	0.8% - 1.5%		0.5% - 0.7%	0.6% - 0.9%
Milletseed Butterflyfish	<0.1%	0.2% - 0.5%		0.1% - 0.2%	0.1% - 0.3%
Shortnose (Geoffroy's) Wrasse	<0.1% - 0.1%	0.2% - 0.4%		0.1% - 0.2%	0.1% - 0.3%
Bicolor Anthias	0.1% - 0.3%	<0.1%		0.3% - 0.9%	0.4% - 1.0%
Orangeband Surgeonfish	<0.1%	0.1% - 0.3%		<0.1%	0.1%
Moorish Idol	0.1% - 0.3%	<0.1%		<0.1%	0.1% - 0.2%
Multiband Butterflyfish	<0.1%	0.1% - 0.3%		<0.1% - 0.1%	0.1%
Psychedelic Wrasse	0.2% - 0.4%	0.6% - 0.8%		0.3% - 0.4%	0.4% - 0.6%

Common Name	No Action Alternative	Pre-Aquarium Collection Ban Alternative	Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative	Limited Permit Issuance (Preferred) Alternative	
				20 Fishers	All fishers (including the 20)
Eightline Wrasse	<0.1%	0.4% - 0.9%		0.3% - 0.7%	0.3% - 0.7%
Crowned Puffer	<0.1%	<0.1%		0.1% - 0.4%	0.1% - 0.4%
Saddle Wrasse	<0.1%	<0.1%		<0.1%	<0.1%
Fisher's Angelfish	<0.1% - 0.2%	0.4% - 0.8%		0.2% - 0.5%	0.2% - 0.6%
Hawaiian Cleaner Wrasse	<0.1% - 0.2%	0.2% - 0.3%		<0.1%	<0.1%
Achilles Tang	0.3% - 0.7%	5.2% - 5.5.%		1.3% - 1.4%	1.5% - 1.6%

[1]Population estimate likely low; actual collection likely below 1% for all alternatives.

5.5.2 Identification of Preferred Alternative

Of the three action alternatives which meet the Applicant's purpose and need, the Limited Permit Issuance Alternative is the Preferred Alternative, as it results in the lowest collection of the 23 species analyzed and includes a bag limit for the Flame Wrasse. In addition, the Preferred Alternative is the only Alternative under consideration which limits the number of permits that would be issued (20 permits).

5.6 EVALUATION OF HEPA SIGNIFICANCE CRITERIA

Below is a summary of the evaluation of the significance criteria described in Title II, Chapter 200, Hawai'i Administrative Rules, with the five criteria where the DLNR requested further analysis shown in bold.

- **Significance Criteria #1:** The Preferred Alternative (i.e., Limited Permit Issuance Alternative) does not involve an irrevocable commitment or loss or destruction of any natural or cultural resource.

  Fish Populations: Collection of the fish species analyzed in this EIS would impact less than 2.5% of the island-wide populations of 20 species. For the 2 remaining species with population estimates available (Yellow Tang and Flame Wrasse), collection is below 25%. However, collection of both these species may potentially be even lower due to uncertainty in the population estimates and is anticipated to be less than 1% of the Flame Wrasse population. While collection of the Yellow Tang may be above 5% of the population, this species displays high fecundity, and collection under the Preferred Alternative is a lower impact compared to the No Action Alternative.

  In addition, the Preferred Alternative has additional benefits over the No Action Alternative, including size limits on the Yellow Tang and bag limits on both the Yellow Tang and Flame Wrasse, as well as other species.

Reef Habitat: Tissot and Hallacher (2003) concluded that there were no significant differences in damaged coral between control and collected sites (i.e., sites where aquarium collection occurs) to indicate the presence of destructive fishing practices. In addition, they found no increases in the abundance of macroalgae where the abundance of herbivores was reduced by aquarium collecting. Fifteen years of data collected and analyzed by the DAR (2018c) also showed no significant direct impacts to reef habitat due to commercial aquarium fishing. Several bag limits and/or size limits on herbivorous fish species would also be in place under the Preferred Alternative. Therefore, it is not anticipated that a significant impact on reef habitat as a result of the Preferred Alternative would occur.

Cultural Resources: As concluded in the CIA, cultural impacts would occur if issuance of Aquarium Permits under an alternative would cause a significant decline in the population of a fish species considered to be a cultural resource, either directly through the collection of fish or indirectly through habitat impacts. Table 4-4 lists the top 20 collected fish species, and Section 4.4 includes a brief summary of known cultural significance by species for these 20 species, 3 additional regulated species, and 1 additional SGCN species that has been collected on O'ahu. While not all species have a known Hawaiian cultural significance, for this analysis, it was assumed that the 19 species identified as having a cultural use for food, medicinal, religious or ceremonial purposes could have a cultural impact if populations of those species were impacted. As detailed in Section 5.4, populations of the fish species analyzed in this EIS are not anticipated to significantly decline under the Preferred Alternative. Therefore, it is not anticipated that a significant impact on cultural resources would occur as a result of the Preferred Alternative.

Other Resources: Aside from reducing the number of Aquarium Permits issued, implementing a daily bag limit for Flame Wrasse, and expanding the Waikiki MLCD (which would only apply to commercial aquarium collectors), the Preferred Alterative does not include any activities different from, or in addition to, those that have occurred in the past. There would be no construction of permanent or semi-permanent infrastructure, no discharges into coastal, surface or ground waters, and no dredging, and no significant use of hazardous materials that could be released into the environment. The Preferred Alternative would not result in significant beneficial or adverse impacts to water and air quality, geology and soil resources, aesthetics, noise, vegetation, terrestrial wildlife, and avian species, threatened and endangered species, land use, public health and safety, communications, transportation, utilities, or population and demographics from the current baseline condition.

- **Significance Criteria #2:** The Preferred Alternative does not curtail the range of beneficial uses of the environment. Act 306 has created a platform on which the public can learn about and participate in the management of the fishery. Since the Act's implementation, the DAR has created FRAs in the state and conducts annual monitoring and research on the fish and coral, ensuring that the full range of beneficial uses of the environment remain now and into the future.

Aquatic Invasive Algae Control: Tissot and Hallacher (2003) found no increases in the abundance of macroalgae where the abundance of herbivores was reduced by aquarium collecting. The pressures from commercial aquarium collection under the Preferred Alternative are anticipated to be lower than rates seen prior to the October 2017 ban on commercial aquarium collection using fine mesh nets; therefore, it is not anticipated that a significant impact on aquatic invasive algae control as a result of the Preferred Alternative would occur.

Tourism: Available data do not suggest that the commercial aquarium collection has impacted the tourism industry in Hawai'i or on O'ahu. The Hawai'i tourism industry achieved new records in total visitor spending and visitor arrivals in 2017, marking the sixth consecutive year of record growth in both categories. Total spending by visitors to the Hawaiian Islands increased 5.6% to a new high of $16.81 billion (HTA 2018). When adjusted for inflation, total visitor spending was up 3.5% from 2016. A total of 9,404,346 visitors came by air or by cruise ship to the state, up 5.3% from the previous record of 8,934,277 visitors in 2016. Total visitor days rose 4.8% compared to 2016. The average spending per day by these visitors ($198 per person) was also higher than 2016 ($197 per person; HTA 2018). Additionally, as described in Section 5.4, populations of fish species collected by commercial aquarium collectors are not anticipated to significantly decline, therefore not significantly impacting viewing opportunities. Consequently, continued commercial aquarium collection under the Preferred Alternative, which would limit the number of Aquarium Permits and decrease collection, is not anticipated to significantly impact tourism.

Integrity of Diverse Aquatic Ecosystems: As described in Section 5.4, populations of the 23 fish species analyzed in this EIS are not anticipated to significantly decline. Additionally, Tissot and Hallacher (2003) concluded that there were no significant differences in damaged coral between control and collected sites (i.e., sites where aquarium collection occurs) to indicate the presence of destructive fishing practices. Tissot and Hallacher (2003) further found no increases in the abundance of macroalgae where the abundance of herbivores was reduced by aquarium collecting. Fifteen years of data collected and analyzed by the DAR (2018c) also showed no significant direct impacts to reef habitat due to commercial aquarium fishing. The pressures from commercial aquarium collection under the Preferred Alternative are anticipated to be lower than rates seen prior to the October 2017 ban on commercial aquarium collection using fine mesh nets; therefore, it is not anticipated that a significant impact on the integrity of diverse aquatic ecosystems as a result of the Preferred Alternative would occur.

- **Significance Criteria #3:** The Preferred Alternative does not conflict with the State's long-term environmental policies, goals, or guidelines as expressed in chapter 344 HRS. As described in Section 5.4, populations of the 23 fish species analyzed in this EIS are not anticipated to significantly decline under the Preferred Alternative and impacts to coral reefs or herbivores are not anticipated, therefore the Preferred Alternative is not in conflict with the conservation of natural resources or the flora and fauna. There would be a minor, beneficial impact to the economy under the Preferred Alternative. There would be no impact on human population, threatened and endangered species, parks, recreation, and open spaces, transportation, energy use, community life and housing, or education and culture. As described in Section 1.1.2, citizen participation has occurred, including public comment periods during the DEA and FEA (see Section 1.1.2), and as part of this DEIS.

- **Significance Criteria #4:** The Preferred Alternative does not substantially affect the economic welfare, social welfare, and cultural practices of the community or State, but plays an important role as a nearshore fishery in the state. According to DAR (2019a), the marine aquarium fishery is the most economically valuable commercial inshore fishery in the State of Hawai'i. Under the Preferred Alternative, it is anticipated that $2.1 to $3.2 million would be added to the state's economy over the 5-year analysis period (average of $422,612 to $642,225 per year), and a minimum of 14 jobs would be created. Loss of the fishery would result in the loss of income, tax revenue, and jobs.

  Cultural Practices: As concluded in the CIA, cultural impacts would occur if issuance of Aquarium Permits under an alternative would cause a significant decline in the population of a fish species considered to be a cultural resource, either directly through the collection of fish or indirectly through habitat impacts. Section 4.4 includes a brief summary of known cultural significance by species. While not all species have a known Hawaiian cultural significance, for this analysis, it was assumed that the species identified as having a cultural use for food, medicinal, religious or ceremonial purposes could have a cultural impact if populations of those species were impacted. As detailed in Section 5.4, populations of the 23 species analyzed in this EIS are not anticipated to significantly decline under the Preferred Alternative. Therefore, it is not anticipated that a significant impact on cultural practices would occur as a result of the Preferred Alternative.

- Significance Criteria #5: The Preferred Alternative would not affect public health.

- Significance Criteria #6: The Preferred Alternative does not involve substantial secondary impacts, such as population changes or effects on public facilities. There is no expectation that populations or the public would be negatively impacted by continuing the fishery.

- Significance Criteria #7: The Preferred Alternative does not involve a substantial degradation of environmental quality. Two studies have concluded that the fishery has no significant impact on coral or the reef ecosystem (Tissot and Hallacher 2003; DAR 2019a).

- **Significance Criteria #8:** The Preferred Alternative does not involve a commitment for larger actions. When the full range of impacts to the fish species analyzed in this EIS are considered (e.g., recreational aquarium collection, non-aquarium commercial fishing, recreational fishing, tourism, climate change), there may be a significant cumulative impact to some species. However, the Preferred Alternative is not a significant contributor to the cumulative effect upon the environment.

- Significance Criteria #9: The Preferred Alternative does not affect threatened or endangered species or their habitats nor does it have a significant impact on rare species.

- Significance Criteria #10: The Preferred Alternative does not detrimentally affect air or water quality or ambient noise levels. At most, 20 boats would be involved in the island of O'ahu's aquarium fishery under the Preferred Alternative as compared to the thousands of other boats on the waters of Hawai'i.
- Significance Criteria #11: The Preferred Alternative would not significantly affect or suffer damage by being located in environmentally sensitive areas, geologically hazardous land, estuaries, freshwater, or coastal water. As noted earlier, the fishery has been active since the late 1940s. Regulations have been implemented restricting the fishery from sensitive areas.
- Significance Criteria #12: The Preferred Alternative does not substantially affect scenic vistas and viewplanes identified in county or state plans or studies.
- Significance Criteria #13: The Preferred Alternative does not require substantial energy consumption.

No significant adverse effects would occur as a result of the Preferred Alternative. Therefore, mitigation for impacts is not warranted and no mitigation measures would be implemented. Nevertheless, the Preferred Alternative includes mitigative measures (see Section 5.0) such as a reduction in the number of Aquarium Permits that would be issued, expanding the Waikiki MLCD, and reducing the bag limit for the Aflame Wrasse, all of which would minimize impacts to biological resources.

Under HRS 188-31, the DLNR may issue a commercial Aquarium Permit to a qualified party for a period of one year in duration, subject to renewal. Therefore, this DEIS analyzes the direct, indirect, and cumulative impacts of issuance of 20 Aquarium Permits on affected resources for a period of five years. Less than significant or slightly beneficial impacts are expected under the Preferred Alternative.

6.0 AGENCIES, ORGANIZATIONS, AND INDIVIDUALS CONSULTED

See the FEA for a list of agencies, organizations, and individuals consulted during development of the FEA, which was used as the basis for development of this DEIS.

6.1 CONSULTED PARTIES

The following individuals requested to be a Consulted Party during development of the DEIS:

- Keith Dane, Hawai'i Policy Advisor, The Humane Society of the United States
- Rene Umberger, Executive Director, For the Fishes
- Laura Friend, Litigation Fellow, The Humane Society of the United States
- Miyoko Sakashita, Oceans Director, Center for Biological Diversity
- Mike Nakachi, President, Moana Ohana

- Teresa E. Kaneakua, ʻAho Hui Kiaʻi Kānāwai Lead Compliance Specialist, Office of Hawaiian Affairs
- Inga Gibson, Policy Director, Pono Advocacy, LLC
- Kealoha Pisciotta, Mauna Kea Anaina Hou and Kai Palaoa

Each of these individuals was contacted on September 16, 2019 via email and/or mail, seeking advice and input for DEIS development. The Applicant requested any information or advice concerning the fishery and other potentially impacted environmental, cultural, or other resources. Consulted Parties were asked to respond within 30 days. Comments received and responses to those comments are provided in Appendix C. The consultation process for cultural resources is described in depth in Section 4 of Appendix A.

6.2 FEDERAL AGENCIES

The following federal agencies were consulted during the development of this DEIS

- National Marine Fisheries Service
- Coral Reef Ecosystem Program

6.3 STATE AGENCIES

The following state agencies were consulted during the development of this DEIS

- Hawai'i Department of Land and Natural Resources, Division of Aquatic Resources
- Hawai'i State Department of Health, Office of Environmental Quality Control

7.0 DRAFT EA PUBLIC REVIEW

The distribution list for the DEIS is included in Appendix D.

8.0 LIST OF PREPARERS

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APPENDIX A

Cultural Impact Assessment

A Cultural Impact Assessment for the Proposed Issuance of Twenty Commercial Aquarium Permits for the Island of O‘ahu

‘Ewa District and Portions of Waialua, Wai‘anae, Honolulu (Kona) Ko‘olauloa, and Ko‘olaupoko Districts
Island of O‘ahu

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A Cultural Impact Assessment for the Proposed Issuance of Twenty Commercial Aquarium Permits for the Island of O‘ahu

‘Ewa District and Portions of Waialua, Wai‘anae, Honolulu (Kona),
Ko‘olauloa, and Ko‘olaupoko Districts
Island of O‘ahu

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CHAPTERS

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1. INTRODUCTION

At the request of K & L Gates, LLP, on behalf of the Pet Industry Joint Advisory Council (PIJAC; the applicant), ASM Affiliates (ASM) has prepared this Cultural Impact Assessment (CIA) to supplement a Hawai‘i Revised Statutes (HRS) Chapter 343 Environmental Impact Statement (EIS) being prepared for the proposed issuance of twenty annual commercial aquarium permits. These permits would allow for the collection of fish species using fine mesh nets or traps from select locations around the Island of O‘ahu. The current study area comprises the intended aquarium fish collection areas, which includes the nearshore waters and up to three nautical miles as measured from the shoreline of the island of O‘ahu, except for previously designated Marine Managed Areas (MMAs), which are currently managed by the Department of Aquatic Resources (DAR). The MMAs, which are no-collection areas include three Marine Life Conservation Districts (MLCDs): Pūpūkea, Hanauma Bay, and Waikīkī; a Fisheries Management Area (FMA): Waikīkī-Diamond Head Shoreline; Paikō Lagoon Wildlife Sanctuary and Coconut Island – Hawai‘i Marine Laboratory Refuge; Waikīkī-Diamond Head Shoreline FMA; and the regulated fishing areas of Honolulu Harbor, He‘eia Kea Wharf, Waialua Bay (Hale‘iwa Harbor), and Pōka‘ī Bay (Figure 1). In addition to the marine managed exclusion areas listed above, aquarium collecting will also be prohibited in four additional areas, currently designated as Fish Report Collection Areas (FRCAs) 405 and 406 that encompass nearly all the nearshore region of the Ko‘olauloa District and FRCA 408 and 418, which comprise the southern reaches of the Ko‘olaupoko District (see Figure 1). Per the draft EIS for this project, the proposed action (and preferred alternative) reads as follows:

> **Alternative 3:** Expanded Waikiki MLCD and Flame Wrasse Conservation Alternative (Proposed Action and Preferred Alternative) - Programmatic Issuance of Aquarium Permits for the Island of O‘ahu with Additional Conservation Measures Expanding the Waikiki MLCD and Limiting Flame Wrasse Catch for the O‘ahu fishery.
>
> > The DLNR would issue Aquarium Permits for the island of O‘ahu under existing regulation set forth in HRS 188-31 (Section 1.2.1). These rules and regulations include restrictions on equipment, restrictions on access to various areas, bag limits on various collected fish species, and reporting requirements.
> >
> > The Waikiki MLCD would be expanded northward to the southern tip of DAR’s Honolulu Harbor Kapalama Canal Fish Management Area (Figure 2). Within the expanded Waikiki MLCD, no commercial aquarium fish collection would occur; however, no restrictions would be placed upon other fisheries (e.g., commercial, recreational).
> >
> > A daily bag limit for Flame Wrasse would be implemented, limiting collection of Flame Wrasse to a 10 per day daily bag limit. (PIJAC 2018:15)
>
> The Preferred Alternative is based on the best available science, supports the DLNR’s purpose to ensure Applicant’s Actions do not lead to degradation of fish populations and the habitats in which they occur in the context of commercial aquarium collection, and supports the Applicant’s purpose and need to continue fishers’ livelihoods participating in the lawful, responsible, and sustainable commercial collection of various fish species from nearshore habitats. (PIJAC 2018:15)

The current document has been prepared in accordance with the Office of Environmental Quality Control (OEQC) *Guidelines for Assessing* Cultural *Impacts*, adopted by the Environmental Council, State of Hawai‘i, on November 19, 1997 (Office of Environmental Quality Control [OEQC] 1997) to assess the potential cultural impacts of the proposed action (the issuance of twenty commercial aquarium permits) on historic and traditional cultural properties and practices. This CIA is divided into five main sections, which include: 1) an introduction of the proposed action; 2) a description of the general geographic context of the study area; 3) a culture-historical background for the nearshore waters of the Island of O‘ahu that includes a discussion of the traditional Hawaiian cultural significance of the Top 20 Collected Aquarium Fish Species on O‘ahu; 4) the methods and results of the consultation process regarding ongoing and former traditional cultural practices and/or resources associated with the Top 20 Collected Aquarium Fish Species, and the proposed action’s potential impacts; and 5) an analysis of potential cultural impacts that may result from the proposed action. The document concludes with recommendations for appropriate mitigation strategies that may be employed by the applicant and DLNR to help minimize the potential for cultural impacts that could result from the proposed action.

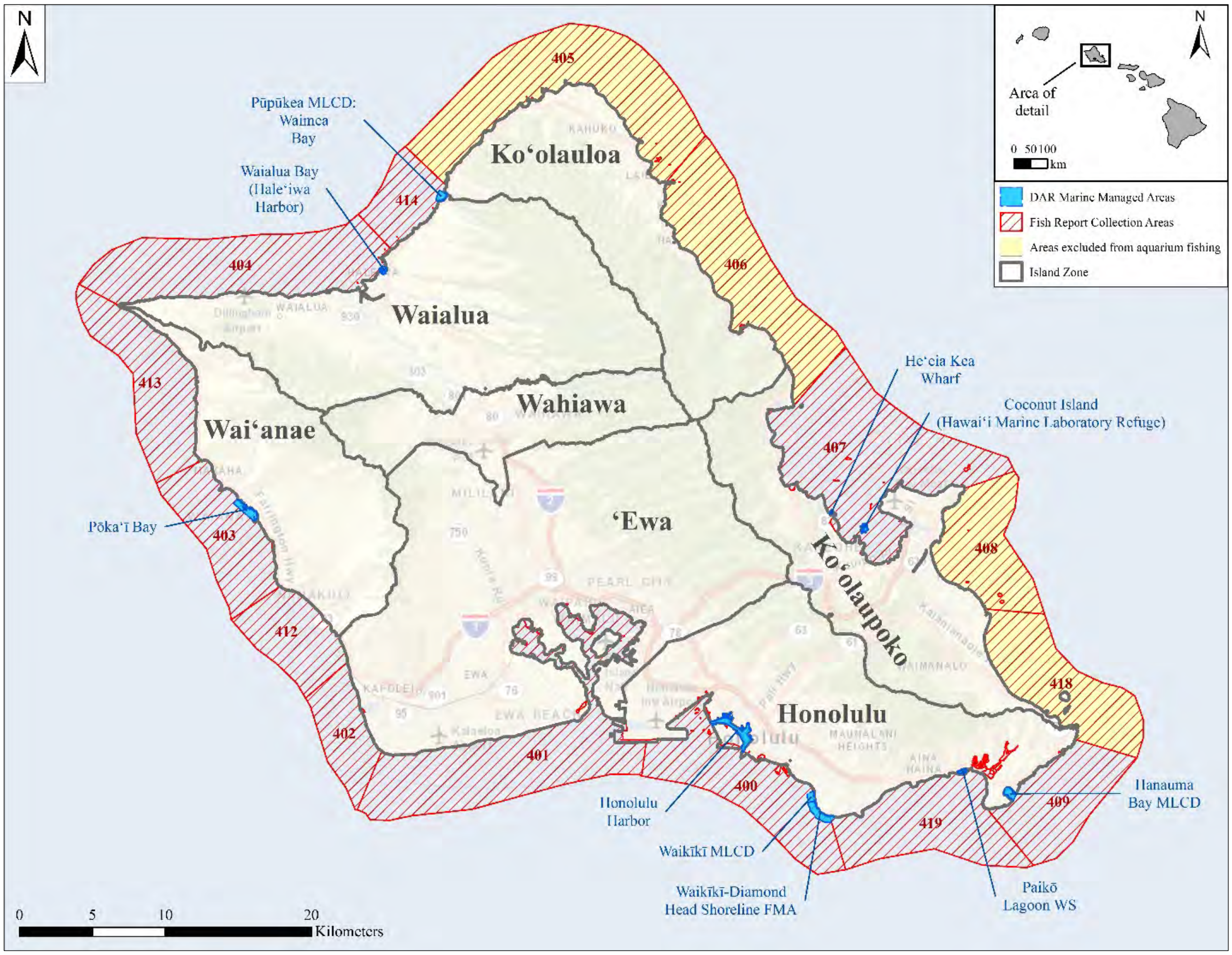


Figure 1. Study area location plotted on ESRI StreetMap World 2D map of O'ahu.

A BRIEF HISTORY OF AQUARIUM FISHING AND RELEVANT REGULATORY AND MARINE CONSERVATION MEASURES IN HAWAI'I

Commercial aquarium fishers have been engaged in aquarium fish collection under permits for over sixty years. The earliest known collection of marine species for aquarium purposes was linked to the establishment of the Honolulu Aquarium in Waikīkī, which opened in 1904 and showcased various marine species that had been collected by local fishermen (University of Hawai'i n.d.; Wiegel 2008). By the 1940s the collection of reef fish and other marine species to be used in aquariums had developed into a commercial fishery. Aquarium collection began with rudimentary equipment and breath-hold diving techniques in the nearshore waters off the leeward coast of O'ahu (Walsh et al. 2004). After World War II, the use of SCUBA gear and synthetic nets "increased the efficiency of [aquarium]collecting" (Walsh et al. 2004:130). In 1953, Act 154 was enacted by the territorial government of Hawai'i, "which authorized the Board of Agriculture and Forestry to establish a permit system for the use of fine-mesh nets and traps for the taking of aquarium fish" (Walsh et al. 2004:130). Soon after, HRS §188-31 (Permits to take aquatic life for aquarium purposes) went into effect:

> (a) Except as prohibited by law, the department, upon receipt of a written application, may issue an aquarium fish permit, not longer than one year in duration, to use fine meshed traps, or fine meshed nets other than throw nets, for the taking of marine or freshwater nongame fish and other aquatic life for aquarium purposes.
>
> (b) Except as prohibited by law, the permits shall be issued only to persons who can satisfy the department that they possess facilities to and can maintain fish and other aquatic life alive and in reasonable health.

(c) It shall be illegal to sell or offer for sale any fish and other aquatic life taken under an aquarium fish permit unless those fish and other aquatic life are sold alive for aquarium purposes.

Per Walsh et al. (2004), the early success of the aquarium fishing industry stalled due to limitations in air shipping; however, in 1959 the introduction of the commercial airline flights expedited the shipping of aquarium fish to buyers on the U.S. mainland. A decade later, the number of Aquarium Permit holders increased, including non-commercial fishers who collected for their own aquaria (Walsh et al. 2004). After 1971, the number of commercial aquarium collectors sharply increased; and by 1973, commercial aquarium collecting on Oʻahu was well established and had become a controversial issue (Calado et al. 2017; Walsh et al. 2004). As a result of growing public concern regarding the aquarium fishery, the Division of Fish and Game (DFG; the antecedent of DAR) placed a moratorium on aquarium collecting and suspended the issuance of aquarium permits (Walsh et al. 2004). In September 1973, DFG met with marine scientists who recommended the establishment of marine sanctuaries and prohibited areas for collection (Walsh 1999). According to Walsh et al. (2004), after the 1973 moratorium was lifted, commercial aquarium collectors were required to report their monthly catches on a detailed form. In 1989, the aforementioned aquarium permit statute (HRS §188-31) was amended to require DLNR to "monitor the aquarium fish catch report and fish dealer's report for export of aquarium fish" and report "a monthly count of the quantities taken of each individual species of aquarium fish exported" to the Board of Land and Natural Resources (HRS §188-31.5). DAR reported annual summaries of catch reports until 1994; since then, catch report summaries have included up to five-years of catch data ((2004:131).

In August 2011, Oʻahu commercial aquarium fishers developed a rule proposal for the management of the Oʻahu aquarium fishery, which they presented to DAR. Subsequently, in December 2012, a public hearing was held regarding the proposed measure and HAR §13-77 was adopted in October 2014 (PIJAC 2018). This regulation is applicable to the collection of aquatic life for aquarium purposes from the nearshore waters of Oʻahu, within three nautical miles from the shore. Methods under regulation include the use of fine or small mesh traps and nets, and exclude throw nets. HAR§13-77 is intended to prevent the use of nets to harvest aquatic life for food, bait, or other consumptive purposes, and the section covering Oahu prohibited activities (HAR§13-77-6) reads as follows:

(a) Notwithstanding the provisions of chapter 13-75, it is unlawful for any person in or on the waters of Oahu, possessing a small mesh net authorized under a commercial aquarium fish permit or recreational aquarium fish permit, to possess a small mesh net that is:

(1) More than thirty (30) feet long; provided that two or more permittees may join two nets, each no more than thirty (30) feet long, for a total net length of no more than sixty (60) feet long; or

(2) More than six (6) feet in height.

(3) These restrictions regarding net length and height in subsection (a) shall take effect after July 1, 2015.

(b) It is unlawful for any person, while possessing, using, or having used a small mesh net authorized under a commercial aquarium fish permit and in or on the waters of Oahu, to possess a small mesh net and take or possess a daily bag limit of more than:

(1) One hundred (100) Yellow Tang;

(2) Seventy-five (75) Kole;

(3) Fifty (50) Potter's angel;

(4) Fifty (50) naso tang;

(5) Twenty-five (25) moorish idol; or

(6) Ten (10) achilles tang.

A daily bag limit includes the cumulative number of regulated aquatic life taken or possessed by a person on any day.

(c) It is unlawful for any person while possessing, using, or having used a small mesh net authorized under a commercial aquarium fish permit and in or on the waters of Oahu, to possess a small mesh net and to take or possess more than six (6) of any of the following per day:

(1) Yellow Tang less than one and one-half (1.5) inches in length;

(2) Yellow Tang more than five (5) inches in length;

(3) Kole more than five (5) inches in length; or

(4) Cleaner Wrasse of any size.

(d) It is unlawful for any person while possessing, using, or having used a small mesh net authorized under a commercial aquarium fish permit and in or on the waters of Oahu, to take or possess more than two (2) bandit angelfish that are longer than five and a half (5.5) inches in length, per day.

(e) It is unlawful for any person while possessing, using, or having used a small mesh net authorized under a commercial aquarium fish permit, to operate a vessel on the waters of Oʻahu with:

(1) More than the daily bag limits as provided in subsections (b), (c), and (d) for the number of permittees on board the vessel; or

(2) More than three times the number of any daily bag limit, regardless of the number of permittees on board.

(f) It is unlawful for any person, while possessing a small mesh net authorized under a commercial aquarium fishing permit or recreational aquarium fish permit while in or on the waters of Oahu, to take or possess any of the following species:

(1) Ornate butterflyfish;

(2) Oval butterflyfish; and

(3) Reticulated butterflyfish.

In addition to limited amounts of aquarium fish collection, Hawaiʻi State law prohibits breaking or damaging coral with any implement. This includes if any marine life is attached to the coral. According to HRS§171-58.5 and §205A-44, the taking of sand, coral rubble, and other marine deposits are permitted depending on the circumstances; however, the material cannot exceed one gallon per person per day.

In 2012, Earthjustice filed a complaint in the First Circuit Court on behalf of four individuals and three non-governmental organizations seeking a court order to force the State of Hawaiʻi to comply with the Hawaiʻi Environmental Policy Act (HEPA) to examine how commercial aquarium collection affects the environment. The complaint made a formal request to halt aquarium collection under the then-existing commercial aquarium permits and for DLNR to stop issuing new permits until the environmental review process is complete (Earthjustice 2012; PIJAC 2018)Pet Industry Joint Advisory Council 2018). Regardless, as a result of subsequent litigation, the issuance of permits continued until late 2017, at which time "the Supreme Court of Hawaiʻi ruled that aquarium collection using fine meshed traps or nets is subject to the environmental review procedures provided in HEPA" (FEA:2). Based on the Supreme Court ruling, the circuit court ruled on October 27, 2017, that existing permits for aquarium fish collection using fine mesh nets were invalid and illegal, and as a result, DLNR discontinued the renewal of existing permits and the issuance of new Aquarium Permits since that time (DAR 2018; PIJAC 2018).

Between 2000 and 2017, DLNR issued a minimum of 66 to a maximum of 126 commercial aquarium permits annually, and aquarium fishers collected approximately 238 fish species (1,295,700 individual fish) under said permits in Oʻahu's nearshore waters. Some of the over 200 species were reported as a general group (e.g. squirrelfishes, wrasses, etc.) rather than as separate species due to the DAR confidentiality statute that does not publicly release "any catch data when less than three collectors report from an individual collection zone" (PIJAC 2018:30-31, 50-51). In addition to the regulatory measures outlined above, the establishment of Marine Managed Areas, discussed below, has contributed to the conservation of marine resources by regulating the types of activities conducted within those areas.

Marine Managed Areas

According to the State of Hawaiʻi DAR's website, Marine Managed Areas (MMAs) "are specific geographic areas designated by statute or administrative rule for the purpose of managing a variety of marine, estuarine, or anchialine resources and their use" (DLNR/DAR 2005). Beginning in the 1930s, federal, state, and local governments across the United States started to establish Marine Protected Areas (MPAs), a subset of MMAs (National Research Council 2001). Per the National Oceanic and Atmospheric Administration (NOAA) website, MPAs "encompass a variety of conservation and management methods in the United States" and "span a range of habitats, including the open ocean, coastal areas inter-tidal zones, estuaries, and the Great Lakes" (National Oceanic and Atmospheric Administration 2018). As MPAs are diverse, restrictions within MPAs also vary. For instance, according to DAR's publication titled *Marine Protected Areas in Hawaiʻi*, the primary goal of a Marine Reserve MPA is preservation and as such, fishing and commercial uses are heavily restricted (DLNR/DAR 2005); while the primary goal of a Marine Life Conservation District (MLCD) MPA is conservation and multiple uses—thus, MLCDs often allow fishing restricted by permit. Please refer to Table 1 below for further information. Of relevance to the current study are the DAR MMAs where aquarium collection is not permitted: Pūpūkea MLCD, Hanauma Bay MLCD, and Waikīkī MLCD; Paikō Lagoon Wildlife Sanctuary and Coconut Island – Hawaiʻi Marine Laboratory Refuge; Waikīkī-Diamond Head Shoreline FMA; and the regulated fishing areas of Honolulu Harbor, Heʻeia Kea Wharf, Waialua Bay (Haleʻiwa Harbor), and Pōkaʻi Bay. As aquarium collection is prohibited within these areas, the commercial aquarium fishery has had to rely on collection sites beyond these protected areas.

Table 1. Objectives and management strategies for FMA and MLCD (DLNR/DAR 2005:15).

Category	*Primary Goals*	*Conservation Objectives*	*Use Management & Objectives*
Fishery Management Area (FMA)	Resource Allocation/ Fishing	Sustain aquatic resources for fishing, reduce habitat damage from fishing and manage over-fishing where it occurs	Resolve fishing conflicts, allocate resources by gear type/group, recreation/subsistence fishing allowed, some non-consumptive recreation allowed and regulate commercial uses
Marine Refuge	Conservation	Protect unique habitats, conserve examples of valuable ecosystems, restore/conserve biodiversity, restore natural communities and avoid human impacts	Biological reference site for science, boats/anchoring may be restricted, all public access may require permit, extractive use/fishing extremely limited and commercial uses restricted
Marine Life Conservation District (MLCD)	Conservation/ Multiple Use	Restore populations to high levels, restore and conserve biodiversity, minimize human impacts and minimize impacts to protected species	Boats/anchoring may be restricted, no fish feeding or alteration of habitat, regulate commercial uses by permit to avoid impacts to resources or to public uses of resources, low-impact fisheries by registration, some recreational use allowed

THE PROPOSED ACTION

The objective of the proposed action is to create a program under the Department of Land and Natural Resources (DLNR) (the approving agency) that will facilitate the process for the issuance of commercial aquarium permits on the island of Oʻahu (pursuant to Aquarium Fishing Permits issued under HRS §188-31). As such, aquarium fishers will be able to continue to operate their businesses in compliance with all the applicable State of Hawaiʻi laws, rules, and regulations pertaining to the industry outlined above.

As previously mentioned, because of a Supreme Court ruling in October 2017, DLNR has not renewed existing permits or issued new permits for aquarium collection using fine meshed traps or nets since September 2017 (PIJAC 2018). As a result, a Final Environmental Assessment (FEA) for the issuance of commercial aquarium permits for the Island of Oʻahu permits was prepared (by the current applicant, PIJAC) and submitted to the DLNR for review on July 26, 2018. The preferred alternative put forth in the FEA included the following conservation measures:

> Under the Expanded Waikiki MLCD and Flame Wrasse Conservation (Preferred) Alternative, the DLNR would begin issuing new Aquarium Permits, thereby allowing commercial aquarium fish collection on the island of O'ahu to resume. Permittees would abide by all existing rules and regulations set forth in HRS188-31 (Section 1.2.1), governing Commercial Aquarium Permit use. For the island of Oʻahu, these rules and regulations include restrictions on equipment, restrictions on access to various areas, bag limits on various collected fish species, and reporting requirements (Section 1.2.3).
>
> In addition to the existing rules and regulations, a conservation measure in the Preferred Alternative would expand the Waikiki MLCD northward to the southern tip of DAR's Honolulu Harbor Kapalama Canal Fish Management Area. The current Waikiki MLCD covers approximately 77.3 acres (31.3 hectares). The area proposed in the Preferred Alternative expands this MLCD by 740 acres (299.5 hectares) to 817.3 acres, more than 10.5 times the size of the current Waikiki MLCD. In addition, the current Waikiki MLCD is bordered to its south by the Waikiki-Diamond Head Shoreline Fisheries Management Area (WDHSFMA) covering approximately 239 acres (96.7 hectares). The WDHSFMA is open to fishing (with restrictions) in even numbered years only.

> Within the expanded Waikiki MLCD, no commercial aquarium fish collection would occur; however, no restrictions would be placed upon other fisheries (e.g., commercial, recreational).
>
> An additional conservation measure in the Preferred Alternative would limit the commercial aquarium collection of Flame Wrasse to 10 individual fish per day. (PIJAC 2018:13 and 15)

The FEA proposed a Finding of No Significant Impact (FONSI) for the issuance of commercial aquarium permits for the Island of Oʻahu. However, in July of 2018, DLNR did not concur with that finding and determined that the project could have a significant impact on the environment, and therefore required the preparation of an Environmental Impact Statement (EIS) (PIJAC 2018). In her review letter, Suzanne Case, Chair of the DLNR, specifically requested that the EIS include further analysis of several significance criteria under HAR § 11-200-12. Specifically, the take of aquarium fish as an irrevocable commitment to loss or destruction of natural or cultural resources, and the impact of the take of aquarium fish on cultural practices in the state. Regarding the assessment of potential cultural impacts of the proposed action, Case stated,

> Cultural impacts of aquarium fishing need significantly more analysis than provided in the FEA. The OEQC guidelines should be followed for assessing cultural impacts, including consulting with traditional cultural practitioners and other knowledgeable informants and sources about cultural resources, cultural practices, and the proposed action's potential impacts. Traditional Hawaiian practices and subsistence uses, local place-based and life-cycle knowledge, and traditional Hawaiian cultural significance of each type of aquarium fish taken should be reviewed. The indirect impact of modern technologies for highly efficient catch methods on traditional harvest capabilities should be included in the analysis. (DLNR Letter dated July 26, 2018)

To address the comments and concerns raised by Ms. Case and to meet the requirements of HRS Chapter 343 with respect to assessing the potential cultural impacts that may result from the proposed action, the current document was prepared following the OEQC *Guidelines for Assessing Cultural Impacts* (adopted by the Environmental Council, State of Hawaiʻi, November 19, 1997). According to those guidelines:

> In scoping the cultural portion of an environmental assessment, the geographical extent of the inquiry should, in most instances, be greater than the area over which the proposed action will take place. This is to ensure that cultural practices which may not occur within the boundaries of the project area, but which may nonetheless be affected, are included in the assessment. (OEQC 1997:11)

As stated in Act 50, passed as Hawaiʻi State House of Representatives Bill No. 2895 and signed into law by the Governor on April 26, 2000, "environmental assessments or environmental impact statements should identify and address effects on Hawaiʻi's host culture, and traditional and customary rights" (State of Hawaiʻi 2011). Furthermore,

> . . . native Hawaiian culture plays a vital role in preserving and advancing the unique quality of life and the "aloha spirit" in Hawaiʻi. Articles IX and XII of the state constitution, other state laws, and the courts of the State impose on governmental agencies a duty to promote and protect cultural beliefs, practices, and resources of native Hawaiians as well as other ethnic groups.
>
> Moreover, the past failure to require native Hawaiian cultural impact assessments has resulted in the loss and destruction of many important cultural resources and has interfered with the exercise of native Hawaiian culture. The legislature further finds that due consideration of the effects of human activities on native Hawaiian culture and the exercise thereof is necessary to ensure the continued existence, development, and exercise of native Hawaiian culture. (State of Hawaiʻi 2011)

It is the need to identify and address the effects of the proposed action (the issuance of 20 commercial aquarium permits for the island of Oʻahu) on Hawaiʻi's native culture, and traditional and customary rights, that has necessitated the preparation of this CIA. While the action proposed in the current EIS differs somewhat from the action previously proposed in the FEA—limiting the geographic extent for the issuance of permits to select locations around the island of Oʻahu (rather than the entire Island of Oʻahu) and capping the total number of annual commercial aquarium permits issued at twenty—the additional analysis requested above by the DLNR has been used to guide the scope of work presented in this CIA.

2. STUDY AREA DESCRIPTION

The current study area consists of roughly 79 percent of the Oʻahu coastline and begins at the nearshore waters and extends into the open ocean for three nautical miles but excludes all marine managed areas (Figure 2). As depicted in Figure 2 below, the study area includes all of the nearshore waters of the *moku* (district) of ʻEwa (FRCAs 412, 402, and 401), Waialua (FRCAs 404 and 414), Waiʻanae (FRCAs 413, 403, and 412), Honolulu/Kona (FRCAs 401, 400, 419, and 409), as well as much of northern Koʻolaupoko (the area west of Mōkapu Peninsula; FRCA 407). The remaining 21 percent of the coastline where aquarium collecting will be prohibited and is not included in this study includes southern Koʻolaupoko, extending from the southeastern coastline of Mōkapu Peninsula to Makapuʻu (FRCAs 408 and 418), and the majority of Koʻolauloa District (FRCAs 405 and 406). However, a small portion of the nearshore waters located in Pūpūkea Ahupuaʻa at the westernmost end of Koʻolauloa is included within FRCA 414 and is thus included in the current study area. Also excluded from the current study area are roughly 5 square kilometers of nearshore waters that comprise the aforementioned DAR Marine Managed Areas: Waialua Bay (Haleʻiwa Harbor); Pūpūkea MLCD – Waimea Bay; Heʻeia Kea Wharf; Coconut Island Hawaiʻi Marine Laboratory Refuge; Hanauma Bay MLCD; Paikō Lagoon Wildlife Sanctuary; Waikīkī-Diamond Head Shoreline Fisheries Management Area; Waikīkī MLCD; Honolulu Harbor; and Pōkaʻī Bay (see Figure 1). For the purposes of this study and to better understand the broad geographical range, the study area is divided into four quadrants, all of which are futher described in the ensuing paragraphs.

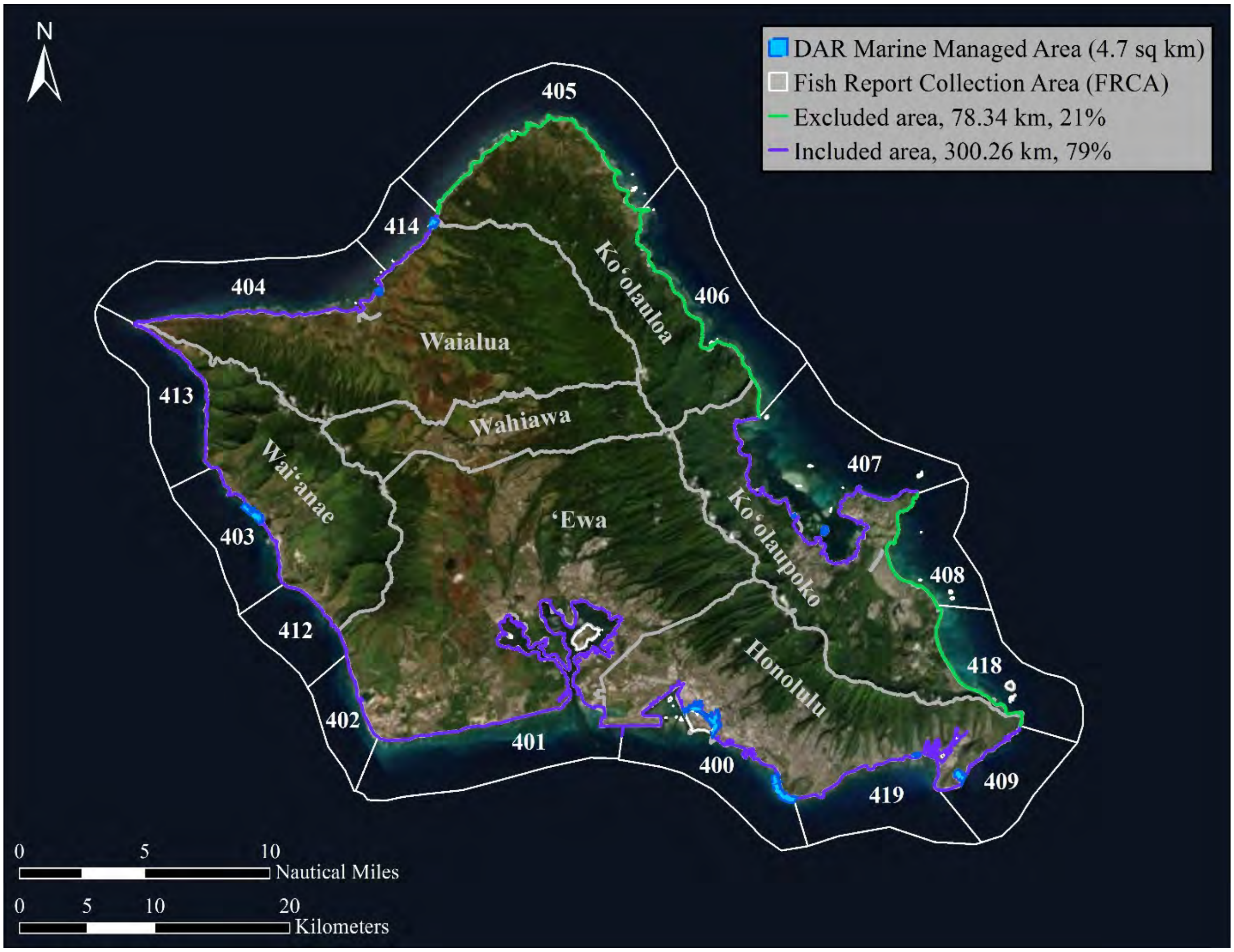


Figure 2. Overview of the study area depicting those portions of that are included and excluded from the proposed action plotted on a Hillshade Surface map.

THE NORTHWEST PORTION OF THE STUDY AREA

The northwest portion of the study area is within the traditional *moku* of Waialua and the northern portion of Waiʻanae (Figure 3). Waialua includes (from west to east) the traditional *ahupuaʻa* (land division) of Kaʻena, Keālia, Kawaihapai, Kikahi, Aukuʻu, Mokulēʻia 2, Mokulēʻia 1, Kamananui, Paʻalaʻa, Kawailoa, Lauhulu, Kuikuioloa, Punanue, Kapaeloa, and Waimea. The area from Kaʻena to Kamananui extends along the northern slopes of the Waiʻanae Mountain Range, while the area from Paʻalaʻa to Waimea encompasses the leeward portions of the Koʻolau Mountain Range (Figure 4). There are three prominent bays within this portion of the study area: Kaiaka, Waialua, and Waimea. Kaika Bay is fed by Helemano and Poamoho streams, both of which flows through Kamananui Ahupuaʻa. Waialua Bay is fed by the Anahulu River, which extends through Paʻalaʻa Ahupuaʻa (Figure 5). Polipoli and Makaleha streams meander through Kawaihapai Ahupuaʻa. Commercial aquarium collection is currently and will remain prohibited under the proposed action at Waialua Bay, Waimea Bay, and Pūpūkea MLCD. Boating access within this part of the study area is limited to the marine managed Haleʻiwa Harbor located at Waialua Bay (see Figure 3). The majority of the north shore coastline consists of long stretches of white sandy beaches and areas with shallow limestone reef outcrops, such as Laniākea and the region spanning from Kaʻena to Mokulēʻia, the latter being popular for fishing and diving (DLNR 2019). The north shore of Oʻahu is known for its famous surf breaks and exceptionally large winter swells that attract local and visiting spectators (Hawaiian Lifeguard Association 2019).

The northern area of Waiʻanae that is within this portion of the current study area includes the *ahupuaʻa* of Keawaʻula, Kahanahaiki, and Mākua (see Figure 3). The shoreline in this area varies between long expanses of white sandy beaches (Figure 6) separated by sheer rocky cliffs. The western shoreline is prone to high surf and strong currents throughout the year (Hawaiian Lifeguard Association 2019). Streams in this portion of the study area include Kaluakauila Stream in Keawaʻula Ahupuaʻa, Punapōhaku and Mākua streams in Mākua Ahupuaʻa, and Waikomo in ʻŌhikilolo Ahupuaʻa.

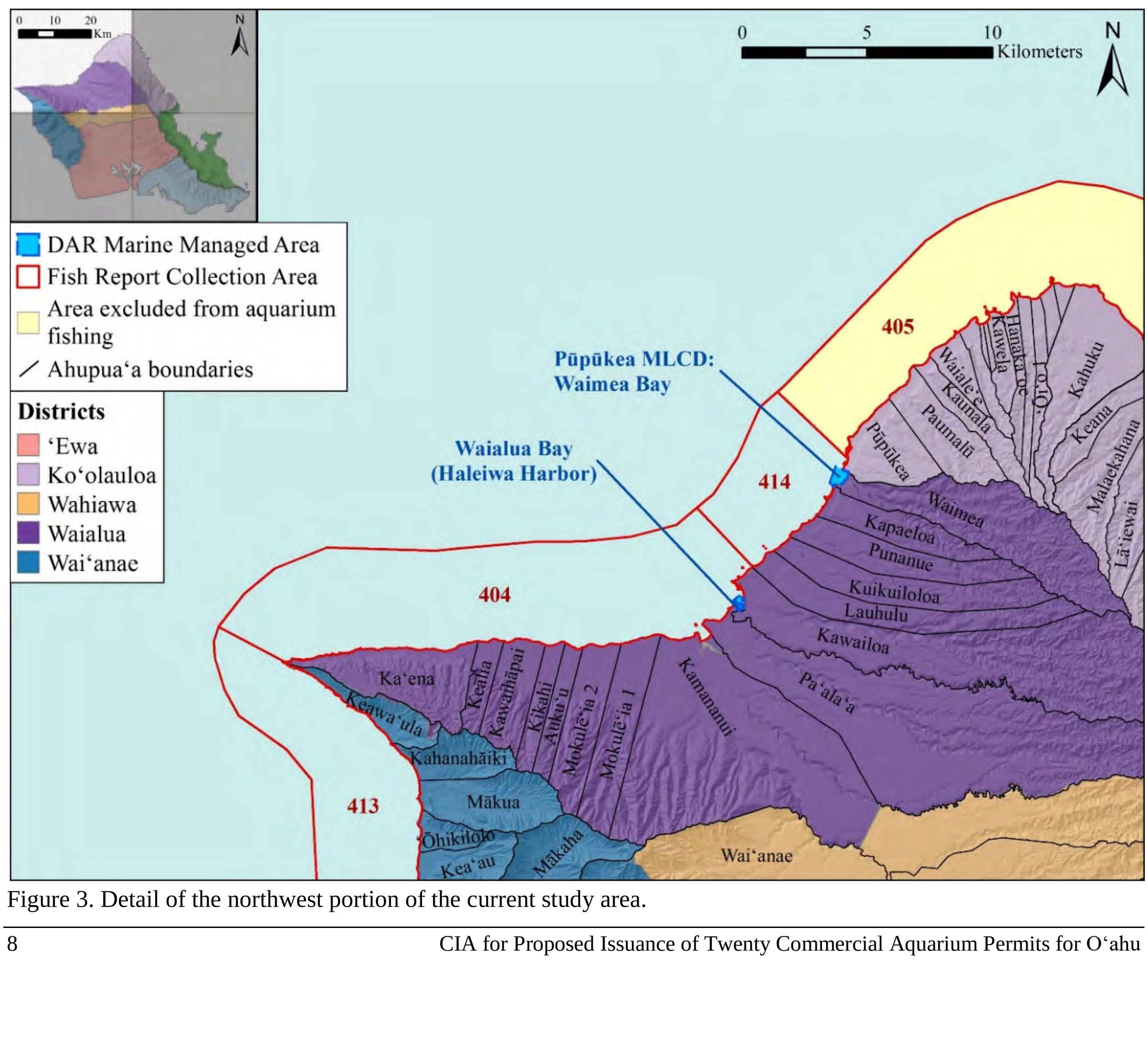


Figure 3. Detail of the northwest portion of the current study area.

Figure 4. Waialua coastline as seen from Keālia Trail in Keālia Ahupuaʻa, view to the north.

Figure 5. Aerial view of Anahulu River and Haleʻiwa Harbor with Loko ʻEa fishpond to the right (USACE n.d.).

Figure 6. Keawa‘ula Beach with view of Wai‘anae coastline; view to southeast.

THE SOUTHWEST PORTION OF THE STUDY AREA

The southwest portion of the study area includes portions of the Wai‘anae and the entirety of ‘Ewa *moku* (Figure 7). Those *ahupua‘a* within Wai‘anae that are included in this portion of the study area are (from north to south), ‘Ōhikilolo, Kea‘au, Mākaha, Wai‘anae, Lualualei, and Nānākuli; all, except for ‘Ōhikilolo, border the leeward side of the Wai‘anae Mountain Range (see Figure 7). Wai‘anae is composed of relatively rocky, arid coastal lands and is renowned for its ocean resources, particularly deep-sea fishing. The shoreline consists mostly of sandy beaches with some areas of fringing limestone reefs (i.e. Mā‘ili Point; Figure 8). The waters off leeward O‘ahu are known to have strong currents throughout the year (Hawaiian Lifeguard Association 2019). Pōka‘ī Bay within Wai‘anae Ahupua‘a is a marine managed area where commercial aquarium collection is and will remain prohibited under the proposed action. Boating access in this part of the study area is restricted to the Wai‘anae Boat Harbor and short term anchoring is permitted at Pōka‘ī Bay (Figure 8). Streams in this part of the study area include Mākaha and ‘Eku within Mākaha Ahupua‘a; Kaupuni, Mā‘ili‘ili, and Ma‘ipalaoa in Wai‘anae Ahupua‘a; and Ulehawa in Nānākuli Ahupua‘a.

The *moku* of ‘Ewa includes (from west to east) the *ahupua‘a* of Honouliuli, Hō‘ae‘ae, Waikele, Waipi‘o, Waiawa, Mānana, Waimano, Waiau, Waimalu, Kalauao, ‘Aiea, and Hālawa (see Figure 7). ‘Ewa also encompasses Ke-awa-lau-o-Pu‘uloa (Figure 10), commonly known as Pearl Harbor, and the islets of Laulaunui and Moku‘ume‘ume (also known as Ford Island). The name Pearl Harbor became widespread due to the prevalence of *pipi* or oysters (Pukui et al. 1974:182). In addition to its deep bays, the area was favorable for the construction of *loko i‘a* (fishponds) and fish traps for deep-sea fish, many of which have since been destroyed. Honouliuli is the only *ahupua‘a* in the ‘Ewa *moku* where there are areas of white, sandy beaches. The area known as Ko ‘Olina in the western portion of Honouliuli includes Kalaeloa Harbor (also known as Barber’s Point Harbor), Malakole Harbor, and resorts with man-made lagoons (Figure 11). Additional boating access in southern ‘Ewa is limited to three federally managed facilities: Iroquois Point Small Boat Harbor, Rainbow Bay Marina and Small Boat Harbor, and Hickam Habor and Small Boat Harbor and the privately owned Ko ‘Olina Marine (see Figures 7 and 11). The 12-mile coastline consists of a shallow fringing limestone reef (Figure 12) that offers a variety of marine resources. Freshwater streams in this *moku* include Honouliuli, Waikele, Waiawa, Waimalu, ‘Aiea, and Hālawa, all of which flow through their namesake *ahupua‘a.*

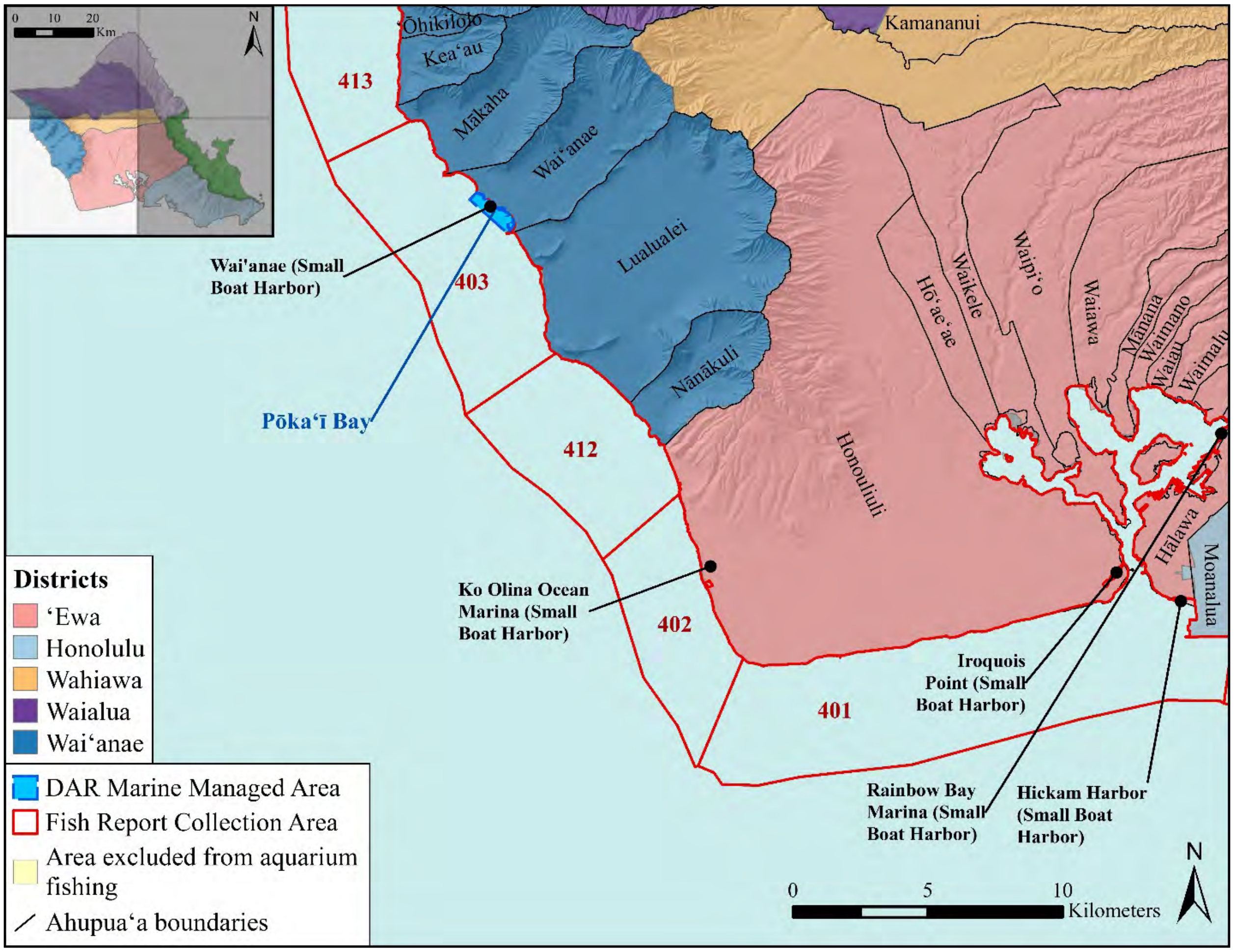


Figure 7. Detail of the southwest portion of the current study area.

Figure 8. A portion of the Wai'anae coastline from Mā'ili Point, view to northeast (UHM SOEST 2005).

Figure 9. Aerial of Wai‘anae Boat Harbor (left) and a portion of Pōka‘ī Bay (right), view to the northeast (UHM SOEST 2005).

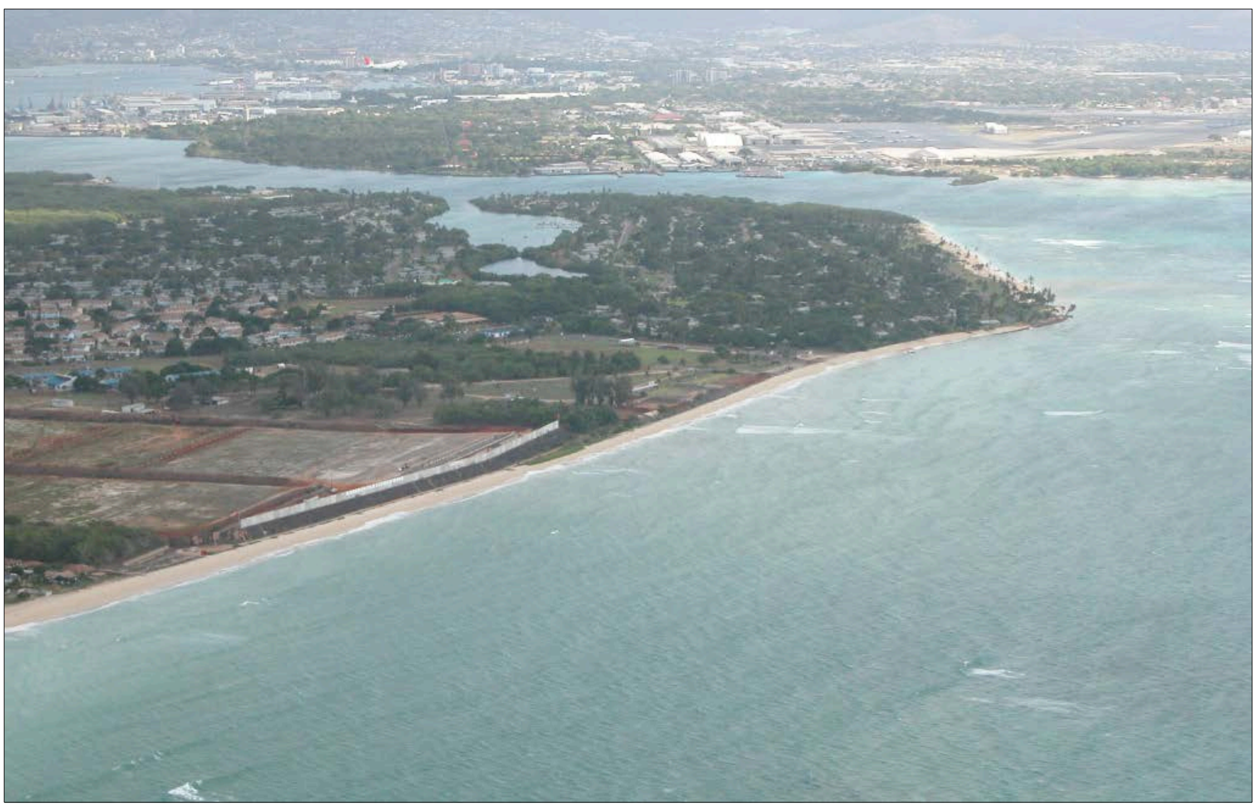


Figure 10. A portion of the ‘Ewa coastline with Ke-awa-lau-o-Pu‘uloa in the background, view to the north (UHM SOEST 2005).

Figure 11. Man-made lagoons and Ko ‘Olina harbor in the western portion of Honouliuli Ahupua‘a (UHM SOEST 2005).

Figure 12. Honouliuli shoreline near Kalaeloa in ‘Ewa Moku; view to southeast (Lee 2017).

THE SOUTHEAST PORTION OF THE STUDY AREA

The southeast portion of the study area includes the *moku* of Honolulu and the majority of Koʻolaupoko. Included in the *moku* of Honolulu are the *ahupuaʻa* (from west to east) of Moanalua, Kahauiki, Kalihi, Kapālama, Honolulu, Waikīkī, and Waimānalo, all of which extends along the leeward side of the Koʻolau Mountain Range (Figure 13). The area spanning from Moanalua to Honolulu consists of industrial parks and federally protected areas such as the airport and Honolulu Harbor (Figure 14). Access to the shoreline in this area is limited and has been extensively been modified throughout the years to accommodate the industrial expansion (i.e. dredging of coral reefs and the creation of artificial islands). Within Moanalua Ahupuaʻa in Keʻehi Lagoon—an area heavily used for canoe paddling—are several islets, including Mokuoeo, Kahakaʻaulana, and Mokauea (Figure 15). Adjacent to Mokauea and Honolulu Harbor is Sand Island (see Figure 14), which has a coarse, sandy beach on the southern shoreline that is favored by fishers. Streams in the *moku* of Honolulu include: Moanalua, Kalihi, Kapālama, which flow thru their namesake *ahupuaʻa* and Waolani, Nuʻuanu, Pauoa, Mānoa, and Waiʻalae that flow through Honolulu Ahupuaʻa. Boating access within this part of Honolulu is at Keʻehi Habor/Lagoon, Sand Island Launch Ramp, Honolulu Harbor, Kewalo Basin Small Boat Harbor, Ala Wai Small Boat Harbor, and Waikīkī Beach Waters anchorage (see Figure 13).

To the east, in Honolulu Ahupuaʻa, Kakaʻako Waterfront Park allows access for surfers and fishers, and is comprised of a rocky shoreline and deep channels of water such as Kewalo Basin (Figure 16). Ala Moana Beach Park (see Figure 16) is located on former marshland where Honolulu Ahupuaʻa borders Waikīkī Ahupuaʻa. Imported fill was used to create the sandy shoreline that faces south while the eastern shoreline of the park faces Kahanamoku Lagoon and the Ala Wai Boat Harbor (see Figure 16). Today, Ala Moana Beach Park is considered one of the most popular parks in Honolulu and attracts fishers, divers, surfers, canoe paddlers, swimmers, recreationists, and visitors (Clark 2004; Department of Parks and Recreation 2019). Some of the most popular southshore surf breaks are located outside of the reef that fronts the park (Clark 2004). The majority of the iconic Waikīkī coastline consists of white sandy beaches that attract surfers, fishers, and tourists. With the exception of the rugged Kūpikipikiʻō also known as Black Point, the southeastern portion of Waikīkī Ahupuaʻa, from Lēʻahi (Diamond Head) to Maunalua Bay Beach Park, contains pockets of sandy beaches along with sections of mud flats fronting the shoreline (Figure 8). Adjacent to Maunalua Bay in Waimānalo Ahupuaʻa, Kuapā Pond was once a fully-functioning *loko iʻa*, and has since been filled to create artificial islands for residential development and a marina (Pukui et al. 1974:119). Boating access within this part of the study area is at Maunalua Bay Launch Ramp, Hawaiʻi Kai Marine and Small Boat Harbor, and at Hancock Landing and Launch Ramp (see Figure 13).

Within Waimanalo Ahupuaʻa, the southastern shoreline that faces Kui Channel consists of steep rocky terrain Such inaccessible vertical cliffs stretch eastward from Hawaiʻi Kai, around Kaihuokapuaʻa to Paiʻoluʻolu Point before opening up to Hanauma Bay MLCD (Figure 18). The east-facing shore of this protected bay hosts shallow reefs that are ideal for snorkeling. The remainder of the Waimānalo Ahupuaʻa shoreline (to the northeast of Hanauma Bay) faces the Kaiwi Channel, which lies between Oʻahu and the island of Molokaʻi and is considered one of the toughest channels to navigate due to strong winds, currents, and large swells. (Hawaiian Lifeguard Association 2019).

The nearshore waters of the following *ahupuaʻa* within Koʻolaupoko are subect to aquarium collection and are thus included as part of the current study: Kāneʻohe, Heʻeia, Kahaluʻu, Waiheʻe, Waiāhole, Waikāne, Hakipuʻu, and the south-facing section of nearshore waters in Kualoa 1 Ahupuaʻa (see Figure 13). All upper regions of these *ahupuaʻa* extend along the windward side of the Koʻolau Mountain Range while the *makai* areas touch the shoreline with the exception of Heʻeia, which extends across Kāneʻohe Bay and includes the western shores of Mōkapu Peninsula. In the middle of the semi-closed Kāneʻohe Bay between Kahaluʻu and Heʻeia *ahupuaʻa* at low tide, an approximately three-acre sandbar traditionally known as Ahu O Laka or "altar of Laka" can be seen that attracts locals, visitors, fishers, and divers (Pukui et al. 1974:6). This sand bar is part of the expansive barrier reef that protects the nearshore environment of Kāneʻohe Bay (Jokiel 1991). The sheltered conditions created by the barrier reef and the lagoon fringing reefs coupled ample freshwater input made this area an exceptional location for the construction of *loko iʻa*. As such historically, this part of Oʻahu was home to an estimated thirty *loko iʻa*, however, over the years many of these fishponds fell into disrepair or were filled in to accommodate the urban expansion (ibid.). Today, there are approximately twelve recognizeable *loko iʻa* (Figure 8) within the area (ibid.). The Heʻeia Kea Wharf is a DAR MMA where aquarium collection is prohibited. Streams within the *moku* of Koʻolaupoko include Kāneʻohe, Kahaluʻu, Heʻeia, and Waiāhole, which flow through their respective *ahupuaʻa*, as well as Puha and Waimānalo located in Waimānalo Ahupuaʻa, and Kawa, Keaʻahala, and Kaʻalaea in Kāneʻohe Ahupuaʻa. Boating acess within this part of the study area is limited to the Kāneʻohe Small Boat Harbor and the Makani Kai Small Boat Harbor (see Figure 13).

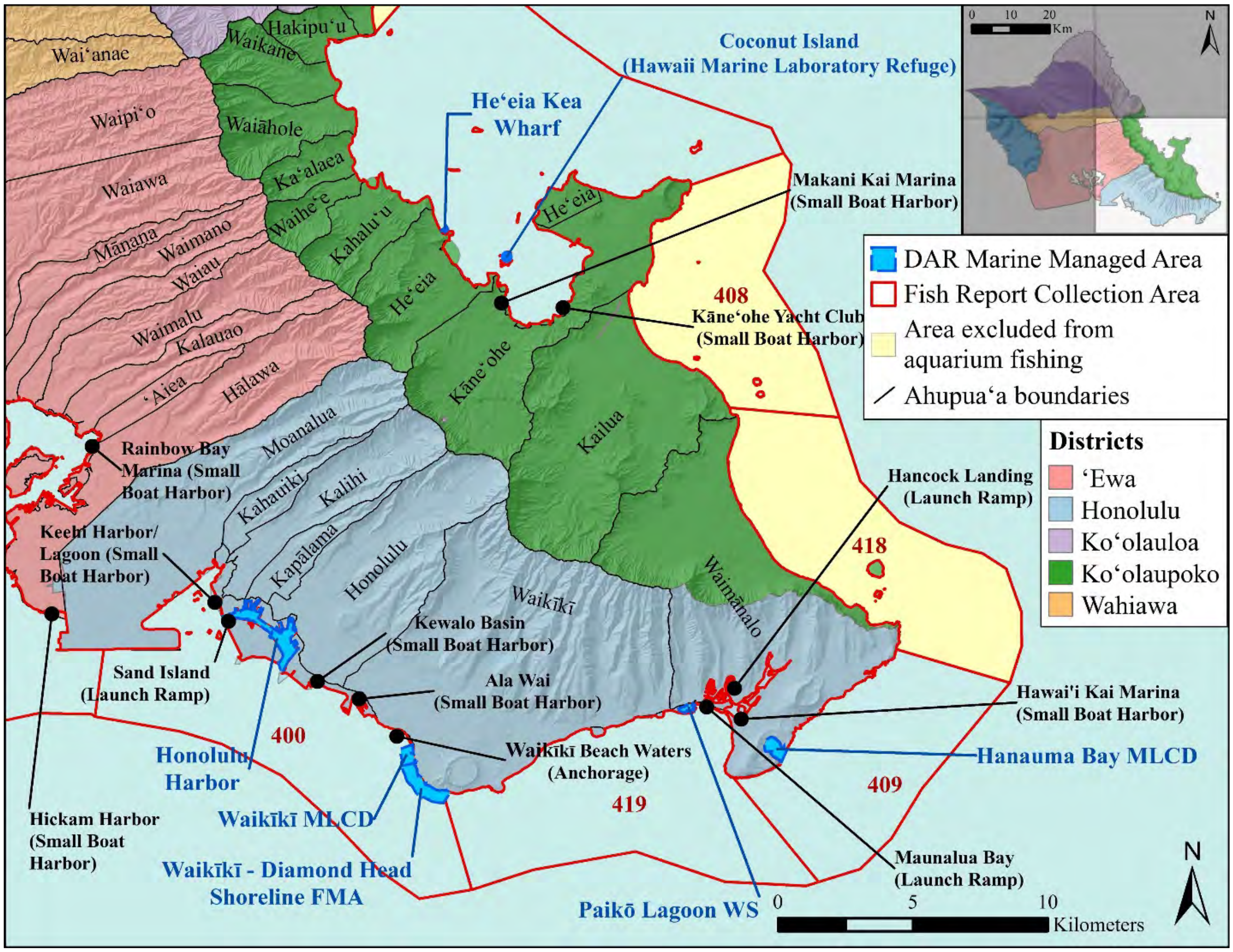


Figure 13. Detail of southeast portion of study area.

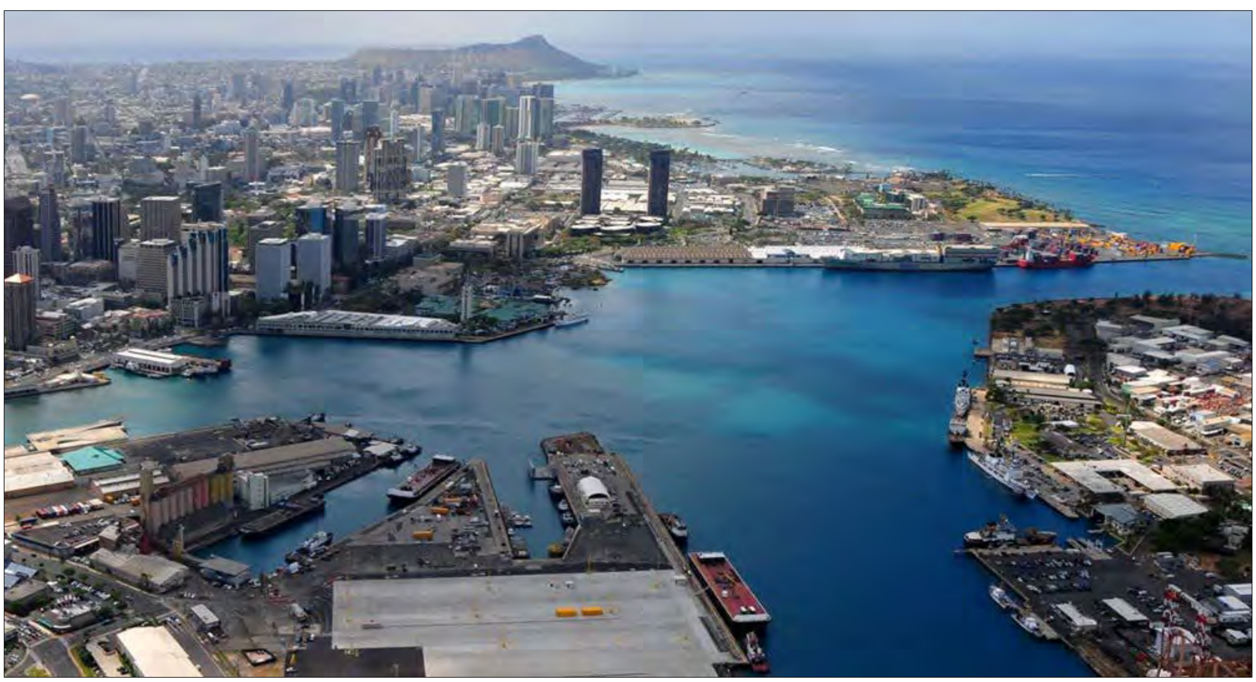


Figure 14. Aerial of Honolulu Harbor and Sand Island (right), view to the southeast (CruiseMapper n.d.).

Figure 15. Ke‘ehi Lagoon in Moanalua Ahupua‘a, view to the northeast (UHM SOEST 2005).

Figure 16. Aerial showing Kewalo Basin (left) and Ala Moana Beach Park, and a portion of the Ala Wai Boat Harbor (right); view to the northeast (UHM SOEST 2005).

Figure 17. Aerial showing the southeast portion of Waikīkī Ahupuaʻa with Kūpikipikiʻō (Black Point), view to the southeast (UHM SOEST 2005).

Figure 18. Waimanalo Ahupuaʻa coastline with Hanauma Bay MLCD (right), view to the east.

Figure 19. Aerial showing Mokuoloʻe (Coconut Island Hawaiʻi Marine Laboratory Refuge) and Kāneʻohe Bay, view to the west (UHM SOEST 2005).

Figure 20. Aerial of the *loko iʻa* of Heʻeia in Heʻeia Ahupuaʻa, Koʻolaupoko, view to the west (UHM SOEST 2005).

THE NORTHEAST PORTION OF THE STUDY AREA

The northeast portion of the current study area is within northernmost portion of the *moku* of Koʻolaupoko which includes the *ahupuaʻa* extending from Waikāne to Kualoa (Figure 21). The area spanning from Hakipuʻu to Kualoa (Figure 22) consists of sandy beaches and coral reefs ideal for fishing, diving, swimming, and aquaculture. The majority of this shoreline is shallow, however, a portion of the shoreline fronting Hakipuʻu drops abruptly into deeper channels in Kāneʻohe Bay (Clark 2004:79-80). The coastline is generally calm within Kāneʻohe Bay offering protection from offshore winds and currents.The off-shore islet adjacent to Kualoa 1 Ahupuaʻa within Kāneohe Bay is called Mokoliʻi ("little moʻo;" see Figure 22) but because of its conical shape, is more commoly referred to as Chinaman's Hat (Pukui et al. 1974:154). Mokoliʻi also lends its name to a traditional fish pond located along Kāneohe Bay within Kualoa Ahupuaʻa (Figure 23).

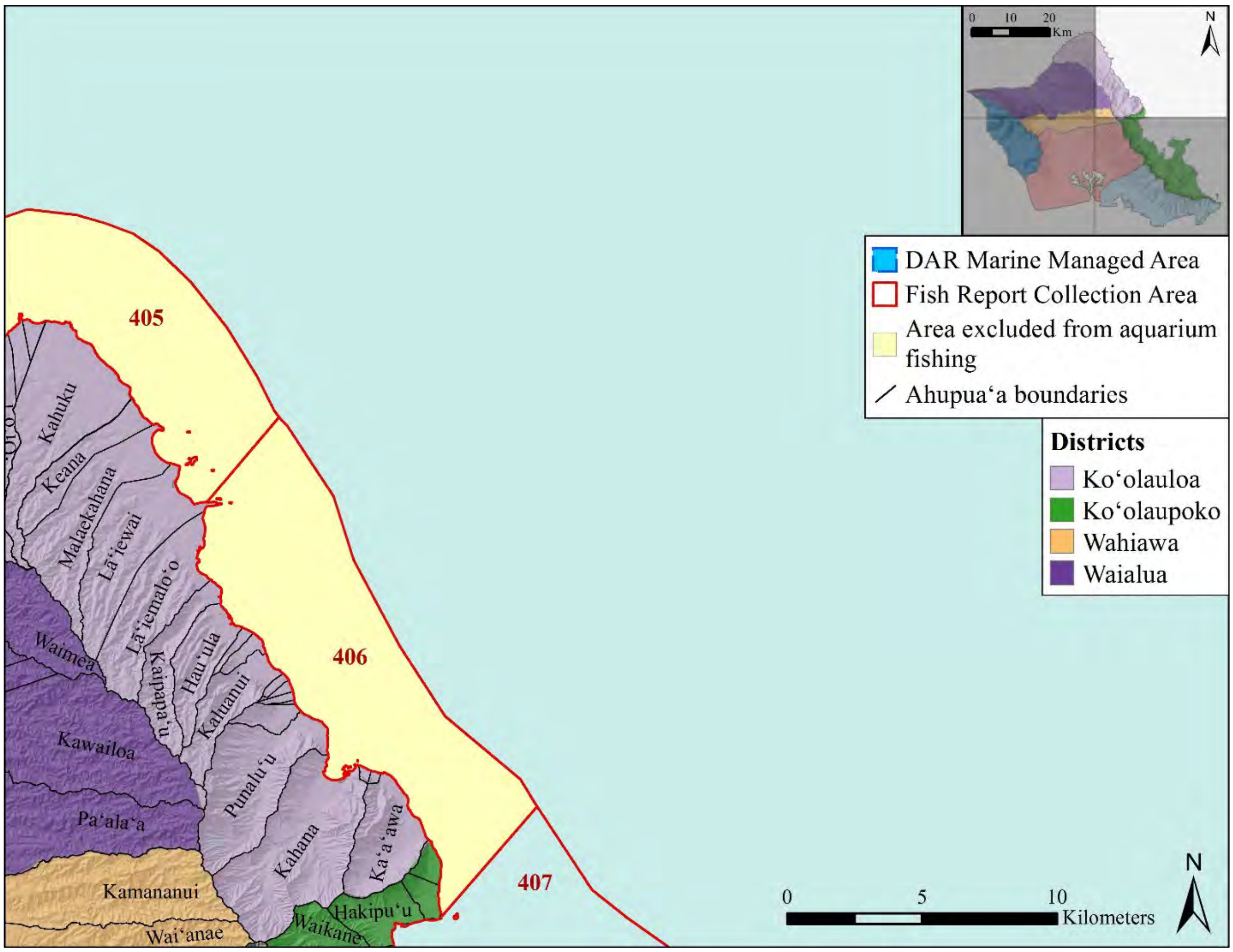


Figure 21. Detail of northeast portion of the current study area.

Figure 22. Aerial of the northernmost portion of Koʻolaupoko showing Hakipuʻu, Kualoa, and Mokoliʻi (right), view to the northwest.

Figure 23. Mokoliʻi Loko Iʻa (foreground) and Kāneʻohe Bay (background); view to the south.

THE TOP 20 COLLECTED AQUARIUM FISH SPECIES LIST

According to the FEA prepared by PIJAC, "since 2000, approximately 238 fish species have been collected under Aquarium Permits in O'ahu waters; however, some of these included those species reported as a general group" (PIJAC 2018:30). PIJAC continues thusly, "only 161 species were reported by enough permits (>2 permits reporting from each collection area during each year of collection) to determine total numbers of individuals collected" and add that "collection areas with less than three permits reporting fall under the DAR confidentiality statute" and do not release their counts publicly (2018:30). Since 2010, NOAA fisheries has operated the Pacific Reef Assessment and Monitoring Program (Pacific RAMP), which utilizes standardized survey methods to monitor the health of coral reef habitats and their inhabitants (Pacific Islands Fisheries Science Center 2019). The Pacific Islands Fisheries Science Center (PIFSC) has reported findings from reef fish population surveys conducted as part of the Coral Reef Ecosystem Program (CREP) in the waters of O'ahu in 2010, 2012, 2013, 2015, and 2016 (PIJAC 2018). Despite limitations that may underestimate some aquarium fish species populations, PIJAC used the CREP data as the basis for assessing impacts in the preparation of the 2018 FEA.

The Top 20 Collected Aquarium Fish Species List (Top 20 Species, hereafter) as reported by PIJAC (2018) accounts for 80% of the fish collected from the nearshore waters of O'ahu for the commercial aquarium trade between 2000 and 2017 (Table 2). The top three species make up 45.3% of the overall fish collection: Yellow Tang—273,356 individuals collected; Kole—175,425 individuals collected; and the Potter's Angelfish—138,669 individuals collected.

Table 2. Top 20 Collected Aquarium Fish Species of O'ahu per PIJAC (2018).

Scientific Name	*Common Name*
Zebrasoma flavescens	yellow tang
Ctenochaetus strigosus	goldring surgeonfish
Centropyge potteri	Potter's angelfish
Naso lituratus	orangespine unicornfish
Halichoeres ornatissimus	ornate wrasse
Cirrhilabrus jordani	flame wrasse
Pseudocheilinus tetrataenia	fourlined wrasse
Canthigaster jactator	whitespotted Toby
Forcipiger flavissimus	forcepsfish
Chaetodon miliaris	milletseed butterflyfish
Macropharyngodon geoffroy	shortnose wrasse
Pseudanthias bicolor	Bicolor Anthias
Acanthurus olivaceus	orangeband surgeonfish
Zanclus cornutus	moorish idol
Chaetodon multicinctus	multiband butterflyfish
Anampses chrysocephalus	psychedelic wrasse
Pseudocheilinus octotaenia	eightline wrasse
Canthigaster coronate	Crowned puffer
Thalassoma duperrey	saddle wrasse
Centropyge fisheri	Fisher's angelfish

In 2015, DLNR prepared the Hawai'i's State Wildlife Action Plan or SWAP, in which various marine species were identified as Species of Greatest Conservation Need (SGCN); however, these species "are not threatened, endangered, or otherwise legislatively protected species" (PIJAC 2018:27). Per PIJAC (2018), the 2015 SWAP proposed conservation actions such as habitat restoration, fishing regulations, and education, along with population surveys, and research to ensure the SCGN species' conservation and sustainability. In an effort to protect wildlife species endemic to Hawai'i, DLNR and DAR added endemic aquatic fishes and invertebrates to the SCGN list and "nearly 25% of fish, 20% of mollusks, 18% of algae, and 20% of the corals are considered endemic to Hawai'i and listed as SGCN species" (ibid.:27). Three SGCN species have been reported as being collected by commercial aquarium fishers on O'ahu: Psychedelic Wrasse, Fisher's Angelfish, and Tinker's Butterflyfish. Psychedlic Wrasse and Fisher's Angelfish are both among the Top 20 Species, ranking as the sixteenth and twentieth most collected species, respectively (see Table 2).

In addition to fish, a small portion of invertebrates are reported under Aquarium Permits (1.6%). There are approximately 4,100 species of known marine invertebrates found in Hawaiian waters. Between 2000 to 2017, an aggregrate number of approximately sixty-six invertebrate species were collected under Aquarium Permits for O‘ahu. Only forty-four species were reported by enough permits in a collection area to determine individuals collected (under DAR’s confidentiality statute). The top three invertebrates collected include the hermit crab (1,505,061 individuals from 2000-2017), zebra hermit crab (694,565 individuals from 2000-2017), and the feather duster worm (465,102 individuals from 2000-2017); but are not included in the Top 20 Species list.

3. BACKGROUND

CULTURE-HISTORICAL CONTEXT

To understand the culture-historical context of the vast landscape that comprises the current study area, and the mores and traditions that developed as the Hawaiian people, or Kānaka Maoli (lit. the true people) interacted with their natural environment, the research presented below was conducted within the epistemological framework of Hawaiian culture. This was achieved by using indigenous narratives as a source, whenever possible. This chapter provides a comprehensive background discussion to inform a better understanding of the cultural significance of the area and the Top 20 Species, as well as establish an analytical basis for the assessment of any potential cultural impacts from the proposed issuance of commercial aquarium permits on O‘ahu.

The chronological summary presented below begins with the settlement of the Hawaiian Islands and a discussion on the development of the *ahupua‘a* system and its marine components. This is followed by a presentation of legendary accounts that focuses on the oceanic origins and cosmogony of Kānaka Maoli, and a discussion of traditional marine resource management strategies and fishing practices. A discussion of the customary uses of the Top 20 Species is also provided. A summary of accounts from the Historic Period, which include the arrival of westerners in 1779 and the *Māhele ‘Āina* of 1848 and their impacts upon traditional marine resource procurement and management practices is also presented. The chapter concludes with a discussion of the study area during the 20th century that includes the history of commercial aquarium fishing and a brief summary of actions that triggered the preparation of the current document.

SETTLEMENT OF THE HAWAIIAN ISLANDS

While the question of the timing of the first settlement of Hawai‘i by Polynesians remains unanswered, several theories have been offered that derive from various sources of information (i.e., archaeological, genealogical, mythological, oral-historical, and radiometric). However, none of these theories is today universally accepted because there is no archaeological evidence to support the proposed timing for the initial settlement, or colonization stage, of island occupation. More recently, with advances in palynology and radiocarbon dating techniques, Kirch (2011) and others (Athens et al. 2014; Wilmshurst et al. 2011) have convincingly argued that Polynesians arrived in the Hawaiian Islands sometime between A.D. 1000 and A.D. 1200, and expanded rapidly thereafter (c.f., Kirch 2011).

The initial settlement of Hawai‘i is believed to have originated from the southern Marquesas Islands (Emory in Tatar 1982). In these early times, Hawai‘i’s inhabitants were primarily engaged in subsistence level agriculture and fishing (Handy et al. 1991). This was a period of great exploitation and environmental modification, when early Hawaiian farmers developed new subsistence strategies by adapting their familiar patterns and traditional tools to their new environment (Kirch 1985; Pogue 1978). Their ancient and ingrained philosophy of life tied them to their environment and kept order; which was further assured by the conical clan principle of genealogical seniority (Kirch 1984). According to Fornander (1969), the Hawaiians brought from their homeland certain Polynesian customs and beliefs: the major gods Kāne, Kū, and Lono; the *kapu* system of law and order; cities of refuge; the *‘aumakua* concept; and the concept of *mana*.

Initial permanent settlements in the islands were established at sheltered bays with access to fresh water and deep-sea fisheries. The nearshore fisheries and coastal fishponds, which were enriched by nutrients carried in the fresh water, also offered opportunities for resource extraction and stewardship. Communities shared extended familial relations and there was an occupational focus on the collection of marine resources. Clusters of houses were found in these coastal areas where, over time, agricultural production first became established. Over a period of several centuries the areas with the richest natural resources became populated and perhaps even crowded, and inland elevations began to be used for agriculture and some habitation. Meanwhile, an increasing separation of the chiefly class from the common people began to emerge. As the environment reached its maximum carrying capacity, the result was social stress, hostility, and war between neighboring groups (Kirch 1985). Soon, large areas of the Hawaiian Islands were controlled by a few powerful chiefs.

As time passed, a uniquely Hawaiian culture developed. The portable artifacts found in archaeological sites of this period reflect not only an evolution of the traditional tools, but some distinctly Hawaiian inventions. The adze (*ko'i*) evolved from the typical Polynesian variations of plano-convex, trapezoidal, and reverse-triangular cross-section to a standard Hawaiian rectangular/quadrangular-tanged adze. A few areas in Hawai'i produced quality basalt for adze production, such as Mauna Kea on the island of Hawai'i. The two-piece fishhook and the octopus-lure breadloaf sinker are Hawaiian inventions of this period, as are '*ulu maika* stones and *lei niho palaoa*. The latter was a status item worn by those of high rank, indicating a trend toward greater status differentiation (Kirch 1985).

As the population continued to expand, so did social stratification. The Expansion Period is characterized by major socioeconomic changes, and intensive land modification. By this time, most of the ecologically favorable zones of the windward and coastal regions of all the major Hawaiian Islands were settled, and the more marginal leeward areas were being developed. The greatest population growth occurred during the Expansion Period; for it was during the Expansion Period that a second major migration settled in Hawai'i, this time from Tahiti in the Society Islands. Rosendahl (1972) has proposed that settlement at this time was related to seasonal, recurrent occupations in which coastal sites were occupied in the summer to exploit marine resources, and upland sites were occupied during the winter months with a focus on agriculture. An increasing reliance on agricultural products may have caused a shift in social networks as well; as Hommon (1976) argues, kinship links between coastal settlements disintegrated as those links within the *mauka-makai* settlements expanded to accommodate the exchange of agricultural products for marine resources. This shift is believed to have resulted in the establishment of the *ahupua'a* system sometime during the A.D. 1400s (Kirch 1985), which added another component to an already well-stratified society. The implications of this model include a shift in residential patterns from seasonal, temporary occupation, to permanent dispersed occupation of both coastal and upland areas.

According to Cordy (2002), during the 14th century the districts of 'Ewa, Ko'olaupoko, and Kona (present-day Honolulu District) emerged as the main political centers on O'ahu, however by the 18th century, these political centers shifted to the Kona District. By this time, the island of O'ahu was divided into six traditional districts or *moku*: 'Ewa, Wai'anae, Waialua, Ko'olauloa, Ko'olaupoko and Kona (Figure 24).

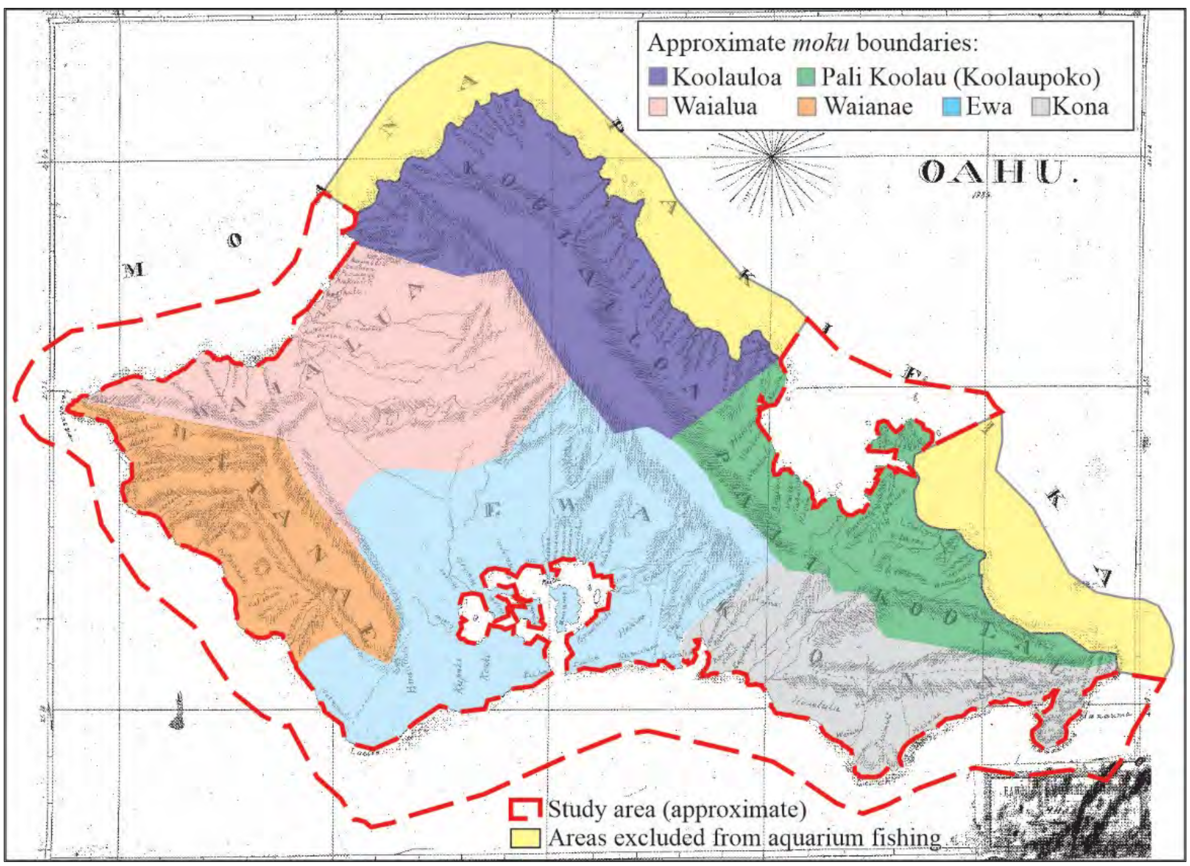


Figure 24. Hawaii Registered Map 455, showing the current study area relative to the traditional *moku* of O'ahu, ca. 1883.

As previously mentioned, the current study area comprises the coastal waters and up to three nautical miles as measured from the shores of *ahupuaʻa* that lie within the traditional *moku* of ʻEwa, Waiʻanae, Waialua, Kona (present-day Honolulu), eastern Koʻolaupoko, and a sliver of westernmost Koʻolauloa (see Figure 24). *Moku* were further divided into distinct land units known as *ahupuaʻa.* The development of this vital component of traditional Hawaiian socio-economic structure and resource management is further discussed in the following section.

DEVELOPMENT OF THE *AHUPUAʻA* SYSTEM AND ACCESS TO NATURAL RESOURCES

During the early 14th century, Māweke, "the nominal ruling chief of Oʻahu" (Kirch 2010:84) divided the lands of Oʻahu into three district-based polities whose rule he trusted to his three sons; Muliʻeleali'i ruled the Kona district, Keaunui ruled the ʻEwa district (including Waiʻanae, and Waialua), and Kalehenui ruled the Koʻolau district. Per Kirch, "Each of these regions was centered around an important core of irrigation lands, and each also incorporated fisheries and dryland farming areas" (2011:88). Māweke's eldest son Muliʻelaiʻi also had three sons and upon Muliʻelaliʻi's death, the descendants of his eldest son Kumuhonua inherited control of the ʻEwa lands, Kalehenui's descendants inherited the Koʻolau region, and Moʻikeha's descendants ruled over Kona district (Kirch 2011). According to Cordy, the Māweke-Kumuhonua line centered in the ʻEwa polity soon dominated over the rest of the island, and "oral accounts indicate that during the A.D. 1400s, the island was unified into one polity" (2002:24); under the rule of Laʻakona (of the Māweke-Kumuhonua line) from whom descended the *Mōʻī* (kings)of Oʻahu (ibid.). Cordy reports that the unification of the island of Oʻahu under a single ruler resulted in the establishment of, "at least three administrative levels of chiefs. . . the ruler, high chiefs over one or more districts (or over multiple communities), and local chiefs" (2002:25). Cordy explains the early development of the *ahupuaʻa* system thusly,

> It is likely that junior kinsmen of the ruler and high chiefs were appointed over community lands as local chiefs to provision overlords with food, status items, weapons, etc. Most researchers believe that the appointment of such outside chiefs would have replaced local lineage chiefs, led to the breakdown of the local kin groups' corporate control of community lands, and ended commoner kin ties to the ruling chiefs (Earle 1978; Green 1980; Hommon 1976, 1986, 1992). Some suggest that the resulting land-holding and local political system, termed the *ahupuaʻa* system, became established in the A.D. 1400s-1500s (2002:25).

Kirch writes that between roughly AD 1410 and 1570, "Oʻahu was the center of cultural innovation" (2010:88) in the Hawaiian Islands. In his summary of political developments of the 15th and 16th centuries in Hawaiʻi, Kirch (2010), credits the Oʻahu *aliʻi* Haka, of the Māweke-Kumuhonua line, who ruled between AD 1470 and 1490 as the first to unify the island under one rule; although he did so by way of aggression and was later killed by his own forces during a rebellion. After Haka, another descendent of Māweke, Māʻilikūkahi was chosen as *aliʻi nui* (paramount chief) of Oʻahu and moved the seat of power from ʻEwa to Waikīkī. Kirch then goes on to quote Kamakau's account of how Māʻilikūkahi divided the lands of Oʻahu and established the *ahupuaʻa* system as follows:

> When the kingdom passed to Māʻilikūkahi, the land divisions were in a state of confusion; the *ahupuaʻa*, the *kū* [*ʻili kūpono*], the *ʻili ʻāina*, the *moʻo ʻāina*, the *pauku āina*, and the *kīhāpai* were not clearly defined, Therefore Māʻilikūkahi ordered the chiefs, *aliʻi*, the lesser chiefs, *kaukau aliʻi*, and warrior chiefs, *pūʻali aliʻi*, and the overssers, *lunas* to divide all of Oʻahu into *moku* and *ahupuaʻa*, *ʻili kūpono*, *ʻili ʻāina*, and *moʻo ʻāina*. There were six districts, *moku*, and six district chiefs, *aliʻi nui ʻai moku*. . . (Kirch 2010:84-90).

As previously mentioned, the six *moku*—Kona, ʻEwa, Waiʻanae, Waialua, Koʻolauloa, and Koʻolaupoko—were further divided into eighty-six *ahupuaʻa* and smaller units.

An *ahupuaʻa* is a traditional land division that typically incorporated all of the eco-zones from the mountains to the sea, and for several hundred yards beyond the shore, assuring a diverse subsistence resource base for its residents, and a source of taxation (tribute) for the *aliʻi* (Hommon 1986). The size and shape of *ahupuaʻa* varied greatly because their boundaries were generally defined by natural topography (i.e. hills, ridgelines, gulches, craters, etc.), as well as the natural resources that occurred within a given area (Cannelora 1974; Kamakau 1976; Lyons 1875). In summarizing "the way *ka poʻe kahiko* [the ancient people] named the land from mountain peak to sea" found within a given *ahupuaʻa*, Hawaiian scholar and historian, Samuel Kamakau writes:

> Here are some names for [the zones of] the mountains—the *mauna* or *kuahiwi*. A mountain is called a *kuahiwi*, but *mauna* is the overall term for the whole mountain, and there are many names applied to one, according to its delineations (*ʻano*). The part directly in back and in front of the summit proper is called the *kuamauna*, mountaintop; below the *kuamauna* is the *kuahea*, and *makai* of the

> *kuahea* is the *kuahiwi* proper. This is where small trees begin to grow; it is the *wao nahele*. *Makai* of this region the trees are tall, and this is the *wao lipo*. *Makai* of the *wao lipo* is the *wao ʻeiwa*, and *makai* of that the *wao maʻukele*. *Makai* of the *wao maʻukele* is the *wao akua*, and *makai* of there is the *wao kanaka*, the area that people cultivate. *Makai* of the *wao kanaka* is the *ʻamaʻu*, fern belt, and *makai* of the *ʻamaʻu* the *ʻapaʻa*, grasslands. A solitary group of trees is a *moku laʻau* (a "stand" of trees) or an *ulu laʻau*, grove. Thickets that extend to the *kuahiwi* are *ulunahele*, wild growth. An area where *koa* trees suitable for canoes (*koa waʻa*) grow is a *wao koa* and *mauka* of there is a *wao laʻau*, timber land. These are dry forest growths from the *ʻapaʻa* up to the *kuahiwi*. The places that are "spongy" (*naele*) are found in the *wao maʻukele*, the wet forest. *Makai* of the *ʻapaʻa* are the *paheʻe* [pili grass] and *ʻilima* growths and *makai* of them the *kula*, open country, and the *ʻapoho* hollows near to the habitations of men. Then comes the *kahakai*, coast, the *kahaone*, sandy beach, and the *kalawa*, the curve of the seashore—right down to the *ʻae kai*, the water's edge. . . (1976:8-9)

Entire *ahupuaʻa* were generally under the jurisdiction of appointed *konohiki* or lesser chief landlords, who oversaw and coordinated stewardship of an area's natural resources and answered to an *aliʻi-ʻai-ahupuaʻa* (chief who controlled the *ahupuaʻa* resources (Lam 1985). The *aliʻi-ʻai-ahupuaʻa* in turn answered to an *aliʻi ʻai moku* (chief who claimed the abundance of the entire district) (Malo 1951). Thus, *ahupuaʻa* resources supported not only the *makaʻāinana* (*lit.* people that attend the land) and *ʻohana* (families) who lived on the land, but also contributed to the support of the royal community of regional and/or island kingdoms. This form of district subdividing was integral to Hawaiian life and was the product of strictly adhered to resource management planning. In this system, the land provided fruits and vegetables and some meat in the diet, and the ocean provided a wealth of protein resources. Also, in communities with long-term royal residents, divisions of labor (with specialists in various occupations on land and in procurement of marine resources) emerged.

Although *moku* comprised multiple *ahupuaʻa*, they were considered geographical subdivisions with no explicit reference to rights in the land (Cannelora 1974). Collectively, *aliʻi*, regardless of their rank, held a vested responsibility and were obligated to ensure "the beneficial use of the land for all of the people" (MacKenzie 1991:173). This complex system evolved well before the Western concepts of private property and codified laws were introduced to the Hawaiian Islands. Place-based knowledge developed over the centuries and detailed information of an area's natural cycles and resources was passed down intergenerationally through direct teaching and experience, and ultimately became ingrained and inherently understood. This knowledge formed the basis for decisions pertaining to the use and management of natural resources and resulted in the development of sustainable approaches that met the needs of a growing Precontact population.

Many *ahupuaʻa* were further divided into smaller land units termed *ʻili* and *ʻili kūpono* (often shortened to *ʻili kū*) and cultivated patches known as *kōʻele*, *māla*, and *kīhāpai*, generally oriented in a *mauka-makai* direction, and often marked by stone alignments (*kuaiwi*) (Beamer 2014; Lyons 1875). *ʻIli* were created for the convenience of the *ahupuaʻa* chief, and they served as the basic land unit in which the *hoaʻāina* (native tenants) made a living; these land units were often retained by specific *ʻohana* for long periods of time (Jokiel et al. 2011). As the *ʻili* themselves were typically passed down in families, so too were the *kuleana* (responsibilities, privileges) that were associated with them. The right to use and cultivate *ʻili* was maintained within the *ʻohana*, regardless of any change in title of the *ahupuaʻa* chief (Handy et al. 1991). Malo (1951), recorded several types of *ʻili*, including the *ʻili paʻa,* a single intact parcel, and the *ʻili lele*, a discontinuous parcel dispersed across an area. Whether dispersed or wholly intact, the *ʻili* land division required a cross section of the available resources, and for the *hoaʻāina*, this generally included access to agriculturally fertile lands, and the coastal fisheries. While much of these same resource principles applied to another type of *ʻili*, the *ʻili kūpono*, these land units were politically independent of the *ahupuaʻa* chief. This *ʻili kūpono* designation was often applied to specific areas containing resources that were highly valued by the ruling chiefs, such as fishponds (Handy et al. 1991). As long as sufficient tribute was offered and *kapu* (restrictions) were observed, the people who lived in a given *ahupuaʻa* had access to most of the resources from the mountains to the ocean. These access rights were almost uniformly tied to residency of a particular land, and earned as a result of taking responsibility for stewardship of the natural environment and supplying the needs of the *aliʻi* (see Malo 1951:63-67).

The *hoaʻāina* and *ʻohana* who lived on the land had rights to gather forest and marine resources for subsistence and for tribute (Jokiel et al. 2011; MacKenzie 1991). As part of these rights, the residents were also required to supply resources and labor to support the royal community of regional and/or island-wide kingdoms, as well as provide offerings to appease the multitude of *akua* (deities) (Malo 1951). These services were a *kuleana* (privilege and responsibility); a vital part of tenancy within a given *ahupuaʻa*. The *ahupuaʻa* thus became the equivalent of a local community, with its own social, economic, and political significance, and it also served as a taxable base for the *aliʻi* during the Makahiki (Kelly 1956). During the annual Makahiki procession, the highest chief of the land sent select members of his retinue to collect *ho'okupu* (tribute and offerings) in the form of goods from each *ahupua'a*. The *hoa'āina* who resided in the *ahupua'a* brought their share of *ho'okupu* to an *ahu* (altar) that was symbolically marked with the image of a *pua'a* (pig). Kamakau describes some of the reasons for the annual Makahiki and notes the observance of *kapu* that restricted the consumption of certain vegetables and meats including fish:

> The Makahiki festival was a time to rest, and a time to make great feasts of commemoration (*'aha'aina ho'omana'o*) for life and health of the body, and for the help received from the gods. All manual labor was prohibited and there were several days of resting and feasting. Chiefs and people made many joyful Makahiki feasts at the end of each year. The custom (*malama*) of feasting came from very ancient times; and from the time that chiefs became rulers of the kingdoms…
>
> They made kapu the last three months of the year. The Makahiki began (*e kauwelu ai*) in the month of Hilina, and at this time pork, coconut, and fish were placed under kapu; the eating of flesh foods (*i'o*) was kapu during these months. (Kamakau 1964:19)

In describing the intimate connection between the *ahupua'a* system and the *'ohana*, Handy and Pukui relate, "the *'Ohana* as a functioning social mechanism operates within the *milieu* of the sea, shore, coastal and inland slopes and uplands, subject to weather, sun and moon" (1998:18). *Ahupua'a* residents were not bound to the land, if the living conditions under a particular *ahupua'a* chief were deemed unsuitable, the residents could move freely in pursuit of more favorable living conditions (Lam 1985). This social structure safeguarded the well-being of the people and the overall productivity of the land, lest the chief lose the support and loyalty of his, or her, principal supporters.

Another important component of the *ahupua'a* system was access to nearshore and offshore fisheries, which is discussed in further detail in the following section. In detailing the nature of traditional Hawaiian fisheries, Lyons writes:

> While the smaller ahupuaas had to content themselves with the immediate shore fishery extending out not further than a man could touch bottom with his toes, the larger ones swept around outside of these, taking to themselves the main fisheries much in the same way as that in which the forests were appropriated. (Lyons 1875:111)

Nā Papakū O Ka Moana: Marine Extension of the *Ahupua'a*

In some places, the *po'o lawai'a* (head fisherman) held the same responsibilities as the *konohiki* within the *ahupua'a* system (Jokiel et al. 2011). In such cases, the *konohiki* had the right "to regulate the taking of fish and other marine life from the reefs and fishing grounds abutting the *ahupua'a*" (MacKenzie 1991:173). *Hoa'āina* could also gather fish; however they were "subject to the right of the *konohiki* to manage and conserve the fisheries" (MacKenzie 1991). When necessary, the *konohiki* took the liberty of implementing *kapu* to protect the area's resources from physical and spiritual depletion. Thus, the *ali'i* produced lists of kapu fish, associated with their particular *ahupua'* or smaller land units therein. For example, the *'anae* or mullet was *kapu* in the *'ili* of Hālekou and Waikalua in Kāne'ohe Ahupua'a; while *uhu* was *kapu* in Kea'ahala 'Ili of Kāne'ohe Ahupua'a (Devaney et al. 1982:136). An alternative to certain species being designated as *kapu* was for the *konohiki* to consult with tenants of the land to *kapu* fishing during certain months of the year. The boundaries of the traditional fisheries extended to a certain distance out to sea; often times from the shore to a reef, but if there was no reef the fisheries typically extended one nautical mile from the shoreline (Cobb 1902:759). When a *kapu* was placed on the area, the branches of the *hau* (beach hibiscus; *Hibiscus tiliaceus*) were planted along the shore; residents of the area would notice the *kapu* and comply until the *hau* was removed, which indicated the taboo was lifted (Thrum 1907:270).

Regarding marine resource management, Kānaka Maoli carefully regulated resource extraction within distinct marine zones to ensure the preservation of the physical, biological, and ecological integrity of the *kai*, as well as the perpetuation of the *'ohana*-based socio-economic system (Jokiel et al. 2011). As related by Handy and Pukui:

> . . . The fisherman needing *poi* or *'awa* would take fish, squid or lobster upland to a household known to have taro, and would return with his *kalo* (taro) or *pa'i'ai* (hard poi, the steamed and pounded taro corm). A woman from seaward, wanting some medicinal plant, or sugar cane perhaps, growing on the land of a relative living inland would take with her a basket of shellfish or some edible seaweed and return with her stalks of sugar cane or her medicinal plants. In other words, it was the *'ohana* that constituted the community within which the economic life moved. (Handy and Pukui 1998:6)

Kānaka Maoli organized the *kai* into distinct ecological zones along both horizontal and vertical planes known as *nā papakū o ka moana* (marine zones). Each zone bore a unique name based on location, depth, color, geographical character, and procurable coastal and pelagic resources. These marine zones extended from where the waves gently dissolve over the sand to the distant *kahikimoe* (horizon). In his book *Hawaiian Antiquities*, Hawaiian scholar David Malo enumerated *nā papakū o ka moana* as follows:

1. The ancients applied the name *kai* to the ocean and all its parts. That strip of the beach over which the waves ran after they had broken was called *ae-kai*.
2. A little further out where the waves break was called *poina-kai*. The name *pue-one* was likewise applied to this place. But the same expressions were not used of places where shoal water extended to a great distance, and which were called *kai-kohola* (such as largely prevail for instance at Waikiki).
3. Outside of the *poina-kai* lay a belt called the *kai-hele-ku*, or *kai-papau*, that is, water in which one could stand, shoal water; another name given it was *kai-ohua*.
4. Beyond this lies a belt called *kua-au* where the shoal water ended; and outside of the *kua-au* was a belt called *kai-au*, *ho-au*, *kai-o-kilo-hee*, that is, swimming deep or sea for spearing squid, or *kai-hee-nalu*, that is, a surf-swimming region. Another name still for this belt was *kai-kohola*.
5. Outside of this was a belt called *kai-uli*, blue sea, squid-fishing sea *kai-lu-hee,* or sea-of-the-flying-fish, *kai malolo*, or sea-of-the-*opelu*, *kai-opelu*.
6. Beyond this lies a belt called *kai-hi-aku*, sea for trolling the *aku*, and outside of this lay a belt called *kai-kohola*, where swim the whales, monsters of the sea; beyond this lay the deep ocean, *moana*, which was variously termed *waho-lilo* (far out to sea), or *lepo* (underground), or *lewa* (floating), or *lipo* (blue-black), which reach Kahiki-moe, the utmost bounds of the ocean.
7. When the sea is tossed into billows they are termed *ale*. The breakers which roll in are termed *nalu*. The currents that move through the ocean are called *au* or *wili-au*.
8. Portions of the sea that enter into recesses of the land are *kai-hee-nalu*, that is a surf-swimming region. Another name still *kai-o-kilo-hee*, that is swimming deep, or sea for spearing squid, or called *kai-kuono*; that belt of shoal where the breakers curl is called *pu-ao*; another name for it is *ko-aka*.
9. A blow-hole where the ocean spouts up through a hole in the rocks is called a *puhi* (to blow). A place where the ocean is sucked with force down through a cavity in the rocks is called a *mimili*, whirlpool; it is also called *mimiki* or an *aaka*.
10. The rising of the ocean tide is called by such names as *kai-pii* (rising sea), *kai-nui* (big-sea), *kai-piha* (full sea), and *kai-apo* (surrounding sea).
11. When the tide remains stationary, neither rising nor falling, it is called *kai-ku*, standing sea; when it ebbs it is called *kai-moku* (the parted sea), or *kai-emi* (ebbing sea), or *kai-hoi* (retiring sea), or *kai-make* (defeated sea).
12. A violent, raging surf is called *kai-koo*. When the surf beats violently against a sharp point of land, that is a cape (*lae*), it is termed *kai-ma-ka-ka-lae*.
13. A calm in the ocean is termed a *lai* or a *malino* or a *pa-e-a-e-a* or a *pohu*. (1951:48-49)

As outlined by Malo above, Kānaka Maoli also distinguished the various moods and surface characteristics of the ocean by name. For instance, calm and peaceful seas were known as *kai malina*, *kai pohu*, or *kai paeaea*; and areas where the sea was glassy and appeared to puddle on the surface were called *kai kāhekaheka*, *kai kiʻo*, or *kai hāpuna* (Kamakau 1979). There were also designations for contrasting parts of the *kai* based upon its color. Areas of the *kai* that were white were generally referred to as *kai kea*, with foamy, white seas being distinguished as *kai keʻokeʻo*. The ancient people also identified parts of the *kai* which were designated for certain activities. For instance, shallow parts of the sea where one could wade out into the shoal were known as the *kai hele kū*, and places where one could submerge and bathe were referred to as *kai ʻau kohana*. There were also places designated for diving—*kai luʻu,* as well as surfing—*kai heʻe nalu* or *kuaʻau* (Kamakau 1979).

The shoreline geography of Oʻahu varies from nearly vertical sea cliffs to fine-sanded bays. Per Kamakau (1979), Hawaiians also had distinct names for the various coastal topographic features, such as *loko kai* to refer to lagoons and *kai kūʻono* to refer to bays. *Kai hāloko* or *kai puhi lala* refer to sea ponds surrounded almost entirely by land, while areas of the sea that were nearly landlocked were called *hāloko kai*, and places where seawater surged into a pond were known as *kai hī*. There were also specific names to indicate areas where waves multiplied—*kai ko'o*, and subsequently diverged from each other—*kai kulana.* Kamakau (1979) also mentions that in more rugged environments, places where waves crashed against points of land were known as *kai maka lae*, and places where waves crashed into the bases of cliffsides were termed *kai kuehu*.

With the complex *ahupua'a* system, Kānaka Maoli incorporated their spiritual beliefs into the management of terrestrial and marine management resources, and a uniquely Hawaiian culture coevolved with the islands. Their relationship to the land and sea was fortified by their origin stories, which tied them to the greater cosmos. As evidenced in the subsequent section, Kānaka Maoli did not agree on a single creation story; rather, they took a pluralistic approach to explain the origin of the Hawaiian Islands, their natural environement, and themselves. Many of these origin stories feature a profound link between Kānaka Maoli and the ocean. Although ancient, these stories provide valuable insight into the deep reverence and connection Kānaka Maoli have with the land and the sea. As the current study area includes the nearshore waters of Oʻahu, the oceanic origins of the Hawaiian people are discussed below.

OCEANIC ORIGINS

Kānaka Maoli were anchored through their ingrained philosophy of life to the *'āina* (land), *wai* (water), *lewa* (heavens), and *kai*. These life-giving aspects of their natural environment were the foundation upon which they constructed their physical and spiritual world. Every natural element found within the Hawaiian world, whether on the land, in the sea, or in the heavens, was believed to be the physical embodiment of the *akua.* The natural wonders of the universe were the source of life for Kānaka Maoli, and were thus acknowledged, named, and deeply revered. Traditional legendary accounts describing the origins of the *Kanaka* (humans) are plentiful, and a review of these accounts reveals that the ancient people of these islands did not agree on a single creation story (Fornander 1916-1917). While Western scientists emphasize the geological formation of the Hawaiian Islands, traditional accounts feature the ocean as the origin point of the islands. The ocean is also described as the pathway of the gods and people who traveled by way of the *wa'a* (canoe), and the very element that connected them to their ancestral homeland, Kahiki. The most relevant of these legendary accounts are summarized below.

The Great Fishermen, Kapūheʻeuanui

The following account concerns the genealogy of a Tahitian priest namedʻŌpuʻukahonua (lit. the budding earth), who established the "royal parents or ancestors of these islands" as there were "ninety-five generations from him to Kamehameha the Great" (Fornander 1916–1917:20). According to this genealogical account, as told by Fornander, the islands "were found or obtained by the fishing of Kapuheeuanui," (1916–1917:20), a great fisherman (*ka lawai'a nui*), who fished them out of the sea, one-by-one:

> When Kapuheeuanui let down his fishing line into the sea from Kapaahu [Kohala] his line caught something that he thought was a fish and drew the line onto the canoe when, behold, it was a piece of coral. The priest Laulialamakua came along as Kapuheeuanui was disentangling his line from the coral and preparing to throw it away. Then the priest spoke to him, "Eh! Don't throw away that piece of coral, for that is a chief, a foreteller of events. Go thou and look for a pig and appease the god, and after prayer call its name Hawaiiloa, then throw it back into the sea, and it will grow up into an island." (1916-1917:20)

Kapūheʻeuanui obeyed the commands of the priest and the next day, he went back out and again fished up another piece of coral. The priest Laulialamakua intervened and declared that this piece of coral be called Mauiloa. Then, Fornander continues,

> On the third day of Kapuheeuanui's fishing his line was again entangled on a coral, making the third piece of coral brought to the surface by his line, and, as he had done before after freeing it from his line, took it to the priest. The latter on beholding this coral xclaimed, "That is a man, a wohi, a chief from the sacred air; call his name Oahunuialaa." . . . And thus, according to this tale, the islands of this group grew up from pieces of coral. (1916-1917:20-22)

Thus, Oʻahu (Oahunuilaa) was brought up from the depths by a great fisherman.

Kanaloa, Deity of the Ocean

Kanaloa is one of the four male gods that were worshipped by both *maka'āinana* and *ali'i* in Hawaiʻi and throughout Polynesia (Beckwith 1970; Malo 1951). The three other male gods—Kāne, Kū, and Lono, along with four female gods: Laʻilaʻi, Haumea, Hina, and Pelehonuamea, make up the pantheon of Hawaiian gods (Kanakaʻole Kanahele et al. 2009). In Hawaiʻi, his domain extended over the ocean and many native Hawaiians today maintain the understanding that the ocean itself is Kanaloa. Kanaloa (the ocean) was considered the roadway for the navigator and served as the connection between the various islands across the vast Pacific Ocean; navigators and paddlers, who traveled at the mercy of Kanaloa often invoked prayers to him for favorable weather and ocean conditions.

Kanaloa is embodied in several ocean species including the elusive and polychromatic *heʻe* (octopus) and *mūheʻe* (squid) (Handy et al. 1991). The *heʻe* form of Kanaloa was also used by *kahuna lapaʻau* (healing practitioners) to perform a healing ceremony called *heʻe mahola* (Malo 1951). Per Malo, *heʻe mahola* was performed if a patient appeared to be somewhat relieved or *maha*, said patient would be put to bed and the *kahuna* would perform the certemony; if rain fell on that night, the patient would die for "the omens derived from the *hee mahola* ceremony were adverse" but if no rain fell, the patient would live, for "the *hee mahola* has been attended with favorable omens" (Malo 1951:109). The next morning, "a fire, called *ahi mahola*, was lighted, the squid was cooked, and the prayer called pule hee having been offered by the *kahuna*, the patient ate of the squid and thus ended the medical treatment and the incantations (*hoomana*)" (ibid.). Malo expounds upon this ceremony writing, that the "*hee mahola* ceremony was thought to be the thing to disperse (*hehee*) disease and bring healing to the body" (ibid.).

Other important bodily forms of Kanaloa included the *koholā* (whale), specifically the *palaoa* (sperm whale), from which was carved the *lei niho palaoa* (ivory tooth pendant) that were worn exclusively by Hawaiian *aliʻi*. Kanaloa is also embodied in other large marine mammals including the *naiʻa* (dolphin), *niuhi* (tiger shark), *pololia* (jellyfish), and the *hāhālua* (manta ray) (Kanakaʻole Kanahele et al. 2009; Liliuokalani 1978).

Māui Uses Manaiakalani to Fish the Hawaiian Islands Out of the Sea

There are numerous *moʻolelo* that feature the *kupua* (demi-god) Māui and his mischievous acts, and each of the Hawaiian Islands has their own version of Māui tales. Born to Akalana and Hina-kawea, Māui had two brothers named Maui-mua and Maui-ikiiki and often got into mischief with them. In a chapter titled "Maui the Fisherman," Westervelt writes about Māui fishing the Hawaiian Islands out of the underworld with his mother's help:

> The Hawaiian myths sometimes represent Maui as trying to draw the islands together while fishing them out of the sea. . .
>
> Maui went out from his home at Kauiki, fishing with his brothers. After they had caught some fine fish the brothers desired to return, but Maui persuaded them to go out farther. Then when they became tired and determined to go back, he made the seas stretch out and the shores recede until they could see no land. Then drawing the magic hook, he baited it with the Alae or sacred mud hen belonging to his Mother Hina. Queen Liliuokalani's family chant has the following reference to this myth:
>
> > "Maui longed for fish for Hina-akeahi (Hina of the fire, his mother),
> >
> > Go hence to your father,
> >
> > There you will find line and hool.
> >
> > Manaiakalani is the hook.
> >
> > The ancient seas are connected.
> >
> > The great bird Alae is taken,
> >
> > The sister bird,
> >
> > Of that one of the hidden fire of Maui."
>
> . . . Down in the deep sea sank the hook with its struggling bait, until it was seized by "the land under the water."
>
> But Hina the mother saw the struggle of her sacred bird and hastened to the rescue. She caught a wing of the bird, but could not pull the Alae from the sacred hook. The wing was torn off. Then the fish gathered around the bait and tore it in pieces. If the bait could have been kept entire, then the land would have come up in a continent rather than as an island. Then the Hawaiian group would have been unbroken. But the bait broke—and the islands came up as fragments from the under world. (Westervelt 1910:26-28)

The following account, as told by Beckwith, tells how Māui used his supernatural fishhook, Manaiakalani, to fish the Hawaiian Islands from the depths of the sea. Like Westervelt before her, Beckwith mentions how Māui who resided with his mother in Mākua cave on the Waiʻanae coast, desired to unite the Hawaiian Islands, but to no avail for he is fooled by a bailer that has transformed into a beautiful woman:

> His mother sends him to Ka-ale-nui-a-hina, who tells him he must hook Uniho-kahi at the fishing station of Ponaha-ke-one off Ulehawa. Maui and his brothers paddle out to the fishing ground with the hook Manai-a-ka-lani. He tells his brothers to catch the bailer (kaliu) they will see floating by, and himself take it into the canoe. When they reach the fishing station the bailer has become transformed into a beautiful woman. She accompanies Maui’s hook into the sea and bids Uniho-kahi open his mouth, as she and Maui have been disputing about the number of his teeth. When he obeys she hooks him fast. They brothers paddle. Maui bids them not look back; but they disobey, the hook comes loose, and the islands separate again. (Beckwith 1970:233)

The ***Kumulipo***

While the above accounts attribute the origin of the Hawaiian Islands to various *akua* (deities) and great fishermen who raised the islands from the depths of the ocean, the following account is a *mele ko‘i honua*, or cosmogonic chant, known as the *Kumulipo,* which explains the origins of the Hawaiian universe in a different manner. This account describes the birth of various aquatic and terrestrial organisms found in the Hawaiian Islands. Containing over 2,000 lines, this chant was uttered by the high priest Puou in Kealakekua, Kona upon the birth of the 18th-century high chief Ka‘ī‘īmamao, as a way to recognize and fortify the depth of his royal family’s divine origin (Liliuokalani 1978). Various scholars and Hawaiian royalty, including Queen Lili‘uokalani and her brother King David Kalākaua, have attempted to translate this epic chant, with each translator offering their own interpretation. The *Kumulipo* anchors the Hawaiian world and its people to the ocean by way of the primal substance known to the Hawaiian people as *walewale* (slime). According to the *Kumulipo*, all animate and inanimate objects were *hānau* (born), including the *‘uku ko‘ako‘a* (coral polyp), which was recorded as the very first organism born in the ocean. The small and simple *‘uku ko‘ako‘a* is of vital importance to life, as it is the basic building block for all life in the sea. It is from the *‘uku ko‘ako‘a* that the *‘āko‘ako‘a* (coral head) was born, thus forming the broader foundation for all other marine organisms that inhabit the nearshore reefs.

This lengthy chant is broken up into sixteen *wā* (eras). The recurring theme of duality appears in the first four *wā* in which each aquatic life form is paired with a terrestrial counterpart. The first *wā* describes a time of eternal darkness (*pō*) that passes progressively through the union of male and female energies, and ultimately gives birth to light (*ao*). It is in this first *wā* that organisms of the benthic zone are born. The second *wā* of the *Kumulipo* describes the birth of the fishes and their forest counterparts; the third *wā* describes the emergence of the winged creatures of both land and sea, and the fourth *wā* describes the birth of the amphibious creatures (Beckwith 1951). In her explanation of the pairs of aquatic and terrestrial counterparts, Martha Beckwith writes:

> The names are not invented for mere rhyme value…The punning of names have in some cases a practical magical function. For example, in plant medicine the first food to be taken after dosing with a special medicinal herb is the sea-growing thing whose name matches with it…Such is the nature of the language that these lists may be extended indefinitely. (1951:50-51)

It is not until the eighth *wā* of the Kumulipo that Kānaka Maoli are born. This birth order informs us of the Hawaiian thought process, which suggests that Kānaka Maoli derive from the same source as all other living creatures, Furthermore, the idea that Kānaka Maoli were born so long after the ocean highlights the reverence that they hold for the *kai* and all of its life forms. The *Kumulipo* also serves as a reminder that the well-being of Kānaka Maoli is dependent upon maintaining the delicate balance between all life forms, and that a symbiotic relationship exists between the land and the ocean and their inhabitants. Although this account is set in Hawai‘i’s distant past, the messages and meanings remain deeply embedded in the spirits and minds of Native Hawaiians today.

For the purposes of the current study, in an effort to provide a more complete understanding of the cosmogony of marine life in the Hawaiian Islands, the entirety of the second *wā* of the *Kumulipo* is provided in Hawaiian with an English translation next to it. The Hawaiian version of this chant comes from a text written by King David Kalākaua that was published by Beckwith (1951:190-194). The English translation is derived from a version of the *Kumulipo* published by King Kalākaua’s sister, Queen Lili‘uokalani (Liliuokalani 1978:6-11). All fish names are presented in bold print for emphasis; while the Top 20 Species have been underlined for ease of identification:

123. *Hanau kama a ka Powehiwehi*	The first child born of Powehiwehi (dusky night)
124. *Ho‘oleilei ka lana a ka Pouliuli*	Tossed up land for Pouliuli (darkest night),
125. *O Mahiuma, o Ma‘apuia*	For Mahiuma or Maapuia,
126. *O noho i ka ‘aina o Pohomiluamea*	And lived in the land of Pohomiluamea (shoughy hill of Mea);
127. *Kukala mai ka Haipu-aalamea*	Suppressed the noise of the growth of unripe fruit,
128. *O naha wilu ke au o Uliuli*	For fear Uliuli would cause it burst, and the stench
129. *O ho‘ohewahewa a kumalamala*	To disagree and turn sour,
130. *O pohouli a poho‘ele‘ele*	For pits of darkness and pits of night.

131. *O na wai ehiku e lana wale*
132. *Hanau kama a **hilu**, a holo*
133. *O ka **hilu** ia pewa lala kau*
134. *O kau[l]ana a Pouliuli*
135. *O kuemiemi a Powehiwehi*
136. *O pouliuli ke kane*
137. *O Powehiwehi ka wahine*
138. *Hanau ka i'a, hanau ka **Nai'a** i ke kai la holo*
139. *Hanau ka **Mano**, hanau ka **Moana** i ke kai la holo*
140. *Hanau ka **Mau**, hanau ka **Maumau** i ke kai la holo*
141. *Hanau ka **Nana**, hanau ka **Mana** i ke kai la holo*
142. *Hanau ka **Nake**, hanau ka **Make** i ke kai la holo*
143. *Hanau ka **Napa**, hanau ka **Nala** i ke kai la holo*
144. *Hanau ka **<u>Pala</u>**, hanau ke **<u>Kala</u>** i ke kai la holo*
145. *Hanau ka **Paka**, hanau ka **Papa** i ke kai la holo*

146. *Hanau ke **Kalakala**, hanau ka **Huluhulu** i ke kai la holo*
147. *Hanau ka **Halahala**, hanau ka **Palapala** i ke kai la holo*
148. *Hanau ka **Pe'a**, hanau ka **Lupe** i ke kai la holo*
149. *Hanau ke **Ao**, hanau ke **Awa** i ke kai la holo*
150. *Hanau ke **Aku**, hanau ke **'Ahi** i ke kai la holo*

151. *Hanau ka **Opelu**, hanau ke **Akule** i ke kai la holo*

152. *Hanau ka **'Ama'ama**, hanau ka **'Anae** i ke kai la holo*

153. *Hanau ka **Ehu**, hanau ka **Nehu** i ke kai la holo*
154. *Hanau ka **'Iao**, hanau ka **'Ao'ao** i ke kai la holo*
155. *Hanau ka **'Ono**, hanau ke **Omo** i ke kai la holo*
156. *Hanau ka **Pahau**, hanau ka **Lauhau** i ke kai la holo*

157. *Hanau ka **Moi**, hanau ka **Lo'ilo'i** i ke kai la holo*
158. *Hanau ka **Mao**, hanau ka **Maomao** i ke kai la holo*
159. *Hanau ke **Kaku**, hanau ke **A'ua'u** i ke kai la holo*
160. *Hanau ke **Kupou** hanau ke **Kupoupou** i ke kai la holo*
161. *Hanau ka **Weke**, hanau ka **Lele** i ke kai la holo*
162. *Hanau ka **Palani**, hanau ka **Nukumomi** i ke kai la holo*
163. *Hanau ka **Ulua**, hanau ka **Hahalua** i ke kai la holo*
164. *Hanau ka **'Ao'aonui**, hanau ka **Paku'iku'i** i ke kai la holo*
165. *Hanau ka **Ma'i'i'i**, hanau ka **Ala'ihi** i ke kai la holo*
166. *Hanau ka **'O'o**, hanau ka **'Akilolo** i ke kai la holo*

167. *Hanau ka **Nenue**, noho i kai*
168. *Kia'i ia e ka Lauhue noho i uka*
169. *He po uhe'e i ka wawa*
170. *He nuku, he kai ka 'ai a ka i'a*
171. *O ke Akua ke momo, 'a'oe komo kanaka*

172. *O kane ia Wai'ololi, o ka wahine ia Wai'olola*
173. *Hanau ka **Pahaha** no i kai*
174. *Kia'i ia e ka Puhala noho i uka*
175. *He po uhe'e i ka wawa*
176. *He nuku, he kai ka 'ai a ka i'a*
177. *O ke Akua ke momo, 'a'oe komo kanaka*

178. *O kane ia Wai'ololi, o ka wahine ia Wai'olola*
179. *Hanau ka **Pahau** noho i kai*
180. *Kia'i ia e ka Lauhau noho i uka*
181. *He po uhe'e i ka wawa*
182. *He nuku, he kai ka 'ai a ka i'a*
183. *O ke Akua ke momo, 'a'oe komo kanaka*

184. *O kane ia Wai'ololi, o ka wahine ia Wai'olola*
185. *Hanau ka **He'e** noho i kai*
186. *Kia'i ia e ka Walahe'e noho i uka*
187. *He po uhe'e i ka wawa*
188. *He nuku, he kai ka 'ai a ka i'a*
189. *O ke Akua ke momo, 'a'oe komo kanaka*

Then the seven waters became calm.
Then was born a child (kama), 'twas a **Hilu** and swam.
The **Hilu** is a fish with standing fins,
On which Pouliuli sat.
So undecided seemed Powehiwehi,
For Pouliuli was husband
And Powehiwehi his wife.

And fish was born, the **Naia** (porpoise) was born in the sea and swam.

The **Mano** (shark) was born, the **Moana** was born in the sea and swam.

The **Mau** was born, the **Maumau** was born in the sea and swam.

The **Nana** was born, the **Mana** was born in the sea and swam.

The **Nake** was born, the **Make** was born in the sea and swam.

The **Napa** was born, the **Nala** was born in the sea and swam.

The **<u>Pala</u>** was born, the **<u>Kala</u>** was born in the sea and swam.

The **Paka** (an eel) was born, the **Papa** (crab) was born in the sea and swam.

The **Kalahala** was born, the **Huluhulu** was born in the sea and swam.

The **Halahala** was born, the **Palapala** was born in the sea and swam.

The **Pea** (starfish) was born, the **Lupe** was born in the sea and swam.

The **Ao** was born, the **Awa** was born in the sea and swam.

The **Aku** (bonito) was born, the **Ahi** (same kind) was born in the sea and swam.

The **Opelu** (same as above) was born, the **Akule** was born in the sea and swam.

The **Amaama** (mullet) was born, the **Anae** (large kind) was born in the sea and swam.

The **Ehu** was born, the **Nehu** was born in the sea and swam.

The **Iao** (used for bait) was born, the **Aoao** was born in the sea and swam.

The **Ono** (large fish) was born, the **Omo** was born in the sea and swam.

The **Pahau** (striped flatfish) was born, the **Lauhau** was born in the sea and swam.

The **Moi** was born, the **Loiloi** was born in the sea and swam.

The **Mao** was born, the **Maomao** was born in the sea and swam.

The **Kaku** was born, the **A'ua'u** was born in the sea and swam.

The **Kupou** was born, the **Kupoupou** was born in the sea and swam.

The **Weke** was born, the **Lele** was born in the sea and swam.

The **Palani** was born, the **Nuku Moni** was born in the sea and swam.

The **Ulua** was born, the **Hahalua** was born in the sea and swam.

The **Aoaonui** was born, the **Pakuikui** was born in the sea and swam.

The **Maiii** was born, the **Alaihi** was born in the sea and swam.

The **Oo** was born, the **Akilolo** was born in the sea and swam.

The **Nenue** was born and lived in the sea;
Guarded by the Lauhue that grew in the forest.
A night of flight by noises
Through a channel; salt water is life to fish;
So the gods may enter, but not man.

Man by Waiololi, woman by Waiolola,
The **Haha** was born and lived in the sea;
Guarded by the Puhala that grew in the forest.
A night of flight by noises
Through a channel; salt water is life to fish;
So the gods may enter, but not man.

Man by Waiololi, woman by Waiolola,
The **Pahau** was born in the sea;
Guarded by the Lauhau that grew in the forest.

190. *O kane ia Wai‘ololi, o ka wahine ia Wai‘olola*
191. *Hanau ka **‘O‘opukai** noho i kai*
192. *Kia‘i ia e ka ‘O‘opuwai noho i uka*
193. *He po uhe‘e i ka wawa*
194. *He nuku, he kai ka ‘ai a ka i‘a*
195. *O ke Akua ke momo, ‘a‘oe komo kanaka*

196. *O kane ia Wai‘ololi, o ka wahine ia Wai‘olola*
197. *Hanau ka **puhi Kauwila** noho i kai*
198. *Kia‘i ia e ka Uwila noho i uka*
199. *He po uhe‘e i ka wawa*
200. *He nuku, he kai ka ‘ai a ka i‘a*
201. *O ke Akua ke momo, ‘a‘oe komo kanaka*

202. *O kane ia Wai‘ololi, o ka wahine ia Wai‘olola*
203. *Hanau ka **Umaumalei** noho i kai*
204. *Kia‘i ia e ka ‘Ulei noho i uka*
205. *He po uhe‘e i ka wawa*
206. *He nuku, he kai ka ‘ai a ka i‘a*
207. *O ke Akua ke momo, ‘a‘oe komo kanaka*

208. *O kane ia Wai‘ololi, o ka wahine ia Wai‘olola*
209. *Hanau ka **Paku‘iku‘i** noho i kai*
210. *Kia‘i ia e ka la‘au Kukui noho i uka*
211. *He po uhe‘e i ka wawa*
212. *He nuku, he kai ka ‘ai a ka i‘a*
213. *O ke Akua ke momo, ‘a‘oe komo kanaka*

214. *O kane ia Wai‘ololi, o ka wahine ia Wai‘olola*
215. *Hanau ka **Laumilo** noho i kai*
216. *Kia‘i ia e ka [la‘au] Milo noho i uka*
217. *He po uhe‘e i ka wawa*
218. *He nuku, he kai ka ‘ai a ka i‘a*
219. *O ke Akua ke momo, ‘a‘oe komo kanaka*

220. *O kane ia Wai‘ololi, o ka wahine ia Wai‘olola*
221. *Hanau ke **Kupoupou** noho i kai*
222. *Kia‘i ia e ka Kou noho i uka*
223. *He po uhe‘e i ka wawa*
224. *He nuku, he kai ka ‘ai a ka i‘a*
225. *O ke Akua ke momo, ‘a‘oe komo kanaka*

226. *O kane ia Wai‘ololi, o ka wahine ia Wai‘olola*
227. *Hanau ka **Hauliuli** noho i kai*
228. *Kia‘i ia e ka Uhi noho i uka*
229. *He po uhe‘e i ka wawa*
230. *He nuku, he kai ka ‘ai a ka i‘a*
231. *O ke Akua ke momo, ‘a‘oe komo kanaka*

232. *O kane ia Wai‘ololi, o ka wahine ia Wai‘olola*
233. *Hanau ka **Weke** noho i kai*
234. *Kia‘i ia e ka Wauke noho i uka*
235. *He po uhe‘e i ka wawa*
236. *He nuku, he kai ka ‘ai a ka i‘a*
237. *O ke Akua ke momo, ‘a‘oe komo kanaka*

238. *O kane ia Wai‘ololi, o ka wahine ia Wai‘olola*
239. *Hanau ka **‘A‘awa** noho i kai*
240. *Kia‘i ia e ka ‘Awa noho i uka*
241. *He po uhe‘e i ka wawa*
242. *He nuku, he kai ka ‘ai a ka i‘a*
243. *O ke Akua ke momo, ‘a‘oe komo kanaka*

244. *O kane ia Wai‘ololi, o ka wahine ia Wai‘olola*
245. *Hanau ka **Ulae** noho i kai*
246. *Kia‘i ia e ka Mokae noho i uka*
247. *He po uhe‘e i ka wawa*
248. *He nuku, he kai ka ‘ai a ka i‘a*
249. *O ke Akua ke momo, ‘a‘oe komo kanaka*

250. *O kane ia Wai‘ololi, o ka wahine ia Wai‘olola*
251. *Hanau ka **Palaoa** noho i kai*
252. *Kia‘i ia e ka Aoa noho i uka*
253. *He po uhe‘e i ka wawa*
254. *He nuku, he kai ka ‘ai a ka i‘a*
255. *O ke Akua ke momo, ‘a‘oe komo kanaka*

A night of flight by noises
Through a channel; salt water is life to fish;
So the gods may enter, but not man.

Man by Waiololi, woman by Waiolola,
The **Hee** was born and lived in the sea;
Guarded by the Walahee that grew in the forest.
A night of flight by noises
Through a channel; salt water is life to fish;
So the gods may enter, but not man.

Man by Waiololi, woman by Waiolola,
The **Oopukai** was born and lived in the sea;
Guarded by the Oopuwai that lived in the forest.
A night of flight by noises
Through a channel; salt water is life to fish;
So the gods may enter, but not man.

Man by Waiololi, woman by Waiolola,
The **Puhi kauwila** was born and lived in the sea;
Guarded by the Uwila that lived in the forest.
A night of flight by noises
Through a channel; salt water is life to fish;
So the gods may enter, but not man.

Man by Waiololi, woman by Waiolola,
The **Umaumalei** was born and lived in the sea;
Guarded by the Ulei that grew in the forest.
A night of flight by noises
Through a channel; salt water is life to fish;
So the gods may enter, but not man.

Man by Waiololi, woman by Waiolola,
The **Pakuikui** was born and lived in the sea;
Guarded by the Laukukui that grew in the forest.
A night of flight by noises
Through a channel; salt water is life to fish;
So the gods may enter, but not man.

Man by Waiololi, woman by Waiolola,
The **Laumilo** was born and lived in the sea;
Guarded by the Milo that grew in the forest.
A night of flight by noises
Through a channel; salt water is life to fish;
So the gods may enter, but not man.

Man by Waiololi, woman by Waiolola,
The **Kapoou** was born and lived in the sea;
Guarded by the Kou that grew in the forest.
A night of flight by noises
Through a channel; salt water is life to fish;
So the gods may enter, but not man.

Man by Waiololi, woman by Waiolola,
The **Hauliuli** was born and lived in the sea;
Guarded by the Uhi that grew in the forest.
A night of flight by noises
Through a channel; salt water is life to fish;
So the gods may enter, but not man.

Man by Waiololi, woman by Waiolola,
The **Weke** was born and lived in the sea;
Guarded by the Wauke that grew in the forest.
A night of flight by noises
Through a channel; salt water is life to fish;
So the gods may enter, but not man.

Man by Waiololi, woman by Waiolola,
The **Aawa** was born and lived in the sea;
Guarded by the Awa that grew in the forest.
A night of flight by noises
Through a channel; salt water is life to fish;
So the gods may enter, but not man.

Man by Waiololi, woman by Waiolola,
The **Ulae** was born and lived in the sea;
Guarded by the Mokae that grew in the forest.

256. *O ke ka'ina a* ***palaoa*** *e ka'i nei*
257. *E kuwili o ha'aha'a i ka moana*
258. *O ka* ***opule*** *ka'i loloa*
259. *Manoa wale ke kai ia lakou*
260. *O* ***kumimi****, o ka lohelohe a pa'a*
261. *O ka'a monimoni i ke ala*
262. *O ke ala o Kolomio o miomio i hele ai*
263. *Loa'a Pimoe i ke polikua*
264. *O Hikawainui, o Hikawaina*
265. *O pulehulehu hako'ako'a*
266. *Ka mene 'a'ahu wa'awa'a*
267. *O holi ka poki'i i ke au ia uliuli*
268. *Po'ele wale ka moana powehiwehi*
269. *He kai ko'ako'a no ka uli o Paliuli*
270. *O he'e wale ka 'aina ia lakou*
271. *O kaha uliuli wale i ka po—la*
272. *Po—no*

A night of flight by noises
Through a channel; salt water is life to fish;
So the gods may enter, but not man.

Man by Waiololi, woman by Waiolola,
The **Palaoa** (sea-elephant) was born and lived in the sea;
Guarded by the Aoa that grew in the forest.
A night of flight by noises
Through a channel; salt water is life to fish;
So the gods may enter, but not man.

The train of the **Palaoa** (walrus) that swim by,
Embracing only the deep blue waters,
Also the **Opule** that move in schools,
The deep is as nothing to them.
And the **Kumimi** (a crab) and Lohelohe (a locust) cling together
To the rolling motion of their cradle
On their path so narrow, so slim, to move,
Till Pimoe (a mermaid) is found in the depth of her cave,
With Hikawainui, and Hikawaine
Amongst piles of heated coral
That were thrown in piles unevenly,
So thin and scraggy in the blue tide.
Surely it must be dismal, that unknown deep;
'Tis a sea of coral from the depth of Paliuli,
And when the land recedes from them
The east is still in darkness of night,
'Tis night

As reflected in the origin stories previously described, Kānaka Maoli organized all living things in the natural world into a distinct order. The ocean and its creatures were of divine origin and capable of living and reproducing without the aid of man. A dependence on the thriving, but finite, terrestrial and marine resources, coupled with a growing population, required Kānaka Maoli to develop traditional resource management practices that would maintain the ecological and spiritual integrity of said resources. Over time, what developed was a sophisticated and highly integrated set of stewardship practices that were codified in the sociopolitical system and interwoven with their spiritual beliefs.

TRADITIONAL RESOURCE MANAGEMENT PRACTICES

The ancient and ingrained philosophy of life of the Native Hawaiian people, or Kānaka Maoli, was reinforced through cultural norms, beliefs, values, and practices that tied them to their environment in a very intimate and profound way. Several underlying components are evident in traditional Hawaiian resource stewardship practices: a personal, reciprocal relationship with the resources; the belief that all things are interconnected; the implementation of self-control; the staunch support of a socio-political system that valued the natural resources; and uncodified laws that imposed serious consequences for violators. Traditional Hawaiian place-based cultural practices helped maintain the natural, spiritual, and social order. In his description of the intimate relationship between the Hawaiian people, the *'āina*, and the *kai*, Hawaiian historian and cultural specialist, Kepā Maly writes:

> In the Hawaiian context, these values—the "sense of place"—have developed over hundreds of generations of evolving "cultural attachment" to the natural, physical, and spiritual environments. In any culturally sensitive discussion on land use in Hawai'i, one must understand that Hawaiian culture evolved in close partnership with its' natural environment. Thus, Hawaiian culture does not have a clear dividing line of where culture ends and nature begins.
>
> In a traditional Hawaiian context, nature and culture are one in the same, there is no division between the two. The wealth and limitations of the land and ocean resources gave birth to, and shaped the Hawaiian world view. The *'āina* (land), *wai* (water), *kai* (ocean), and *lewa* (sky) were the foundation of life and the source of the spiritual relationship between people and their environs. (2001:1)

The *'ōlelo no'eau* (proverbial saying) "*Hānau ka 'āina, hānau ke ali'i, hānau ke kanaka* Born was the land, born were the chiefs, born were the commoners" (Pukui 1983:57), conveys the belief that all things of the land, including *kānaka,* were literally born, and are thus connected through kinship links that extend beyond the immediate family The lifeways of early Hawaiians, which depended upon the finite natural resources of these islands, necessitated the development of sustainable resource management practices. Over time, what developed was an adaptable management system that integrated the watershed, freshwater and nearshore fisheries, which are connected through the many unique ecosystems that extend from the mountains to the sea (Jokiel et al. 2011). Kānaka Maoli were masters of exploring, utilizing, and maximizing the wide array of island resources and incorporated forms of traditional land use, such as the practice of *mālama*: "to take care of, tend, attend, care for, preserve, protect, beware, save, maintain; to keep or observe, as a taboo…" (Pukui and Elbert 1986:232). The practice of *mālama* was a shared responsibility that was reinforced at the personal, familial, and social level. In traditional Hawaiian society, all persons who exercised their right to utilize a resource were also expected to follow social and customary rules and rituals, one of which included the practice of *hoʻokupu* (giving of offerings) to the many *akua*, who in their elemental forms imparted abundance and fertility to the land and sea.

Hoʻokupu & *Pule*: Reciprocity as a Means to Maintaining Spiritual Balance and Abundance

While the people were responsible for tending to the land and sea, it was the prerogative of the aliʻi to care for the and maintain the solidarity among the people (Malo 1951). Sustaining a reciprocal relationship with the *kini akua* (multitude of gods) and *ʻaumākua* (ancestral gods) however, was traditionally a task undertaken by all classes of people. This was accomplished through ritualistic processes, including *pule* (prayers), giving *hoʻokupu* in the form of physical offerings, and also performing *heiau* (temple) rituals. Maintaining balance with the gods was a practice vital to the life of Kānaka Maoli. Failure to provide an adequate tribute to the gods was believed to disrupt the solidarity of the land and people, thereby provoking the gods to unleash their elemental powers upon them.

Kilo: Astute Observation of the Natural World

Kilo or perceptive observation of the natural world was perhaps one of the most fundamental stewardship tools used by the Kānaka Maoli. The practice of *kilo* enabled them to observe and record the subtlest changes, distinctions, and correlations in their natural world and acquire specialized knowledge. Examples of their keen observations are evident in Hawaiian nomenclature, where numerous types of rains, clouds, winds, stones, terrestrial and oceanic environments, flora, and fauna—many of which are geographically unique have been given distince names). For example, Pali Kilo is a hill located at Mōkapu Peninsula and was the location of two significant archaeological sites dedicated to fish—a large *heiau* dedicated to Kū and Hina and a *koʻa* (fishing shrine) that contained the stones of Kāne and Kanaloa (Sterling and Summers 1978:202-203). A lookout tower once stood on the bluff that was specifically constructed to *kilo* the offshore fishery and to scan the area for intruders. Other names are recorded in centuries-old traditions such as *oli* (chants), *mele* (songs), *pule*, *inoa ʻāina* (place names), and *ʻōlelo noʻeau*, which were transmitted orally from one generation to the next. Kānaka Maoli's knowledge of the natural environment was further reinforced through other traditional practices and arts including, but not limited to, *lawaiʻa* (fishing) and *mahiʻai* (farming), as well as *hula* (traditional dance), and *lapaʻau* (traditional healing).

Kapu and *Noa*: Harvest Restrictions

As discussed above, the dependence on a finite natural resources led Kānaka Maoli to develop culturally reinforced terrestrial and marine management practices that were governed and enhanced by the concept of *kapu*, which relates directly to *mana*. Kānaka Maoli believed that all natural things, places, and people, especially those of high rank, possessed a certain degree of *mana* or "divine power" (Pukui and Elbert 1986:235; Pukui et al. 1972). The concept of *mana* is derived from the *kini akua*, who were embodied in elemental forces, including the *kai*, the land, certain material objects and individuals (Crabbe et al. 2017). Buck (1993) expands upon this concept, noting that *mana* was associated with the well-being of a community, in human knowledge and skills (canoe building, harvesting) and in nature (crop fertility, weather etc.).

To ensure the *mana* of the resources, certain places, and people remained protected from over-exploitation and defilement, *kapu* of various kinds were strictly enforced and violators faced serious consequences including death (Jokiel et al. 2011). According to Elbert and Pukui (1986:132) *kapu* are defined as "taboo, prohibitions; special privilege or exemption..." Kepelino (1932) notes that *kapu* associated with the gods applied to all social classes, while the *kapu* associated with the chiefs applied to the people. Some *kapu*—particularly those associated with maintaining social hierarchy and gender differentiation—were unremitting, while other *kapu*, such as those placed on natural resources were applied and enforced according to seasonal changes.

As the laws of *kapu* dictated social relationships, they also provided "environmental rules and controls that were essential for a subsistence economy" (Else 2004:246). The application of *kapu* to natural resources ensured that they remained unspoiled and available for future use. When the *aliʻi* or the lesser chiefs, including *konohiki* and *poʻo lawaiʻa*, determined that a particular resource was to be made available to the native residents, a decree was proclaimed indicating that *kapu* had been lifted, thereby making it *noa* or "freed of taboo, released from restrictions, profane, freedom" (Pukui and Elbert 1986:268). Although the transition of a resource from *kapu* to *noa* allowed for its use, people were still expected to practice sustainable harvesting methods and pay tribute to their ruling chief, as well as the gods and goddesses associated with that resource.

Specific details about the *kapu* system as a marine resource management tool were described by early visitors of the islands, including Scottish surgeon and naturalist Archibald Menzies, and British Missionary, William Ellis. Menzies was aboard the *H.M.S. Discovery* when he visited Hawai‘i Island during the 1790s, and recorded many observations of Hawaiian culture in his journals, which were published in 1920. In the following journal entry for February 24th, 1793, Menzies provides an account in which a man had been put to death in South Kona on Hawai‘i Island for breaking a fishing-related *kapu*:

> Close to the foot of the marae [heiau], some of the natives pointed out to us the grave of a man that had been put to death about a fortnight before on account of breaking the kapu, which was simply this: The bay had been tabooed some days on account of a large shoal of fish that appeared on the coast, at which time this unfortunate man was seen going across the entrance of it in a small canoe. He was immediately pursued, and when brought on shore, they first broke the bones of his arms and legs, and afterwards put an end to his miserable existence by stabbing his body with their pahoas [daggers]. (1920:72)

Ellis too, recorded details about the traditional repercussions of breaking a *kapu* related to the consumption of fish, which he referred to as “tabu,” during a visit to the Hawaiian Islands in the 1820s as follows:

> The flesh of hogs, fowls, turtle, and several other kinds of fish, cocoa-nuts, and almost every thing offered in sacrifice were *tabu* to the use of the gods and the men; hence the women were, except in cases of particular indulgence, restricted from using them. . . Particular fruits, animals, and the fish of certain places, were occasionally *tabu* for several months from both men and women (Ellis 1831:387).

Ellis continues, “when the fish of a certain part are tabued, a small pole is fixed in the rocks on the coast, in the centre of the place, to which is tied a bunch of bamboo leaves, or a piece of white cloth” (1831:389). In relating some of the consequences of breaking a *kapu*, Ellis tells of the wife of an *ali‘i*, “who was afflicted with an affection of the spine, which prevented her walking without support,” who told them, “she had incurred the displeasure of the gods by eating a fish that was *tabu*, or sacred, and that the disease which rendered her a cripple was her punishment” (1831:375).

Violators of *kapu* who managed to escape death, either sought refuge at a *pu‘uhonua* (a designated place of refuge), or were sometimes freed by the word of certain chiefs (Kamakau 1992). At the *pu‘uhonua*, after completing the proper rituals, the violator was absolved of his, or her, crime and allowed to reintegrate back into society. Kamakau describes the *pu‘uhonua* of O‘ahu below as comprising entire land divisions in some cases:

> The *pu‘uhonua* in ancient times was an *ahupua‘a* portion of a district (*ahupua‘a ‘okana*), like Kailua and Waikane for Ko‘olaupoko district on Oahu, and also Kualoa, which was a very sacred land and a true *pu‘uhonua*, where persons marked for death were saved if they entered it. There were such places all over Oahu. The stronghold (*pu‘u kaua*) Kawiwi in Waianae was a *pu‘uhonua* in time of war. (Kamakau 1964:18)

The importance of fishing-related and fish-related *kapu* in traditional Hawaiian society and the need to respect such practices in modern times is eloquently conveyed by Manuia Maunupau, a practitioner of traditional Hawaiian fishing methods who was born on O‘ahu in 1872, as follows:

> The ancient Hawaiian did everything he could to preserve the fishing ground. No fishing ground can be preserved unless precautions such as the Hawaiians observed are taken. This is true not only of aku and ahi fishing but of every other kind of fishing. The Hawaiians had a kapu on alongshore fishing in certain places when deep sea fishing was open. The kapu places were marked with coconut leaves. In the case of inshore fishing, one place was kapu for a month; then this area was opened and the next was kapu. At certain times of the year, certain seaweeds were kapu, because when fish food was preserved by this means, the shore fishing was saved for the people. There used to be plenty of fish in Hawaiian waters, but these have to a great extend disappeared because constant fishing has wiped them out. The fish are gone for good unless we have closed and open seasons for different kinds of fishing. The government is trying to place certain restrictions on fishing. If the ancient form of kapu used by the old-time Hawaiians could be revived in these new governmental restrictions, we should again have plenty of fish, provided the restrictions were observed as were the kapus in the old days.

> The old Hawaiian fisherman was a skilled and selected person. He had knowledge of, and respect for, the traditions and customs of fishing. He was careful to observe these customs, because through them, fishing was preserved for the coming generations, and his children were trained in the skill they would need as they became fishermen. Fishing in those days was not a matter of getting all the fish and moving on to another fishing ground. The Hawaiian fisherman was much too clever to do this, and he respected the traditions of his people too much to do it. Laws today cannot help to preserve the fish in Hawaiian waters, unless in addition to the laws, we have a feeling of respect for them and observe them because we see that they are beneficial. (Maunupau in Handy et al. 1981)

Maunupau's sentiments are still echoed today amongst native fishing practitioners and should serve as a valued reminder of the importance of maintaining Hawai'i's precious fishing grounds. Another component of the traditional Hawaiian approach to marine resource management was maintaining designated fishing grounds, known as *ko'a*, which are discussed in detail below.

Ko'a

Ko'a were known fishing grounds where non-current swimming *i'a* (fish) congregated, fed, and slept typically located in the depths of the *kai*. The locations of these concentrations of abundanct marine resource were treasured by the fishers who knew where to find them. Although *ko'a* were established underwater fish habitats, they also had a terrestrial component, for the locations of fishing *ko'a* were often identified by markers on the shore. Some of these markers were geological features, such as *pu'u* (hills) or mountain peaks, while others were natural stone outcrops , or single stones and piles of rocks intentionally placed along the shore; "Some *koa* were nothing more than piles of stones built up in the ocean by members of a fishing family. Such *koa* might be markers for a natural fishing ground or serve to attract a fish colony" (Gutmanis 1991:26). These markers were either used as a means to triangulate the location of the underwater ko'a or simply to coincide with the location of the *ko'a*. For instance, Malo relates the following details regarding how *kanaka* used two points on the land to triangulate the location of deep-sea *ko'a*:

> These koa-lawaia were so deep under water that the eye failed to perceive them, nor could the fish be seen when swimming over them, nor when they seized the hook. In order to find them, it was necessary to take one's bearings from the land. Two bearings were required; and where these were found to intersect, there was the koa, and there the fisherman let down his hook or his net. (1951:211)

Thus, *kānaka* used their deep understanding of the Islands' terrain, both beneath the sea and on land, for their fishing pursuits. In the late 19th century publication *Hawaiian Fisheries and Methods of Fishing*, Beckley elaborates on this point as follows:

> . . . Every rocky protuberance from the bottom of the sea for miles out, in the waters surrounding the islands, was well known to the ancient fishermen, and so were the different kinds of rock fish likely to be met with on each separate rock. The ordinary habitat of every known species of Hawaiian fishes was also well known to them. They often went fishing so far out from land as to be entirely out of sight of the low lands and mountain slopes and took their bearing for the purpose of ascertaining the rock which was the habitat of the particular fish they were after, from the positions of the different mountain peaks. (1883:10)

Locating underwater *ko'a* was only one part of a successful catch. In order to ensure that they would return with food, *po'e lawai'a* had to combine their knowledge of each particular *i'a* sought with their understanding of the most practical materials, methods, and *palu* (bait) for catching them. As discussed above, they also had to observe very specific *kapu* that were dependent upon their particular *akua*, and spiritually express their intent and thankfulness through rituals conducted both prior to, and after, fishing. Furthermore, the success of a *po'e lawai'a* could also be enhanced through the spiritual guidance provided by an *akua* that dwelled within a *ko'a* stone, which was sometimes associated with a *kū'ula* (discussed in the following section):

Some terrestrial *ko'a* also served as fishing shrines (Figure 25) where Kānaka Maoli made offerings and recited prayers either hoping to secure a good catch, or expressing gratitude for the sea's bounty. Elbert and Pukui (1986) explain that these types of structural *ko'a* were utilized in ceremonies that would cause the fish to multiply. Kamakau (1964:33) points out the *ko'a* kū*'ula ho'oulu i'a* was used to increase pelagic quantities, while the *ko'a ho'oulu 'o'opu* was built for the *akua* Kaneko'a and could be found along riverbanks, streams, shorelines, and inland ponds to increase *'o'opu* ("fishes included in the families Eleotridae, Gobiidae, and Bennidae") quantities (Pukui and Elbert 1986:290).

At Mōkapu Peninsula in He'eia and Kāne'ohe Ahupua'a at the base of Keawanui once stood a *ko'a*. It consisted of a small platform where *pōhaku* (stone) dedicated to Kāne and Kanaloa stood upright (McAllister 1933:184). In

1952, Sterling and Summers reported that the *ko'a* had been destroyed to create the runaway for the Marine Corps Base Hawaii (1978:203). They relate the following story regarding Keawanui and Keawaiki:

> Keawanui and Keawaiki were two Hawaiians living at Mokapu. One day they were visited by two men, strangers who came from across the bay, one of whom was lighter in color than the other. While they were the guests of Keawanui and Keawaiki these two men built the small fishpond known as Paohua. This is a low line of stones completely covered at high tide which only partially incloses [sic] an area not more than 30 feet across. Once the ohua, the fish usually caught here during the spring months, enter into this area, they seem unable to get out, and today this is the most famous fishing place in the region. On the beach just above Paohua is a large rock with a shallow depression in which the fish are placed after being caught. It is said that they cannot flop out of this bowl. After being hospitably entertained by Keawanui and Keawaiki, the strangers took their departure; and as the hosts watched their guest leave they saw them walk out over the water into the distance. This was their first indication that they had been entertaining the gods, Kane and Kanaloa. The fishing shrine with the two stones, one light in color (Kane) than the other, commemorates this visit.

Figure 25. *Ko'a* at He'eia State Park with Kāne'ohe Bay and Mōkapu Peninsula in the background, view to the east.

In the vicinity of Pā'ōhua, near Kāne'ohe Bay, is another site connected to the *ko'a* mentioned above. This site consists of two stones that represent Kū and Hina, which were approximately 75-feet from the shoreline (Sterling and Summers 1978:204). The stones were said to have been removed by George Moa who threw them into the ocean. Reportedly Moa became insane and died. However, the two stones could be seen during low tide. Due to dredging of Kāne'ohe Bay, the stones were moved and have traveled deeper into the ocean. It should also be noted that historian Martha Beckwith noted that in discussions with David Malo, he expressed that Kū and Hina are both prayed to by fishermen while he softly recited the prayer he personally used to invoke *kū'ula* (Beckwith 1970:11). Stones believed to embody Kū and Hina depicted in Figure 26 are still found at Kānewai Fishpond.

Figure 26. Kū and Hina *ko'a* stones at Kānewai Fishpond, view to the east.

Kū'ula

A *kū'ula*, meaning "red Kū," is "any stone god used to attract fish, whether tiny or enormous, carved or natural, named for the god of fishermen" (Figure 27); it is also a "heiau near the sea for worship of fish gods;" and a "hut where fish gear was kept with kū'ula images so that gear might be impregnated with kū'ula mana, usually inland and very taboo" (Pukui and Elbert 1986:187). Maunupau, who was intimately familiar with various *ko'a* and their respective *kū'ula* situated along the coast of Hawai'i Island, relates that "the fishermen of old Hawaii believed that they needed some supernatural power to aid them in their undertaking, and hence religion and fishing were closely connected by ceremonies and customs" (in Handy et al. 1981:106). Maunupau provides the following details about *kū'ula*:

> . . . In the olden days, every heiau or temple had in it a fish god or kuula. Each fisherman had his own kuula. Perhaps it might be a stone or image he had pulled up in the ocean, and which he regarded from then on as his kuula, or it might be the family god or aumakua. The kuula was supposed to bring luck and success in fishing. (Handy et al. 1981:105)

Each *kū'ula* was different in terms of what was *kapu*, because what was made *kapu* for one *akua* was not the same for another. For example, a *lawai'a* could be banned from everything that consisted of the color black in his presence, which would include everything from clothing and househould items to encounters with others who might be dressed in black (Malo 1951:208). Other items considered *kapu* included the use of *'ōlena* (turmeric; *Curcuma domestica*) and *'alaea* (water-soluble colloidal ocherous earth), both of which were used for food, medicinal, and clothing dye, among other things.

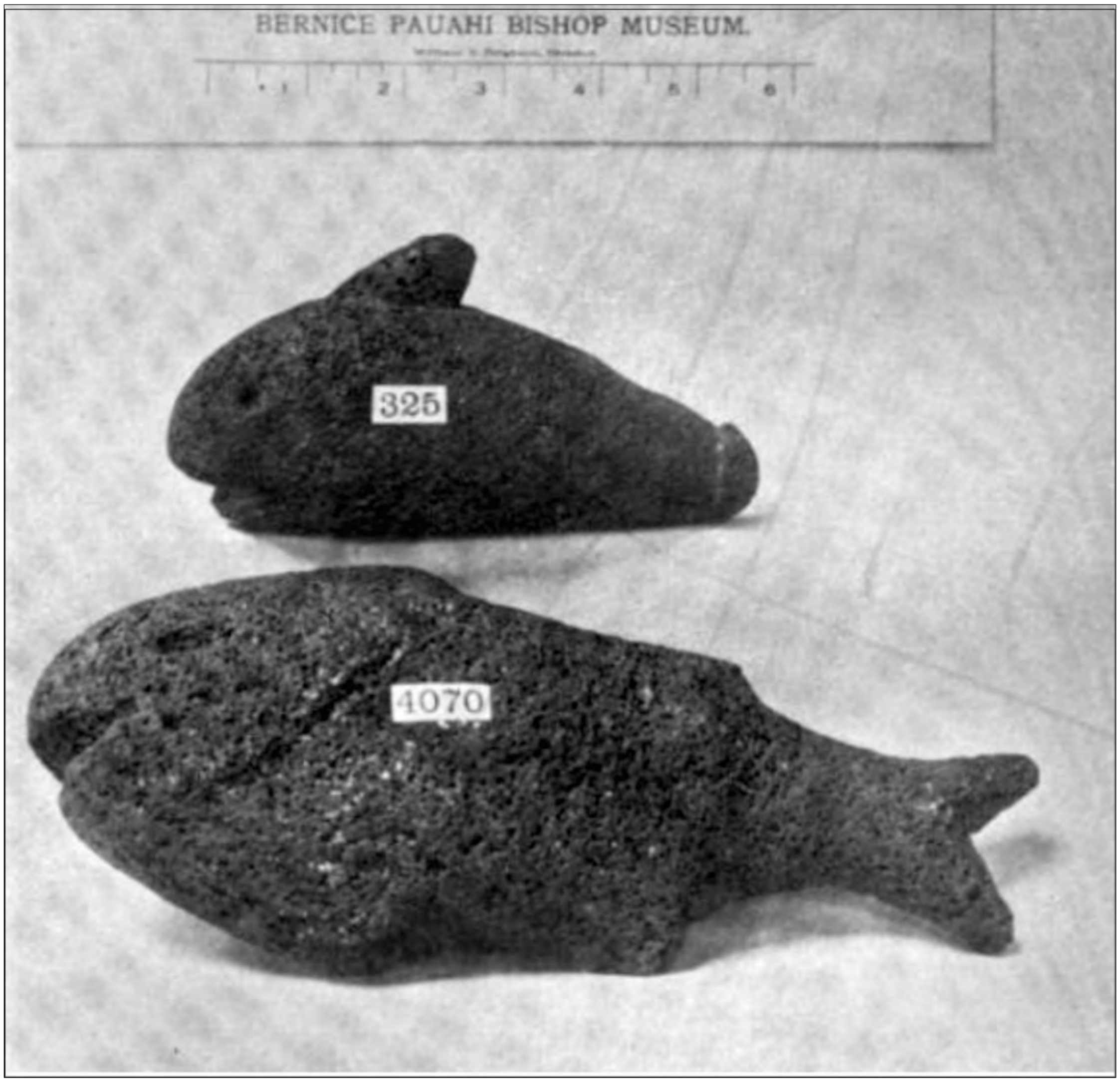


Figure 27. *Kū‘ula* stones (Brigham 1902:94)

According to a legendary account, the goddess Hi‘iaka mentions a *kū‘ula* known as Malei, who was also believed to be a *kupua* (demigod,) in a chant (Emerson 1915). Half-way through the Kaiwi Channel, on her way to O‘ahu from Moloka‘i, Hi‘iaka addresses Malei with the following condolences, which also mention other storied places on Oahu:

Owau e hele I n alae ino o Koolau,	I walk your stormy caps, Ko‘olau,
I n alae maka-kai o Moe-au;	The wave-beaten capes of Moe-au,
E hele ka wahine au-hula ana o ka pali,	Watch-towers, where the women who brave the sea
Nana uhu ka‘i o Maka-pu‘u—	May the uhu coursing by—
He i‘a ai na Malei, na ka wahine	Meat for the woman who faces the gale,
E noho ana i ka ulu o ka makani	Sea-food for the woman Malei;
I Koolau ke ola, i ka huaka‘i malihini	For her living comes from Koolau,
Kanenae i ka we-uwe‘u,	From the pilgrim bands that pass her way;
Ola i ka pua o ka mauu.	Yet we bless the herbs of the field,
E Malei e, e uwe kaua;	Whose bud and flower is meat for Malei:
A e Malei e, aloha-ino no, e.	We pity and weep for Malei. (Emerson 1915:88)

Additional accounts regarding Malei are reported by Sterling and Summers, such as a story in which some men attempted to dig Malei out of the ground but failed to find the *ku‘ula* and fell ill after they heard a voice say, “Onia i paa” or “Move so you cannot be removed” (Sterling and Summers 1978:258). Another account describes Malei being placed at Makapu‘u and how the *ku‘ula* was responsible for increasing the *uhu* population from Makapu‘u Point to Hanauma Bay (Sterling and Summers 1978:259). Once Malei was established on the eastern shoreline, *ali‘i* and *maka‘āinana* placed offerings of *limu līpoa* on the *ku‘ula*.

In describing the purpose of *kū‘ula*, Kihe relates that “*…aia maia wahi he kuula, oia hoi, he wahi hooulu i‘a a maia wahi e hanaia ai na hana hoomana hooulu i‘a, a hoolaupa‘i a hoomomona hoi i ka i‘a…*[located at this place was a *kū‘ula*, that is, a place to increase the fish and at the place is where ritual occurred to increase the fish, and multiply and fatten the fish…]” (1924:4). In his chapter titled “Fish and Fishing” Donald Mitchell repots that large *kū‘ula* were often “set up on promontories along the sea shores, or near streams and ponds” while “small *kū‘ula* were carried to sea in the fishing canoes to attract fish” (Mitchell 2001:151). Per Mitchell, some *kū‘ula* were contained within *heiau* and “set in circular enclosures, nearly always built of limestone or coral,” (ibid.). His description continues thusly,

> Within the enclosure of the large shrine, sometimes called a heiau *ko‘a*, an *imu* was kept. Here pigs were cooked and eaten, along with other feast foods, as part of the ceremony of dedicating a new fishnet. Also within the area was a *lele* altar where bananas were offered. These may be a tribute to Kanaloa who is associated with bananas. (These fruits were never carried to sea by fishermen.)
>
> The customs seem to have differed among the fishermen as to the number of fish that would be left on the fishing shrine when they returned from a successful catch. This is understandable since the fishermen prayed to and respected their own family *‘aumakua* as well as Kū‘ula.
>
> Upon returning from the sea some fishermen went to the *ko‘a* with two fish in their right hand for the male *‘aumākua* and two in their left hand for the female *‘aumākua*. They addressed the gods and placed the fish on the altar. After the gods had received the “essence” (*aka*) of the offering the fishermen were free to take the fish away and add them to the catch for distribution and use.
>
> Maunupau wrote that the first fish caught was marked by cutting off its tail. It was placed in the bow of the canoe and was *kapu*. When ashore the fishermen placed this fish on the *kū‘ula* for his *‘aumakua*. (2001:151-152)

The cycle of giving back to the *akua* was accomplished through regulatory tribute associated with the *kū‘ula*. There are contrasting accounts as to how this was accomplished, but Maunupau relates that “the first fish caught was marked with a tail or fin mark and saved as an offering to the kuula” (Honolulu Star-Bulletin 1931). Similarly, Keli‘ipio and Nakuina (1900:111), writing during the late 19th century, expanded upon this practice but refer to ku‘ula as an *akua* unto itsels, as follows:

> The first fish caught by fishermen, or any one else, was marked and dedicated to Kuula. After this offering was made, Kuula’s right therein being thus recognized, they were free from further oblations so far as that particular variety of fish offered was concerned. All fishermen, from Hawaii to Niihau, observed this custom religiously. When the fishermen caught a large supply, whether by the net, hook or shell, but one of a kind, as just stated, was reserved as an offering to Kuula; the remainder was then free to the people.

Another account tells of offerings made at the *heiau* dedicated to Kū‘ula were made immediately upon the return of the canoe to the shore:

> As soon as the fishing fleet reached the shore, the head fisherman stepped ashore holding an aku fish in each hand and went to the heiau of Ku‘ula where he offered prayer; and when he had finished this worship of the god, he threw down the fishes for the male aumakua on one side and those for the female on the other. (Kamakau inTitcomb 1972:44)

Kū‘ula bear the name of Kūka‘ilimoku (Kū), an *akua* traditionally associated with war. Fishermen often prayed, and still pray, to Kūka‘ilimoku and his wife Hina (Beckwith 1970:11). Kūka‘ilimoku, as the ruler over all of the male gods, had dominion over Kū‘ulakai, an *ali‘i* and *akua* of Hānā, Maui, who himself controlled “all the gods of the sea” (1970:19). Valeri (1985) relates that Kū‘ulakai married Hinapukui‘a (“Hina gathering seafood”), whose dominion was over the shoreline, and to them was born their son ‘Ai‘ai (“eats food”). Fishing stones dedicated to Hina and ‘Ai‘ai were once utilized by the ancient fishers of Hawai‘i. The *mana* of Hina was said to control certain fish, namely the *aku*, *akule*, *‘ō‘io*, *moi*, *a‘u*, and the *manini* (Fornander 1919-1920). Fornander relates that things that were reddish in color were considered sacred to Kū. Therefore, in addition to *‘aumākua*, *kū‘ula* stones were imbued with the spirit of their namesake Kūʻulakai as well as Kūkaʻilimoku. The following account, compiled by June Gutmanis (from George Ai, Louis Aila, Ned Burgess, Arthur K. Cathcart, Ah Sam Cheong, Thomas Maunupau, Kalahikiola Naluelua, Henry Young, and Maryknoll Kalahikiola Sotkaeff), details how *kūʻula* stones acquired the spirits within them. This account explains the mutually beneficial relationship between *kūʻula* and their *poʻe lawaiʻa* caretakers:

> *Kuʻula* stones were believed to contain a spirit that attracted fish and helped fishermen. They could be either naturally shaped stones or slightly worked. According to tradition, the naturally shaped stones contained a spirit, either placed there by the gods or there of its own choice. A man-made *kuʻula* was believed to receive its spirit only after appropriate prayers and offerings had been made. The *kuʻula* could be either of black- or light-colored stone; some said that the dark stones were male and the light ones female.
>
> A naturally formed *kuʻula* might be found by a fisherman realizing that the stone contained a spirit. Other times, it was believed, a stone chose a fisherman for its *kahu* (caretaker). It might come to him in a dream, saying, "I am cold, come and get me." The fisherman would ask, "What do you say? Where are you?" The stone would then describe just where it was and how to find it, what to bring as an offering, and when to come for it. Sometimes the stone would not reveal what it wanted the first time it appeared in a dream. It might take days, weeks, or even months before the stone revealed its whereabouts. If the stone was female and the dreamer a man, the stone might even flirt with him.
>
> The dreamer would search for the stone, carefully following all the directions given by the *kuʻula*. When found, the stone would have the mouth of a fish. It when then be taken home and put in a *kapu* (taboo) place where nothing could disturb it. Only the guardian chosen by the stone could handle it. It was believed that if others handled it and the stone did not wish them to, it would become hot like fire.
>
> Those who had *kuʻula* stones believed that caring for them was as serious as caring for a baby. The guardian would ask the *pohaku* (stone) what it wanted. The answer would come in a dream or vision. The *kuʻula* had to be fed three meals a day. If even one meal were missed, the guardian could be in for trouble. It also needed clothing—a *malo* (loincloth) that could be wrapped around the stone or used as a blanket. The *malo* had to be kept very clean.
>
> According to tradition, if the stone was well cared for and all of the requirements met, its guardian would profit richly. It was said that the more you gave the stone, the more fish you would catch. Lights, laughter, and activity would bless the home of the caretaker.
>
> Sometimes the *kuʻula* would vanish. Like a little child it would go out to play and disappear. But apparently it always knew when it was time to come home and would then reappear.
>
> A person in need of help would traditionally make offerings to the stone and wait. It might take days or even months, but when the stone was ready, it would give the location of a school of fish. It would also tell what time of day the fish would appear and what line or net and bait to use. When caught, the fish were to be shared with everyone. Pregnant women customarily received double the share of others. (Gutmanis 1991:26-28)

Per Gutmanis, an vital aspect of the keeping of *kūʻula* was that they were transferred from one generation to the next:

> A *kuʻula* could be used for generations. When the guardian had grown old, the stone would tell him who the next caretaker should be. It would know which child in the family should carry on the tradition. It was believed that the stone could "fall in love" with anyone.
>
> Sometimes the *kuʻula* would be given to a member of the family, but the guardian would not tell the chosen person the purpose of the stone. One night the stone would come to its new caretaker and reveal its name, its work, and how to care for it. It could be within a few days or it might take years.
>
> Belief in the *kuʻula* and *koa* stones continues. The traditions surrounding them are still practiced by some, and the recipient of such a stone must care for it. Its powers are unknown and untapped. The stone may be a source of power for good, and, if treated with respect, one that will reward its guardian richly. (Gutmanis 1991:26-28)

Thus, the continued care and worship of *kūʻula* by Hawaiian *poʻe lawaiʻa* was a quintessential spiritual practice and heritable custom that endures as a tangible connection to the past. Drawing upon the knowledge of the ancient *poʻe lawaiʻa*, whose spirits remain tied to the depths of the *kai* and the treasured *kai lawaiʻa* (fishing grounds), it is clear that Kānaka Maoli revered all marine life and holistically managed the marine resources. Since becoming a *poʻe lawaiʻa* was a privilege, each fisher felt a deep respect for the ocean's cosmic connection with the heavens and the earth, and while it was their job to provide food for their *'ohana* and *ali'i* on land, they made it their *kuleana* to protect and perpetuate the ancient fishing grounds. Although the *'ike* (knowledge) of Kānaka Maoli extended from the mountain tops to the depths of the ocean, for the purposes of the current study, the remaining discussion will focus on the traditional fishing methods, beliefs, and cultural practices associated with the nearshore fisheries that are within the study area vicinity.

***Loko I'a*: Fishponds**

Another method by which Kānaka Maoli sustainably supported themselves was through the creation of a distinctly Hawaiian aquaculture system, known as *loko i'a* (fishponds). Although not used for aquarium collection, as a number of functioning *loko i'a* are still found within the coastal portion of the current study area, a discussion of these vital components of traditional Hawaiian resource management is presented below. Present-day *loko i'a* located within the study area include Waikalua Loko in Kāne'ohe Ahupua'a, He'eia Fishpond in its namesake *ahupua'a* (Figure 28), Kahouna Fishpond (also known as Kahalu'u Loko I'a also in its namesake *ahupua'a*), Mōli'i Fishpond in Hakipu'u Ahupua'a (Figure 29), Kānewai Loko I'a in Waikīkī Ahupua'a, Kalauha'iha'i Fishpond in Waimānalo Ahupua'a, and Loko Ea and 'Ukoa Pond in Kawailoa Ahupua'a. The term *loko* is used as the general term to refer to any pond, lake or pool of water and *i'a* referring to the fish that were raised therein (Pukui and Elbert 1986). While the initial origins of *loko i'a* remain largely unknown, some walls have been carbon-dated to AD 1400 (Keala et al. 2007).

Traditional lore associates this engineering feat with the god Kū'ulakai (Fornander 1919-1920; Valeri 1985). Kū'ulakai is said to have built a large fishpond next to his home that was filled with fish (ibid.). These fish were considered the bodies of Kū'ulakai, his wife Hinapukui'a, and their son 'Ai'ai, all of whom were important fishing gods (Fornander 1919-1920). A report by Surveyor John Cobb details traditional Hawaiian lore attributing the construction of *loko i'a* to the Menehune, the legendary race of small people who worked at night building fishponds, roads, and *heiau*. The *loko i'a* were typically owned by the *ali'i* who employed *konohiki* to manage and oversee the daily operations while *maka'āinana* (commoner) were principle laborers who built and repaired the pond walls. Cobb was fascinated by the fishponds and noted "this is the only place in United States territory where fish ponds are found on such an immense scale and put to such general and beneficient use" (Cobb 1902:746).

Figure 28. He'eia Fishpond, view to south.

Figure 29. Mōliʻi Fishpond in Hakipuʻu Ahupuaʻa with Kāneʻohe Bay beyond.

During the early 1900s, The United States Fish Commission conducted an in-depth report of commercial fishing throughout the Hawaiian Islands; Cobb surveyed the island of Oʻahu and counted seventy-four fishponds yielding 560,283-pounds of fish with a value of $148,850 (Cobb 1902:749-750). Cobb reported that there were probably double the amount of fishponds a mere thirty years prior to his 1900 survey. His reasons for the decline in fishponds include a diminishing native population who once tended to the ponds on a regular basis; the conversion of *loko iʻa* to rice and *kalo* (taro; *Colocasia esculenta*); the introduction of invasive species that overtook *loko iʻa*; and the filling in of ponds for residential development (Cobb 1902:747). In 1964, Catherine Summers of Bishop Museum reported a count of ninety-seven fishponds in the publication titled *Hawaiian Fishponds* (Summers 1964)

Loko iʻa were a vital component of the total food production system in Precontact times and their primary purpose, as purported by Apple and Kikuchi was to make "fresh food, available in quantity at call…" (1975:6). Keala et al. elaborate on this theme, and note that fishponds "…were used to provide a reliable, convenient, and every-ready supply of fresh seafood for the ruling *aliʻi* (chief) and the royal court" (Keala et al. 2007:7). During Precontact times, and even into the early Historic period, all *loko iʻa* and their products were strictly controlled by the ruling class. Apple and Kikuchi relate the importance of *loko iʻa* to Hawaiian nobility and the general populace thusly,

> Access to these ponds and their products was limited to the elite minority of the native population-- the chiefs and priest. Prehistoric ponds and pond products appear to have been taboo to the vast majority of Hawaiians and to have yielded them no direct benefit. However, indirect public benefit came from ownership by the chiefs of exclusive food sources. Royal fishponds and their terrestrial equivalents, the royal gardens (Kōʻele), insured less demand on the commoners' food production resources. Every fish taken from a royal fishpond left its counterpart in natural habitat available to lesser chiefs and commoners. Ownership of one or more fishponds was one of the ultimate, high-status symbols in the status-conscious Hawaiian culture. (1975:2)

Although fishponds and their products were closely guarded by the ruling *aliʻi*, and practically off-limits to the common people, they helped reduce pressure on the nearshore resources and thus provided a sustainable supply of fish for the massive royal courts that formerly dotted the coast of Oʻahu. While the construction of a fishpond was an enormous undertaking that required the labor of many individuals,fishponds did not require as much labor to maintain; unless the fishpond was impacted by severe weather or war (Apple and Kikuchi 1975). Apple and Kikuchi (1975) identified five primary types of fishponds:1) *loko kuapā*, characterized by its seawall (*kuapā*) in which at least one *makahā* (sluice gate) was built; 2) *loko puʻuone* (or *loko hakuone*), identifiable by its natural elongated sand barrier that enclosed a body of water; 3) *loko wai*, a body of fresh water typically found inland from the shoreline; 4) *loko iʻa kalo* (or *loko loʻi kalo*), a fishpond that utilized an irrigated taro plot; and 5) the *loko ʻumeʻiki*, a fish trap recognizable by its numerous stone-flanked lanes that allowed fish to move into or out of the trap with the ebb and flow of the tide. With the exception of *loko wai* and *loko iʻa kalo*, which were inland freshwater ponds, all remaining fishponds were constructed within the littoral zone and were nourished from a mixture of freshwater (*wai*) and seawater (*kai*) (Keala et al. 2007). Per Kamakau, women were not allowed to walk on *kuapā* during their menses as the walls would be considered defiled (Kamakau 1976).

Guard houses or *hale kiaʻi* (Figure 30) were known at seven fishpond locations throughout the Hawaiian Islands. *Hale kiaʻi* were not considered the primary residence for keepers; instead, they functioned as a shelter for keepers while on patrol The only *loko iʻa* on Oʻahu associated with a *hale kiaʻi* was Heʻeia Fishpond (Apple and Kikuchi 1975:23) Hawaiian historian Samuel Kamakau wrote in the Hawaiian Language newspaper *Ke Au ʻokoʻa* on Dec. 9, 1869:

> On the nights when the tide was high every kiaʻi (keeper) slept by the makahā of which he had charge, and it was the kiaʻi loko (keeper of the pond) custom to build small hale kiaʻi from which to guard the fish from being stolen or from being killed by pigs and dogs (Apple and Kikuchi 1975:24).

Figure 30. Heʻeia Fishpond *hale kiaʻi* and *mākāhā*.

Traditionally, the primary species raised within *loko iʻa* were herbivores, specifically the *ʻamaʻama* (mullet; *Mugil cephalus*) and *awa* (milkfish; *Chanos chanos*) were. While grown primarily for food, these two species were part of a grouping of fish that were traditionally known as *puaʻa kai*, literally translated as "sea pig," which were used as a substitute for pig offerings (Pukui and Elbert 1986:345). Other species of fish that were considered *puaʻa kai* included the *āhole* (*Kuhlia sandvicensis*), *humuhumunukunukuapuaaʻa* (*Rhinecanthus* sp.), *kūmū* (*Parupeneus porphyreus*), and *pualu* (*Acanthurus* sp.). Tribute to the respective gods was an important component of maintaining a fishpond and detailed in the account concerning the great fishpond of Pāʻaiea which was consumed by Pele after being denied fish from the head fisherman (Maguire 1926).

The *ʻoʻopu hue* or white-spotted puffer, which is also on the Top 20 Species list, was an integral component to *loko iʻa* health as it helped keep the *mākāhā* clean. Commonly referred to as the balloonfish, it is known in Japan as *fugu* and considered a deadly delicacy. A biography detailing the recollections of *kiaʻi* of Mōliʻi Loko Iʻa, George Uyemura, recounts when it was legal to sell *ʻoʻopu hue* in the markets. Most of the customers that served this special dish were the Japanese teahouses of Honolulu until it was later banned for sale (Sato and Lee 2007:82). The *ʻoʻopu hue* was an easy fish to cultivate as it came to the *mākāhā* to feed and could be harvested year-round:

> At night and in the early morning hours, George could hang a light over the sluice channel and scoop up the slow-swimming balloonfish as they swam by. The market was small and very limited, but balloonfish was one of the few species George was able to harvest on demand, according to the needs of the market. (2007:82)

TRADITIONAL HAWAIIAN NEARSHORE FISHING TECHNIQUES

Kānaka Maoli were tremendously adept *poʻe lawaiʻa* (fishers) who were intimately connected to the *kai* and its underwater environment. They were sensitive to the ocean's ever-changing conditions and developed myriad methods to harvest the ocean's bounty wherever they lived. Fishing methods varied greatly within *nā papakū o ka moana* with "a different method in shallow water, and in deep water, and a different method again in the fishing grounds midocean" (Fornander 1920:174). While smaller reef fish, *limu*, shellfish, echinoids, and crabs could be gathered from shallow nearshore waters and along the rocky shoreline of the study area, to access the *kai lawaiʻa* within the open ocean, *kanaka* used *waʻa* (canoes) and specific fishing techniques designed for deep-sea fish. Although the harvesting of nearshore marine resources was a year-round endeavor, offshore fishing was typically done during the summer months when the sea was calm and particular types of *iʻa* were more plentiful. (Handy and Pukui 1998). The larger deep-water fish species that were "treasured most for subsistence" included *ʻahi*, *aku*, *aʻu*, *mahimahi*, *naiʻa*, *kumu*, *ʻōpelu*, *pānuhunuhu*, *hala hala*, *uhu*, and *ulua* (Handy and Pukui 1998:223). Handy and Pukui also describe the gender-based division of labor associated with the different harvest zones of the ocean, noting that "offshore, reef and along-shore fishing was the function of men, while the collecting of shellfish, sea urchins, crabs and the like, and seaweed was done by women and children" (1998:176).

Traditional nearshore and intertidal marine zones identified by Malo (1951) and elaborated on by Fornander (1920) and Kamakau (1979) included the *ʻae kai*, also referred to as *lihi kai* (water's edge), the *pāhola*, also known as the *hohola* or *pālaha* (where the water spread about), the *puʻeone*, (sand dunes), also the *poʻina nalu*, *poʻina a kai,* or *poʻina kai* (where the waves break). There were also places specifically designated for the catching of small black crabs known as the *kai ʻelemihi* and *kai haha pāpaʻi*, and for the gathering of cowry, or *leho* known as *kai ʻo leho*. Similarly, *uhu* (parrotfish) were gathered in the shallow waters known as *kai kākā uhu* with dip nets such as the *ʻupena pōuouo*, *ʻupena kākā uhu*, or *ʻupena kākā ʻōpule* often lured by another *pākali* (decoy) *uhu* (Kahāʻuelio 2006). Pole fishing (*kā mākoi*) was conducted in shallower waters when the *kai paeaea* (calm seas) occurred (Kamakau 1979).

The methods used for fishing were dependent upon the type of marine species that were sought. Some methods required nothing more than a gentle, but swift hand and a watchful eye, while other methods required specialized fishing apparatus that were crafted from a blend of natural materials including, but not limited to, processed plant fibers, shell, bone, wood, stone, and foliage. Thus, fishing required careful preparation of not only the fishing tools, but also deliberate composure of the mind, body, and spirit to properly attune with nature (Handy et al. 1981). According to Handy et al. (1981), careful protocol was observed in each step of the preparation for fishing from the shaping and lashing of *makau* (hooks) and *pā* (lures), and the weaving of *ʻupena* (nets) and *hīnaʻi* (baskets) to the shaping of *ʻō* (spears), the storing of the different fishing apparatus, the observation of *kapu* by members of the *ʻohana,* and the silence required prior to an expedition.

Some fishing was done on an individual basis, but as demonstrated below, the traditional practice of nearshore fishing at times involved all able-bodied persons regardless of age or gender. Some of these methods are described by the honorable Daniel Kahāʻulelio, who recognized the immeasurable value of preserving, sustaining, and sharing generational knowledge of ancient Hawaiian fishing practices passed down from his *mākua* (parents) and *kūpuna* (elders). After being approached by the editor of *Ka Nūpepa Kūʻokoʻa*, Kahāʻulelio consented to pen a series of columns detailing traditional Hawaiian fishing methodology, the first of which was published on February 24th, 1902. Subsequent to his passing, Kahāʻulelio's articles, originally written in Hawaiian, were translated into English by Mary Kawena Pukui. Kahāʻulelio's comprehensive narratives offer precious insight into traditional methods of marine resource procurement, many of which are filled with personal recollections.

Twentieth-century scholar and *limu* expert, Isabella Abbott, in drawing from an assortment of manuscripts from early works of J. F. G. Stokes, W. T. Brigham, and Hawaiian scholars like Kamakau, also compiled a great deal of information on traditional fishing methods. Abbott's work focused on the ethnobotanical uses of plants in Hawaiian culture, and was published in her book, *Lāʻau Hawaiʻi Traditional Hawaiian Uses of Plants*; her descriptions of nearshore fishing methods are presented below. In the late 1960s, Thomas S. Newman (1970) compiled information about nearshore fishing methods, which he published in his dissertation titled *Makai—Mauka: Fishing and Farming on the Island of Hawaii in A.D. 1778.* Newman, who attempted to "reconstruct sea exploitation practices for specific time periods" (1970:49) compiled information from late 18th and 19th century accounts. Newman relied almost exclusively on the works of Emma Metcalf Beckley (1883) and John Cobb (1902). Accordingly, 20th century sources were omitted from his synopsis as, according to Newman, these sources failed to provide "(1) demonstratable authority on the subject and (2) a careful delineation of the time period reflected in their descriptions" (1970:49).

Emma Metcalf Beckley Nakuina was a Hawaiian judge who presided over water rights cases. She also wrote extensively about Hawaiian culture and folklore (Hopkins 2012). In 1901, John N. Cobb who was the Agent of the United States Fish Commission conducted an investigation of the fishes and fisheries of the Hawaiian Islands to cover "not only the present condition of the commercial fisheries of the islands, but also of their past history and the changes in the methods, extent, and character of the fisheries in historic times, as shown by records or traditions…" since the arrival of foreigners (Cobb 1902:717). Cobb's work included observational research, interviews with local fisherman, and analysis of government documents, newspapers, and other pertinent records, as well as recommendations on possible improvements to the laws in place at that time. Cobbs study detailed ethnic groups who were employed by the fishing industry (further broken down by fishing methods including type of boats used, specific nets, etc.); market values of species and products, and the weight and value by island. The nearshore fishing methods compiled by Newman for Hawaiʻi Island also apply to Oʻahu and are thus presented in the ensuing discussion, which is organized by method.

Fishing with Basket Traps

Broadly known as *hīnaʻī*, basket traps were most often woven using the roots of the climbing *ʻieʻie* (*Freycinetia arborea*) plants; while crude versions of *hīnaʻī* were sometimes made from the vines of the *ʻāwikiwiki* (*Canavalia galeata*) plant (Abbott 1992). Abbott also relates that both "men and women alike laid traps in the reef shallows for small-to-medium-sized fish such as *hīnālea*" (1992:84). *Hīnaʻi* varied in shape and size, some were baited while others were weighted down with a sinker (Figure 31).

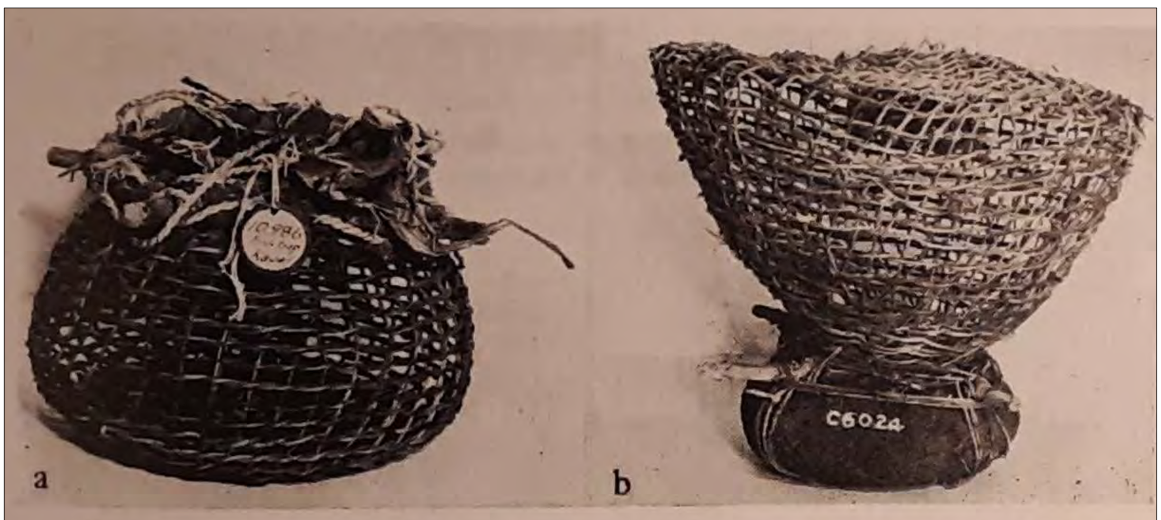


FIGURE 212.—Low, circular traps: **a**, typical form; **b**, with stone sinker.

Figure 31. Basket traps (Source: Buck 1957)

In addition to their use in nearshore waters, some *hīnaʻi* were employed when catching freshwater stream fish including *ʻōpae* (shrimp) and *ʻoʻopu*, which was a practice done almost exclusively by women. Newman related the following details regarding basket traps:

> Relatively few basket traps were made and most were used by women to catch ʻōpae, hīnālea, kala, and ʻuīʻuī. The traps were woven from fresh vines or flexible branches into box-shaped designs. In one common technique, a simple basket was lowered to the bottom in shallow water, often with a bait of pounded shrimp inside and when fish entered the trap, the woman watching nearby would dive to bring the trap to the surface. A more sophisticated version had a conical woven entry protruding into the interior where it terminated in an opening only large enough for a fish to squeeze through. The trap, baited with seaweed, ripe bread-fruit or papayas, cooked pumpkins or sweet potatoes, was lowered to the bottom, and when the fish entered by the conical entry they were unable to find their way back again. (1970:52-53)

One such basket trap was called *hīnaʻi hoʻoluʻuluʻu* (a diving basket), which was made from the vines of the *ʻāwikiwiki (Canvalia galeata*) and later the weeping willow tree to catch *hīnalea* in nearshore waters*.* The method of using the *hīnaʻi hoʻoluʻuluʻu* is described in the book *Hawaiian Fishing Traditions* as follows:

> The hīnaʻi hoʻoluʻuluʻu [diving basket], used in catching hīnālea (a small species of Julis), is a small basket made from the vines of the ʻāwikiwiki (a convolvulus) and is made anew from day to day as wanted. A light framework of twigs is first tied together and then the ʻāwikiwiki vines, leaves and all, are wound in and out round and round till the basket is of the requisite size, three or four feet around and about one and a half feet deep. Shrimp pounded and enclosed in coconut fibre [*sic*] is occasionally placed at the bottom of the basket for bait, but usually the scent of the bruised and withering ʻāwikiwiki leaves seems to be sufficient to attract the hīnālea. Women attend to this kind of fishing. They wade out to suitable places, generally small, sandy openings in coral ground or reef, and let the baskets down suitably weighted to keep them in position. The weights are attached in such a way as to be easily detached. Each woman then moves some distance away from her basket, from where she can watch the fish enter it.
>
> When all the fish in sight have entered, the woman takes the basket up, transfers the fish to a large, small-mouthed gourd, and moves the basket to a fresh place. This kind of fishing can only be done on calm, sunny days at low tide. Since the introduction of the weeping willow, the hīnaʻi hoʻoluʻuluʻu are sometimes made from willow twigs. Such baskets can be used over and over again. Men sometimes take such hīnaʻi and using wana (sea urchin) for bait, with the top of the shell broken to expose the meat, place them in comparatively deep water, piling stones around them to keep them in place. The men leave them for a day or two, and if the place is a good fishing ground, the baskets will be full by the time the men return. (Manu et al. 2006:95)

Other basket traps include the *hīnaʻi uiui* (*Platophrys pantherinus*) which was used on a small flat-fish said to make an appearance every ten, fifteen, and twenty years; when spotted, fishermen and residents usually took this as a bad omen and thought of it as a "precursor of death of a very high chief" (Cobb 1902:732). Other baskets employed were the *hīnaʻi puhi* used for eels and the *hīnaʻi kala* (also known as a *ʻie kala*) that was utilized for catching the *kala*, one of the fish on the Top 20 Species list. A *hīnaʻi kala* was a large trap that could hold up to sixty *kala* at a time (Kamakau 1976:84). Per Kamakau's account, *Limu kala* was used to first feed the fish in a sea pool (*kaheka*) consistently over a period of time. When fishermen saw that the fish were plentiful, an *ʻapi* (feeding basket) was brought back with *limu kala*. Sticks were gathered—*lama* (ebony; *Diospyros*) for warps, *ʻaukā* and *ninika* (Malabar nightshade; *Basella alba*) for the wefts, and *ʻie* (*Freycinetia arborea*) for twine. In the evening, *limu kala* would be dropped in the *koʻa* and the *ʻapi*. The following morning the traps were woven under *kapu*. Those who were weaving the *hīnaʻī* were not allowed to be in contact with a menstruating woman, a corpse, or to leave the site until completion. No shadow was to be cast upon the *hīnaʻī kala* either. Men were not allowed to rejoin their wives or households until the basket was completed. When the basket was completed, a prayer was made to the *akua* who could release the restriction to free the *kapu* (Kamakau 1976:84-85). Once the *kapu* was lifted, husbands could return home and the *hīnaʻī kala* could be used. The day the *hīnaʻī kala* was employed was a highly publicized day where villagers and visitors gathered. Typically, the first day the *hīnaʻī kala* was used, all catches were reserved for the *aliʻi* of that land, the *ʻaumakua*, *akua*, and fishermen (ibid.). The second day the take was for the *kamaʻāina* and fishermen. The first catch was for the *ʻaumakua* to release any restrictions and to make an offering (ibid.).

Collecting Fish by Hand

Hand collecting, which often required nothing more than a watchful eye, a swift hand, and a storage vessel. Hand collection was utilized to catch a variety of nearshore species. In describing the method of hand collecting, a practice that was done by scouring and or diving the nearshore areas, Newman provides the following description of hand collecting, which was primarily a nocturnal pursuit done with the aid of torch light, similar to that depicted in Figure 32,

> Collecting by hand was practiced in shallow water, both on the surface and by diving. Some types of fish were caught by hand in shallow pools as well as by divers in underwater caves while other food items collected by hand included crabs, lobsters, eels, sea urchins, sea cucumbers, shellfish, octopi, shrimp, and seaweed. Much of this type of exploitation was practiced at night, particularly for mobile fauna. No items of material culture were used except for fiber containers in which the organisms were placed, and perhaps the torches used at night to mesmerize fish (Newman 1970:51).

Figure 32. Night fishing with a torch ca. 1948 (Photo credit: Eliot Elisofon).

Fishing with Hook and Line

Although the hook and line method of fishing was primarily used in offshore waters, it was also employed in nearshore waters. Abbott notes that "hooks [Figure 33]were mainly fabricated from non-plant materials—pearl shell, turtle shell, ivory, and bone—but hardwoods like *ʻalaheʻe* [*Canthium odoratum*] and *koaiʻe* (*Acacia koaia*) also played a minor part" and that "…wood served only for the shaft of the two-part hook, the second part being a sharp tip made of bone or another substance that would hold a fine edge" (1992:83). The fibers from the hardy *olonā* (*Touchardia latifolia*) were the choice material for fishing lines. To camouflage the white fibers, fishing lines and nets were often immersed in a dye bath made of pounded *kukui* (*Aleurites mollucana*) bark, which resulted in a reddish brown coloration (Langlas 2003). In some cases the fisher, using just a baited hook and line, simply cast the rig into the ocean from the shore. In describing the use of a hook and line attached to a pole, Newman explains:

> Sub-surface angling was done with a pole and line in shallow water and with hand lines for deep-water bottom fishing…Some were attached directly to the hook, while the palu [chum] bait was merely rubbed on the hook; often a bag of bait was lowered near the baited hooks and released underwater. (1970:62)

Newman also describes a slightly more complex hook and line technique called *kākā*, as follows:

> Kākā Technique:-- Deep-water bottom fishing used a rig of multiple hooks attached by short leaders to the main 3/8th incl (1.7 cm.) fish line at intervals close to the bottom. Each short line with the hook attached was supported by a section of coconut midrib lashed perpendicular to the main fish line which served to keep the multiple hooks separated from one another and from the main line. (1970:62)

Figure 33. Traditional Hawaiian fishhooks (Source: Young 1999).

Fishing with Lures

Fishing lures crafted from a combination of stone, shell, wood, and plant fibers were utilized in the nearshore waters, as well as in offshore trolling. While mother-of-pearl shell was the primary material used for trolling lures, which were attached to a line and dragged behind a canoe to catch offshore pelagic species, nearshore lures were far more specialized and often used to capture *heʻe* (octopus). Octopus lures (Figure 34) were known as *lūheʻe* and Abbot reported the following details about their construction and use:

> In the pre-contact era, octopus was a very highly regarded food, and besides spearing these animals in their holes, Hawaiian fishermen caught them from canoes using two kinds of lures. The simple of the pair consisted of a hood of wood or bone lashed to a stick, a stone attached as a sinker, and a tuft of *tī* leaves to camouflage the hook. The second lure included all these elements but also incorporated the colorful, shiny shell of a Mauritius or tiger cowry (*leho*), bound back to back with the sinker. Since an octopus puts up a good fight, these lures were ruggedly built, tied with *olonā* cordage and perhaps secured with *kēpau* as well.
>
> Similar lures have been made and used throughout Polynesia since time immemorial and, in the hands of a skilled fisherman, are very effective. The octopus (today commonly referred to in Hawaiʻi as "squid") is a keen-eyed animal generally curious about objects introduced into its environment, and it feeds on cowries, so a *leho* lure presented it a double temptation as the fisherman slowly dragged it, cowrie side up, along the bottom. (1992:86)

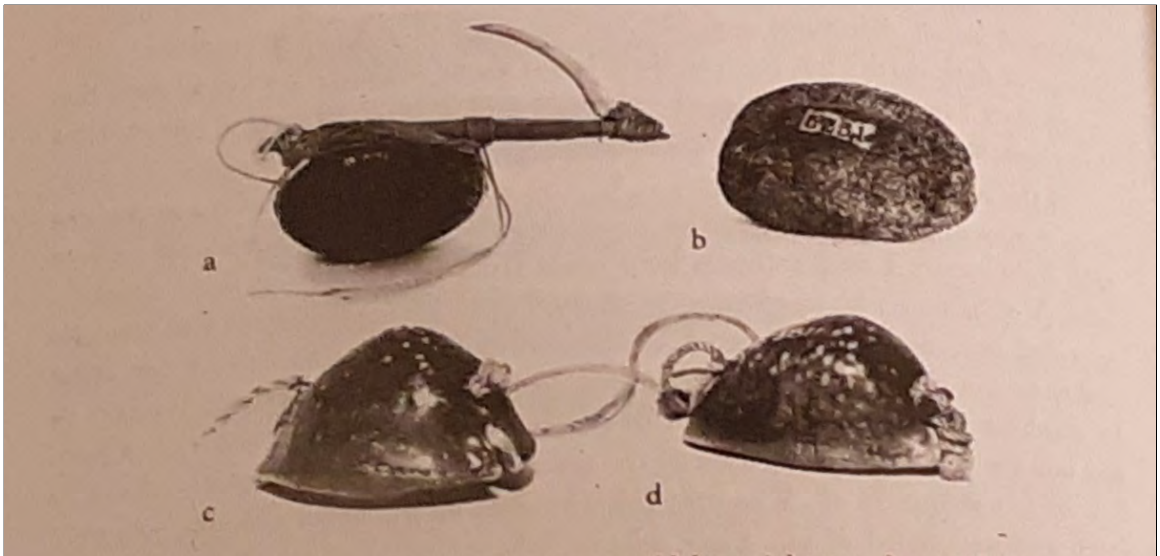


FIGURE 242.—a, *kilo* squid lure; b, stone squid lure sinker; c, lure with knot attachment; d, lure with crossbar attachment.

Figure 34. Examples of *lūheʻe* (Source: Buck 1957).

Kahāʻulelio (2006) describes another traditional fishing technique known as *melomelo*, which involved the use of a carefully curated stick as a lure to attract fish used to attract fish with a net from a canoe. This method was effective in catching various fish including *hīnālea*, which is one of the Top 20 Species (emphasis added), as follows:

> It was a smooth, black stick, as long as from the knuckles to the armpit. It was made black. It had a small knob at the top, around which the line was tied. The stick was constantly toasted over the fire and rubbed with the oil of dried coconuts. The rubbing was done with a piece of *kapa* made of *mamaki* until it shone; then it was wrapped and laid away in the trunk. If we were to smell it, it was heavily fragrant. The canoe went out before sunrise, just outside of the breakers. There were two of us who used to go, my father and I, with a net having meshes two fingers in width, ten fathoms long, and three wide. As soon as the stick was let down, these fishes gathered to the spot: the *palani, mahamea, ʻōpelu, māʻiʻi (palapala), humuhumu,* ***hīnālea*** and so on. The net was lowered from the back of the canoe, then with a cord of the net held fast in the hand, my father leaped overboard and swam. I, in turn, held the *melomelo* stick. He swam around the canoe, where he came to the sticks that held the nets open. He tied them together and went on board the canoe, where he watched the fish circling around the stick. He jumped back into the water and pulled the support sticks until they met. All the fish were caught and we turned shoreward. My father called this kind of fishing a "morning meal," a "cure for hunger," and when the chiefs wanted fish, it was no trouble to get them. (Kahāʻulelio 2006:111)

Fishing with Nets

ʻUpena (nets) of various shapes, mesh width, and sizes were widely used for traditional nearshore and offshore fishing. The fibers of *olonā* (*Touchardia latifolia*) were the primary material from which nets and fishing line were made. *Olonā* required careful cultivation and could only grow in the wetter upland areas. For the fishers who relied on these valued fibers, procuring such material necessitated exchange with those of the uplands—a hallmark activity of the *ahupuaʻa* system (Abbott 1992). Abbott (1992), however, states that the myriad of nets that were traditionally employed can be categorized into four primary types: *ʻupena kuʻu* (gill net); *ʻupena pāloa* (long seine net); *hukilau* (seine net), and scoop nets. In addition, fishers were often seen among the reefs with long nets dangling from their bodies and hands, such throw or cast nets (Figure 35) were introduced by Japanese migrants around 1890, and became known as *ʻupena hoʻolei*, (Mitchell 2001). Elbert and Pukui (1986) list roughly thirty distinct names that were used to refer to different net types. The amount of culture-historical information available regarding traditional net fishing suggests that these methods were likely favored by Kānaka Maoli for the capture of both nearshore and offshore marine species. A selection of different types of nets and traditional netting strategies fishing are described in further detail below.

Figure 35. Man casting *ʻupena hoʻolei*.(Hawaiʻi State Archives PP-22-1-011)

ʻUpena kuʻu (gill nets)

Gill nets or *ʻupena kuʻu* (Figure 36) are so-called because fish become enmeshed within the openings of the net itself along their gills, and are later removed by hand. Of *ʻupena kuʻu*, Abbott writes:

> *ʻUpena Kuʻu* (gill nets)*:* These larger nets, with mesh up to three centimers (one inch) in diameter, were set upright in the water to catch schools of fish such as *ʻōpelu*, and *ʻakule*, species related to the mackerel. They worked by entangling the fills of the swimming fish and ranged from as short as seven meters (twenty-three feet) to ten times that length. (Abbott 1992:83)

Figure 36. Girl with gill net, late 18th century (Hawaiʻi State Archives PP-34-8-008)

Newman also provided the following late 19th century description of different types of gill nets utilized in Hawai‘i:

> Gill nets were designed to entangle the fish in a net with a fairly large mesh instead of merely trapping them within an encircling small mesh net wall as was done with seines and bag nets. Gill nets were manufactured in different sizes according to the type of fish to be caught and the habitat to be exploited, ranging in length from about 55 feet (17 meters) to over 1,200 feet (366 meters), in depth from seven feet (2 meters) to 25 feet (8 meters), with mesh size from one-half to seven inches (1.2 to 17.7 cm.).Three basic techniques were used in gill netting:
>
> 1. letting the net remain stationary and allowing the fish to entangle themselves in the mesh;
> 2. driving the fish into a stationary net; or
> 3. moving the gill net to encircle the fish and then scaring them into the entangling mesh.
>
> Stationary gill nets were often placed at high tide across shallow openings in the coral reef at night to entangle any fish navigating the fish run. Nets used in this fashion usually had a mesh of two to two and one-half inches (5 to 6 cm.).
>
> Drawn gill nets were used to either completely encircle fish or to arc a half-circle around them before the fish were scared into the net by fishermen beating and splashing the water from within the circle or across the open end of the semi-circle. Sometimes, the nets were drawn up on the shore after the fish were meshed but at other times, the fish were taken out of the nets and put into canoes.
>
> Lobsters were caught in a special gill net, with a seven-inch (18 cm.) mesh, by placing the net completely around a rock cluster and leaving it in place all night to entangle the lobsters as they came out of the rock cairn.(1970:53-54)

Moemoe (also known as *ho‘omoemoe*) describes a traditional method where a gill net was typically set then retrieved at a later time, as in the historical account above, fishers would set the gill nets to ensnare fish overnight and pull the nets the following morning—hence the name *moemoe*, which means “to sleep” (Weltman 2013). Kahā‘ulelio relates his experience of *ho‘omoemoe* below:

> The net is laid at seven o’clock in the evening and only two fishermen are needed, one at each end of the long net, sixty fathoms or more in length depending on the desire of the fishermen. If at twelve o’clock the fishermen thought of going out to raise the net, they may do so…When the fish are gathered, we lay the net again for the coming of daylight, then the fisherman goes back to enjoy his sleep (2006:171)

Moemoe is a passive method and an example of the use of a stationary gill net from the 19th century account reproduced above. In contrast, the traditional Hawaiian method known as *pa‘ipa‘i* is an active method that requires active participation on behalf of the fisher to corral the fish into the net (Weltman 2013). As in the historical account, *pa‘ipa‘i* is thus named because the fisher would *pa‘i* or slap, beat, hit the surface of the water to scare the fish towards and into the awaiting gill nets (Weltman 2013).

‘Upena pāloa (seine nets)

Abbott describes *‘upena pāloa* or seine nets thusly,

> . . . Rather than capturing fish by entangling them in the mesh itself, seines encircled the prey. Like gill nets, they were held upright in the water, their upper edged suspended from floats made of *hau* wood, the lower portions weighted with stone sinkers. Using large gill nets and seines was a community operation, involving a large number of people, numerous small canoes, and a lot of cooperation. (Abbott 1992:83-84)

Newman adds the following about *‘upena pāloa*:

> A Hawaiian seine was a net deployed in the water and moved horizontally, trapping fish by impounding them within a complete circle formed by the net, or between the net and the shoreline. The fish were not normally entangled in the mesh as with a gill net, but rather were kept within a small circle by the net wall where they could be scooped out with small bag nets or dragged bodily onshore, net and all. A bag net was often used in conjunction with a seine. . . Seines varied in length from about six to over 350 feet (2 to 107 meters) in length, with the common large net measuring some 150 to 350 feet (46 to 107 meters) in length, about 10 feet (3 meters) in depth, with a mesh width of several inches. The net size and mesh type seem to have been dependent upon the particular types of fish to be caught and the habitats to be exploited. (1970:55)

Abbott uses the term *hukilau* to refer to seine nets that were shorter in length and utilized in communal fishing endeavors carried out along the shoreline, as depicted in Figure 37 below, as follows:

> *Hukilau* nets were used to capture smaller fish in shallow waters, usually in sandy-bottomed bays. The hukilau nets were shorter versions of the seine, with *tī* leaves tied along the top to alarm the fish and drive them into the center of the net. Setting a *hukilau* net, too, was a large, cooperative endeavor but with much of the work done by waders rather than from canoes. (Abbott 1992:84)

Although Abbott uses the term hukilau to refer to a type of large seine net, Kahāʻulelio (2006) uses variations of the term *lau* to refer to various cooperative fishing methods, which involved the use of a *lau* or large seine net (Figure 38). Kahāʻulelio (2006) describes the *lau* nets as being sewn together from at least three distinct nets that contained a different mesh width. These nets were traditionally woven from the fibers harvested from *wauke* (*Broussonetia papyrifera*) and *olonā.* Once the net was completed, men, women, and children were ordered to the uplands to gather yellowed foliage of plants such as *tī* or *maiʻa* (banana), along with dried *wiliwili* (*Erythrina sandwicensis*) wood, or dried gourds, for use as floats that were attached to the dragline and knotted with *tī* leaves.

Kahāʻulelio also describes a cooperative fishing method known broadly as *lau*, which was carried out by men, women, and children under the direct supervision of a *poʻo lawaiʻa* (head fishermen); he reports that "these people became the owners and shareholders in this kind of fishing" (2006:3). Although a great deal of labor and knowledge was involved in the preparation for and execution of communal fishing, it provided an abundance of reef fish such as *ʻōpule*, *moi liʻi*, *palapala*, *kūmū*, *weke*, *kala*, *manini*, *moano*, *uhu*, *ʻōʻio*, *hilu*, *ʻaʻawa* that could feed multiple *ʻohana*. Per Kahāʻulelio, *lau* was divided into two types—methods known as *lau nui*, *lau lele*, *lau kapalili*, and *lau ʻapoʻapo*, which utilized large draglines and were "done outside of the surf line, or where there was no surfline" (ibid.:3); and *lauahi*, *lau ʻōhua*, *lau ʻōhia liko*, *lau kō ʻupena pahu*, and the *lau kō pua liʻiliʻi*, which utilized drag nets and were "done within the reef" (ibid.).

Figure 37. *Hukilau* fishing with seine net (Hawaiʻi State Archives PP-23-1-1-001).

Figure 38. *Lau* nets at Kualoa Ahupuaʻa with Mokoliʻi in background; view to the northeast (Hawaiʻi State Archives PP-59-2-008-001).

Kahāʻulelio (2006) explains that with the *lau nui* method the net, which was attached to the dragline was loaded onto a canoe along with divers who took the net out to a depth of about fifteen fathoms. At the command of the *poʻo lawaiʻa* (head fisherman), and with the aid of several other canoes, the divers carefully placed and arranged the net in the ocean and watched as the men in the canoe slowly paddled the canoes and net closer to shore. Kahāʻulelio writes of how the *lau* net was moved into shore thusly,

> At that place, fifteen fathoms in depth, which I had mentioned before, the *lau* is let down to about half of the depth and is moved evenly up to a depth of four or five fathoms or less. The drag line goes almost to the sea floor but it doesn't completely touch, lest it snag on the corals or catch in hollows. When the stone anchors of the *lau* canoes are set, the men begin to pull the *lau* lines, six or seven men per canoe. When the sun shines directly down on the line, the shadows of the *lau* drive the fish shoreward to the place where the lines are being drawn. (2006:5)

As the net was drawn closer to shore, the *poʻo lawaiʻa* and divers continued to monitor and adjust the net. The *poʻo lawaiʻa* then determined where to lay the *papa* net, which measured roughly six to seven fathoms in length. While the *lau* net was used to usher the fish closer to shore, the *papa* net was used to catch the fish that were brought in; as the fish came closer to shore, the *papa* net was placed at the open end of the *lau* net. The divers continued to watch as the fish entered into the *papa* net, and when it was time the *poʻo lawaiʻa* called for the lifting of the net into the canoe. Kahāʻulelio writes that "at this excited time, like a garden laden with flowers, such are the colors of the fish then as they surge excitedly to and fro, eager to find a way out" (ibid.:7). Kahāʻulelio adds that "the canoe to hold the fish draws near and the man the head fisherman placed on that canoe is hard-hearted, cross and stingy so that people don't crowd about and their hands plow in, bringing misfortune to the group" (ibid.:7-9).

Kahāʻulelio (2006) goes on to describe the lesser types of *lau* fishing, one of which was *lau kapalili*. Executed in a manner similar to the *lau nui* method, the *lau kapalili* technique utilized a much smaller net and was carried out in sandy areas and lagoons. The net was dragged shoreward, and the people dragged the net from the shore to the beach, where the fish flapped (*kapalili*) on the sand. The *lau ahi* fishing method was carried out during dark nights with no wave action. The net was drawn shoreward within the surf break into a sheltered bay. Kahāʻulelio (ibid.) describes the *lau ʻōhua* method as being carried out primarily by children and women, noting that the men aided only in drawing the *lau* net to shore. The fish caught using this method included juvenile wrasses such as the *ʻōhua paʻawela* and *ʻakilolo*.

The *lau ʻōhua liko* method utilized a fine mesh net that measured roughly a fathom in length. The small mesh size allowed for the capturing of small shrimp and other small fish that lived around a heaped up cairn of rocks known as an *imu* or an *ahu*. The name used, however, varied from place to place. This method was typically employed in the early morning during low tides. Kahāʻulelio (ibid.) notes that when mosquito netting became available during the Historic Period it was also used in the *lau ʻōhua liko* method. The fine mesh net was placed around the stone cairn and people removed the stones one by one until none remained. The fleeing fish and shrimp were caught in the net then placed into a small pail and later consumed.

The *lau kō pua* method was done by children and adults during the wettest time of the rainy months when the streams were swollen, and the ponds near the beach would break open to the sea. This influx of freshwater attracted schools of tiny fish that were ushered into the sandy shore by children using yellowed banana leaves. The children and adults then picked up the small fish either by hand, or during the Historic Period by using mosquito netting. The captured fish were placed into a calabash and eaten later. In reflecting upon more recent fishing regulations of the 20th century, Kahāʻulelio laments that "because laws have been made about catching such small fish, this type of fishing is no longer seen." (2006:13)

The last of the lesser type of *lau* fishing detailed by Kahāʻulelio is the *lau kō pahu ʻanae*, which he describes as the "easiest kinds of fishing" (2006:13). This method was used to catch *ʻanae* and required the labor of four men, two of which kept control of the bag net while the other two controlled the *lau* dragline. The men worked in unison to bring the dragline and net together to draw in a school of *ʻanae*. This method was sometimes repeated four or five times, and as many as eighty or more fish could be caught.

Scoop Nets and Bag Nets

The final net types recorded by Abbott are hand-held scoop nets, which she describes as follows:

> …scoop nets with handles and sometimes with closure mechanisms served a variety of purposes, including catching fish attempting to leap out of seine or *hukilau* nets. These small, one-person nets were also employed to catch crabs and freshwater shrimp (*ʻōpae*), the latter being a speciality of women. Scoop net handles and closures were frequently made from the endemic shrub *ʻūlei* (*Osteomeles anthyllidifolia*), whose spreading branches can be easily bent into loops. The ends of the piece were lashed together with cord to form the handle of the net. (1992:84)

Newman (1970) also details the use of scoop nets, but he instead refers to them as bag nets with two specific types: hand-held ones (Figures 39 and 40), and those that were manipulated by attached ropes (Figure 41). Newman's description of these nets reads thusly:

> Bag nets were made into an enclosed purse with only one open end; or alternately were flat pieces of netting that were closed into a self-contained bag by manipulating attached flexible sticks in a particular manner to seal it. Although bag nets were extensively used in conjunction with seines, there was a great diversity of bag nets used alone, and these seem to have been quite specialized by type of fish to be caught. An initial ordering of these different types may be made on the basis of use technique: (1) hand held, and (2) manipulated by attached ropes.
>
> Hand Held Bag Nets:--The hand-held bag nets were fine meshed small nets fitted on a flexible wooden hoop which held the mouth open, used for dipping out fish trapped by an encircling sein net; for scooping up fish at night in very shallow water areas, usually by torchlight which mesmerized the fish; or by being held across the opening of an underwater hole by a diver while the fish hiding inside were herded into the net with a stick.
>
> Rope Manipulated Bag Nets and Baits:--Bag nets manipulated by attached ropes were often used with some form of bait to draw the fish into the net. Common baits were cooked pumpkin, squash, sweet potatoes, kukui and coconut meat; raw mashed bananas, papaya, breadfruit or taro; pounded up fish, sea urchins, shrimp or eels; whole small fish such as *nehu*, *ʻiao*, and *akule*; or a special mixture called *palu* which was based on the cooked ink bag of the octopus pounded into a paste with ingredients added such as the juices of various plants, salt, spices, kerosene, tobacco juice, liquor, or Perry Davis Pain Killer. These different baits were often mixed with sand, to make the bait sink, and then placed in the water near as well as inside the bag net to attract fish. Some of these baits are obviously the result of European diffusion. When the fish, usually *ʻopelu*, were inside the bag, it was lifted to the surface by the attached ropes. (Newman 1970:56-57)

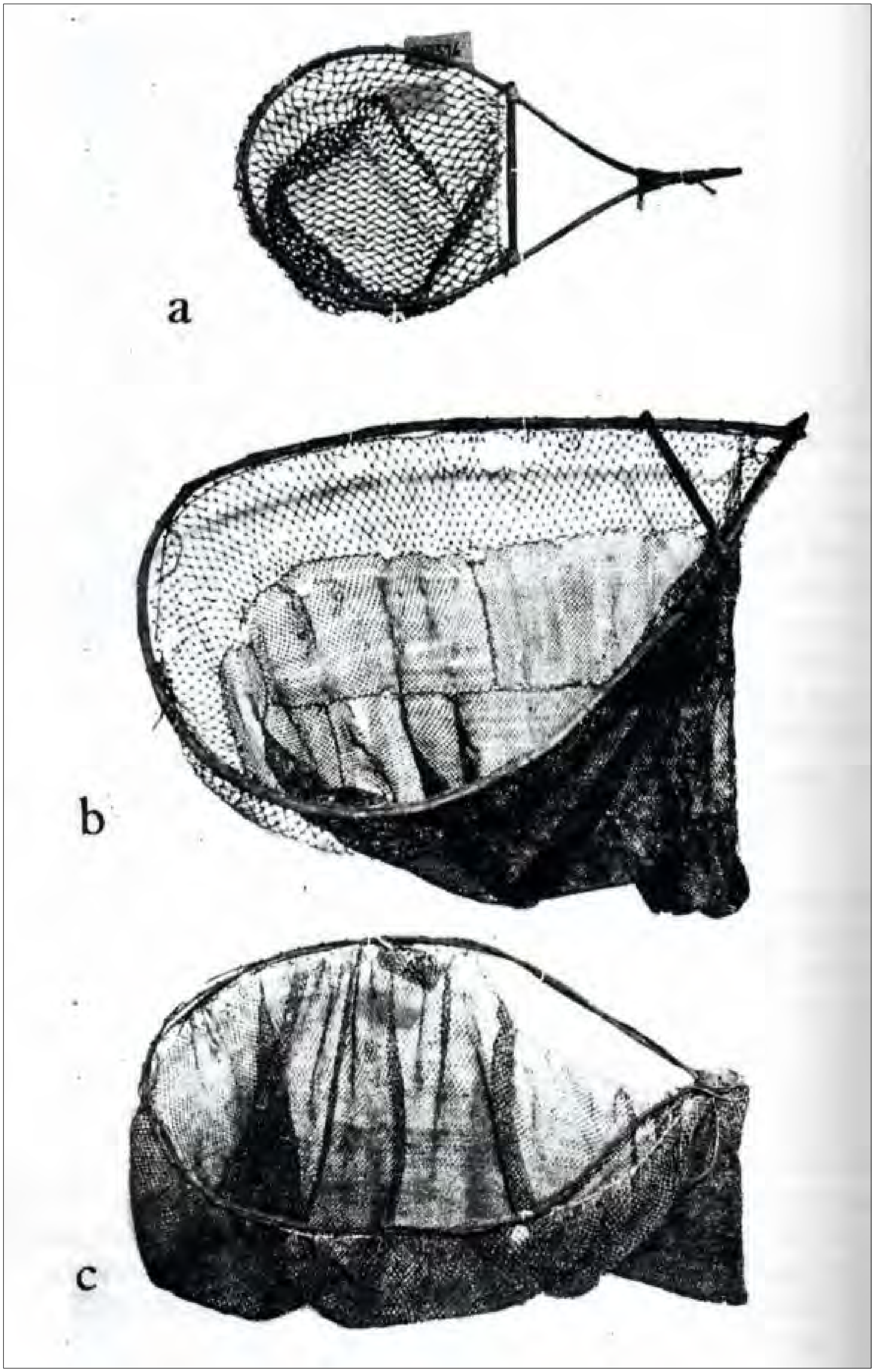
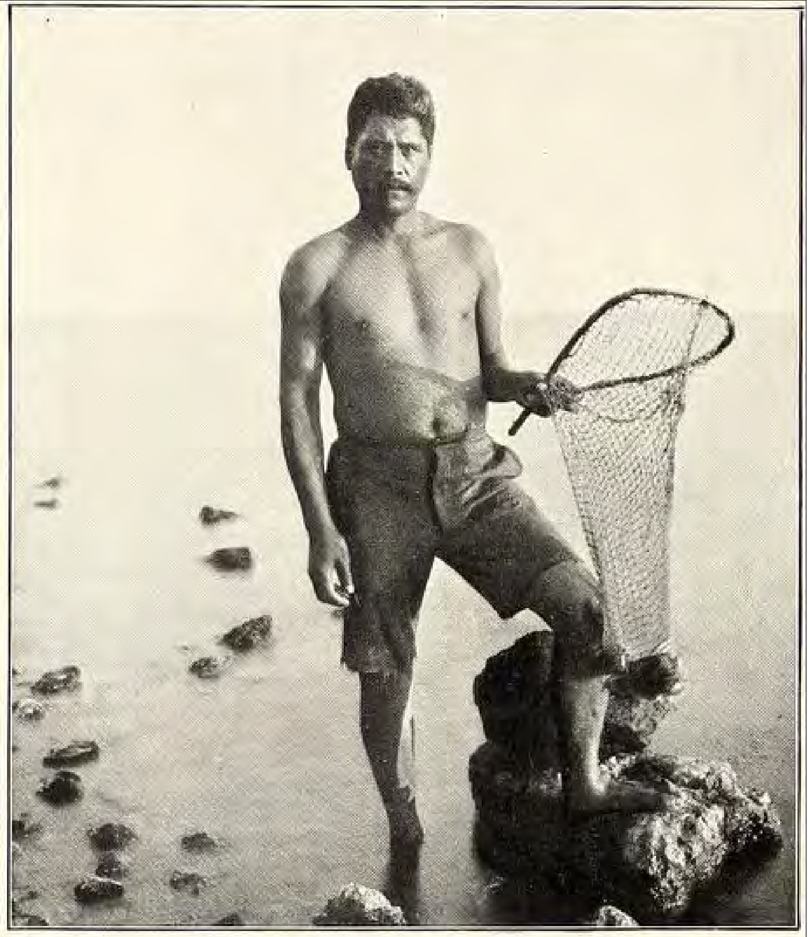


Figure 39. “Scoop nets: a, smallest net with pliable wood frame and crossbar; b. larger net with extended rod frame and crossbar; c. with vine frame, lacking crossbar” (Buck 1957:300).



NATIVE FISHERMAN WITH DIP NET.

Figure 40. Dip net ca. 1900 (Cobb 1902, Plate 23)

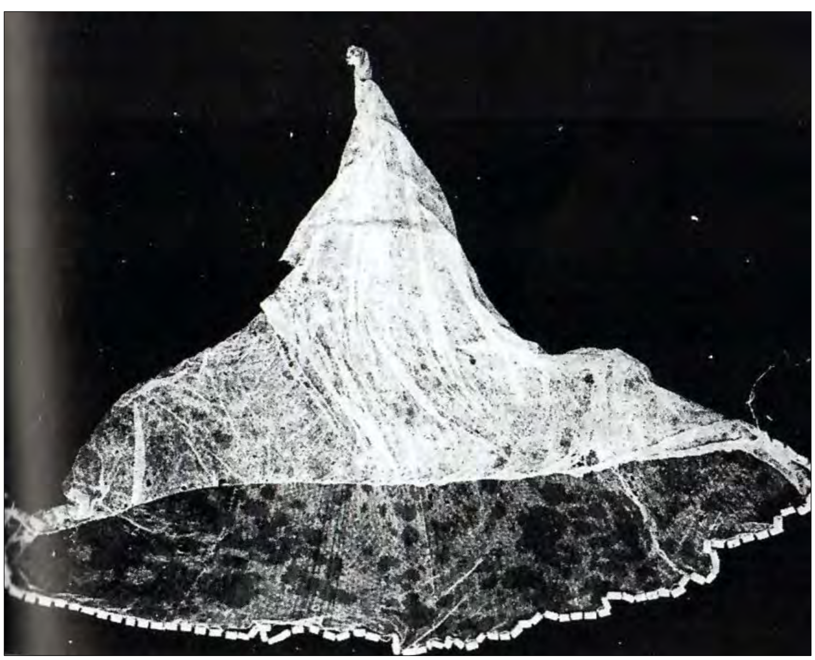


Figure 41. *ʻŌhua* bag net (Buck 1957:309).

Fishing with Poison

The use of plant-based poisons for fishing in Hawai‘i involved two primary agents, the *‘auhuhu* (*Tephrosia purpurea*) and *‘ākia* (*Wikstroemia* sp.). These agents, which can still be found within the study area today (Figure 42), “were crushed, either with a mortar and pestle or with rocks found by the shore,” and then scattered in tide pools, “and in a few minutes the small fish that were present would float to the surface and could be picked up” (Abbott 1992:86).

Figure 42. Photo of ‘*ākia* plant at Maunalua Fishpond Heritage Center with *mākāhā* beyond.

Regarding the impact of the poison, Abbott emphasizes that:

> This effect did not last more than twenty or so minutes, depending on the size of the tide pool and the speed with which fresh seawater entered in and diluted the toxin. Any fish that were washed out of the pools or overlooked in the gathering would recover and swim away, since the toxins merely stupefied the fish rather than killing them outright. In this sense, these old “poisons” more closely resembled modern fish anesthetics than the chemical rotenone, another plant derivative used to catch fish, from which fish do not recover. No data suggest that *‘auhuhu* or *‘ākia* toxins are transferred to humans through consumption of fish caught in this way. (Abbott 1992:86)

Newman’s discussion of plant-based poisons, also refers to *‘auhuhu* (written as *ahuhu*) and *‘ākia*, as follows:

> Although fish poisoning was made a misdemeanor by legislation in 1850 (Jordan and Evermann 1902:365), it was still reported by Cobb in 1902. Poisons used were of plant origin and made of pounded *ahuhu* (*Tephrosia purpurea*) and *‘akia* (*Diplomorpha sandwicensis*) to be inserted into underwater caves; the fish were not affected as a human food by it. For obvious reasons there are no data available on poisoned fish in the 1900 commercial market. (Newman 1970:51)

Newman also cites Campbell (1967), who described fish poisoning in the same manner as Cobb for the late 19th century, but notes that Campbell stated that the fish were instantly gutted after being poisoned to keep the poison from affecting the quality of the flesh. Cobb (1902), like Abbott, on the other hand, states that the poison did not affect the flesh.

Spearing Fish

Traditional *ʻō iʻa* or *pōluhi* (fish spears) used for catching fish were crafted from several types of hardwood species such as *kauila* (*Alphitonia ponderosa)*, *uhiuhi* (*Caesalpinia kavaiensis*), and sometimes *koaiʻe* (*Acacia sp*.), while spears used to catch the elusive *heʻe* (octopus) were made from *alaheʻe* (*Psydrax odorata*), *ʻūlei* (*Osteomeles anthyllidifolia*), and *ʻaʻaliʻi* (*Dodonaea viscosa*) (Abbott 1992). Fishing spears typically ranged in length from one to two meters (Figure 43); those used to catch *heʻe* were much longer, ranging anywhere from two to four meters in length. Kahāʻulelio (2006) reports that spear fishing was done either by swimming, or from canoes. Abbott relates that spears "saw heavy service in night-time torch fishing (see Figure 32), as well as during daylight hours… and were especially useful for picking up sea urchins with venomous spines (wana)" (1992:86).

Figure 43. Fishing with spear ca. 1890 (Bishop Museum Archive).

Newman provides the following description of Hawaiian spear fishing, which during the Historic period also included the use of iron tipped spears:

> Fish spears were about six feet long (2 meters), made of a very hard wood tipped with an iron point, and used underwater by a diver who positioned himself on the bottom and impaled fish on the spear as they came close. It was possible to spear more than one fish per dive by allowing them to slip down the spear after they were pierced. Above surface use of spears was restricted to spearing turtles, octopi, ʻoʻopu-hue, and fish mesmerized by torchlight at night in shallow water. No mention was made of spears propelled by slings or elastic bands, such as the "Hawaiian sling," and these are undoubtedly of twentieth century origin. (1970:52)

While the above-described traditional cultural fishing practices of trapping, hand-collecting, using hook and line, trolling with lures or using octopus lures, netting, poisoning, snaring, and spearing reflect the tangible methods used by *poʻe lawaiʻa* to harvest marine resources, the following section will explore Hawaiian fish nomenclature. This is followed by a discussion of cultural the cultural siginificance and traditional uses of the Top 20 Species.

HAWAIIAN FISH NOMENCLATURE

Kānaka Maoli's connection to the sea, and all its lifeforms, is further reinforced by ways in which fish were categorized, named, and used. Their keen awareness of the natural world, coupled with their dependence upon marine resources culminated in a complex naming system for Hawaiian marine resources that conveyed descriptive information, as well as important cultural information. Hawaiian fish nomenclature mirrors other aspects of traditional Hawaiian society, where detailed naming practices helped to categorize the seemingly endless variety of reef dwellers. Hawaiian fish nomenclature has endured to this day through its constant use—a practice that speaks to both the cultural significane of fish, and the importance of the intergenerational transmission of knowledge. Titcomb relates that "some names of fishes show the relationship of Hawaiians to other Polynesians, and are therefore very old," but that "many names are peculiar to Hawaii" (1972:51). She adds that fish names were maintained through direct use, as well as through the creation of chants that served as a memory aid (ibid.).

According to Malo (1951), all products of the ocean and freshwater streams and rivers, whether mobile or not, were considered *iʻa* (fish); for instance, the various species of *limu* (seaweed) were considered *iʻa*. Likewise, Titcomb conveys that the term *iʻa* was applied to vertebrates and invertebrates alike, even "those that were utterly useless as food and of no importance in any other way" (1972) Titcomb further relates that Hawaiians gave two names to most fish, one designating the kind (or species), the other designating a group characteristic. The names usually chosen for fish were descriptive of the colour, structure or habitat, such as

> (1) colour: *lelo* (reddish), *mele* (yellow), *uli* or *uliuli* (blue, also means green, dark-coloured, that is, the colour of the deep blue sea), *kahauli* (dark-striped), *kea* (white); (2) form: *poʻonui* (large-headed), *waha nui* (large mouthed); (3) a special characteristic: *makaonaona* (bright-eyed); *moe* (sleeping), *holo* (travelling), *kaʻakaʻa lāʻau* (stick rolling), *pili koʻa* (coral clinging). (Titcomb 1972:50-51).

This traditional system of nomenclature is exemplified in the naming of triggerfish known broadly as *humuhumu*; such as, "*humuhumu ʻeleʻele* (black), *h. mimi* (malodorous), *h. nukunukuapuaʻa* (nose like a pig), and others" (Titcomb 1972:50).

Similarly, some fish names incorporated terms that distinguished specific growth stages of the fish; such as, *aka* to indicate when the "body is still transparent" and *hāuli* to indicate when the "body darkens," *mana* to refer to when "markings appear" and *kakau,* which is used when the fish is "fully marked" and had reached the "fullest statge of development" (Titcomb 1972:54). Other terms such as *ōhua* or *ʻāhua* were used refer to the schooling of juvenile fish, including reef fish such as *hīnālea*, *humuhumu*, *kala*, *kūpou*, *manini*, *pualu*, and *uhu* (Pukui and Elbert 1986). Fish that were cultivated in fishponds, including *ʻamaʻama* (mullet), were the subject of close observation, and the names given to these fish were based on size, with *pua* to refer to fish that were a finger's length, and *kahaha* to refer to fish that had reached a hand's length (Titcomb 1972).

While *iʻa* was the broadest term used to refer to all sorts of marine species, Hawaiian fish nomenclature also differentiated fish by their habitat. Fish that dwelled in coral reefs were termed *iʻa o ke koʻa* (*lit.* fish of the reef), while those that lived in deeper waters were referred to as *iʻa o ke kai uli* (*lit.* fish of the deep sea) (Titcomb 1972). Kānaka Maoli also distinguished and named the anatomical features of fish, both the exterior features as well as the principal internal organs. Titcomb provides a list of the anatomical terms that were given to the various parts of the fish, which is reproduced in Table 3 below.

Table 3. List of Hawaiian anatomical terms for fish (after Titcomb 1972:54).

Hawaiian Term	*English Equivalent*	*Hawaiian Term*	*English Equivalent*
nuku, or *nukunuku*	nose	*kualā*	dorsal fin (same for soft dorsal)
lae	frontal region over eye	*unahi*	scales
alo	chest	*unahi kalakala*	the rough scales from mid-body to tail of certain fishes-scutes
alo piko	belly	*kakala*	knife-like cartilage near the tail (as in the surgeon fishes)
mahamaha	gill plate	*hiʻu*	tail
api	gill opening	*pewa*	tail fin
pihapiha	gills	*umiumi*	barbels (same term as is used for beard of a man)
halo	gill fin	*kiwi*	the "unicorn" of the *kala* fish

While the use of some traditional Hawaiian fish names extended across the Hawaiian Islands, Titcomb states that:

> In spite of a conscious effort to hand down knowledge, names for some fish did vary from island to island, and even from one part of an island to another. This may be due in part to faults of memory, though memories were trained to astonishing capacity, and in part to a conscious wish to call a fish by what seemed a more appropriate name. (1972:49)

Understanding how Kānaka Maoli categorized and named the various marine species provides insight into understanding their cultural significance. Further species-specific cultural information pertaining to the Top 20 Species is presented in the following section.

SPECIES-SPECIFIC TRADITIONAL CULTURAL KNOWLEDGE AND PRACTICES PERTAINING TO THE TOP 20 COLLECTED AQUARIUM FISH SPECIES

In an effort to identify any traditional cultural uses, practices, and beliefs associated with the Top 20 Species, the authors of this report began by identifying and compiling the Hawaiian name(s) associated with each of them, as well as their origin status—whether they are indigenous, endemic, or invasive (Table 4).

Table 4. Hawaiian Names and Origin Status of the Top 20 Species.

Scientific Name	*Hawaiian Names*	*Common Name*	*Origin Status*
Acanthurus olivaceus	*naʻenaʻe*	orangeband surgeonfish	Indigenous
Anampses chrysocephalus	species of *hīnālea*	psychedelic wrasse	Endemic
Canthigaster coronate	*puʻu ʻolai*	Crowned puffer	Endemic
Canthigaster jactator	*ʻoʻopu hue*	whitespotted Toby	Endemic
Centropyge fisheri	unknown	Fisher's angelfish	Indigenous
Centropyge potteri	unknown	Potter's angelfish	Endemic
Chaetodon miliaris	*kīkākapu*	milletseed butterflyfish	Endemic
Chaetodon multicinctus	*kīkākapu*	multiband butterflyfish	Endemic
Cirrhilabrus jordani	species of *hīnālea*	flame wrasse	Endemic
Ctenochaetus strigosus	*kole, kole makaonaona*	goldring surgeonfish	Endemic
Forcipiger flavissimus	*lauwiliwili nukunuku ʻoiʻoi*	forcepsfish	Indigenous
Halichoeres ornatissimus	*lāʻō*	ornate wrasse	Endemic
Macropharyngodon geoffroy	species of *hīnālea*	shortnose wrasse	Endemic
Naso lituratus	*umaumalei, kala*	orangespine unicornfish	Indigenous
Pseudanthias bicolor	unknown	Bicolor Anthias	Indigenous
Pseudocheilinus octotaenia	species of *hīnālea*	eightline wrasse	Indigenous
Pseudocheilinus tetrataenia	species of *hīnālea*	fourlined wrasse	Indigenous
Thalassoma duperrey	*hīnālea lauwili*	saddle wrasse	Endemic
Zanclus cornutus	*kihikihi*	moorish idol	Indigenous
Zebrasoma flavescens	*lāʻīpala, lauʻīpala*	yellow tang	Indigenous

To verify the accuracy of traditional naming practices and to address any discrepancies therein, the Hawaiian names were cross-referenced with primary and secondary sources, which are cited in the ensuing paragraphs. The Hawaiian fish names presented in Table 4 should not be considered an exhaustive list, as it may not capture regional names or names used by certain families or individuals. Once all known Hawaiian names were identified and correlated, additional cultural information was gathered for each of the twenty species from various Hawaiian and English language sources.

The information compiled from these sources includes details about ongoing and former traditional uses of the Top 20 Species, species-specific traditional methods for catching said fish species, as well as species-specific legendary accounts. As discussed above, Hawaiian fish nomenclature is sometimes inconsistent or conflicting becuase many species were known by multiple names, some of which were qualifiers for specific characteristics or referred to specific growth stages. Despite the challenges mentioned above, a significant amount of information was found with respect to traditional subsistence practices, beliefs, customs, and general cultural uses of the Top 20 Species—was categorized (see Table 4). Photos were retrieved from the Marine Life Photography database compiled by Keoki and Yuko Stender (www.marinelifephotography.com) and permission to reproduce the photos for this report was granted by Mr. Keoki Stender on December 17, 2019.

Acanthurus olivaceus **(*na‘ena‘e*)**

Acanthurus olivaceus or orangeband surgeonfish (Figure 44) is referred to as *na‘ena‘e*, which means “quick, alert” (Pukui and Elbert 1986:258). *Na‘ena‘e* are grayish-brown in color with an orange band trimmed with a purple streak that extends along its body. Kent (1986) reports that *na‘ena‘e* reside on the outer ends of the reef where waves and sandy beaches are present. The name *na‘ena‘e* is also applied to a native daisy known for its small yellow, orange, purple, or white flowers (Pukui and Elbert 1986). The review of culture-historical literature conducted for this study did not reveal any additional cultural information related to this species.

Figure 44. *Acanthurus olivaceus* at Hanauma Bay, O‘ahu.

Anampses chrysocephalus, Cirrhilabris Jordani, Macropharyngodon Geoffroy, Pseudocheilinus octotaenia, **and** ***Pseudocheilinus tetrataenia*** **(*hīnālea*)**

Anampses chrysocephalus (psychedelic wrasse; Figure 45), *Cirrhilabris jordani* (flame wrasse; Figure 46), *Macropharyngodon Geoffroy* (shortnose wrasse; Figure 47), *Pseudocheilinus octotaenia* (eightline wrasse Figure 48), and *Pseudocheilinus tetrataenia* (fourlined wrasse Figure 49) are all wrasses, which are broadly referred to as *hīnālea,* occasionally shortened to *ālea,* in the Hawaiian language; while *Thalassoma duperrey* (saddle wrasse) are referred to as *hīnālea lauwili,* and discussed in a separate section. Hīnālea, distinguished by their elongated bodies, can range in size from three to ten inches long (Hoover 2007; Kahā‘ulelio 2006); and are also described in ethnographic literature as having sharp protuberances (Malo 1951). Their colors and attributes vary according to species.

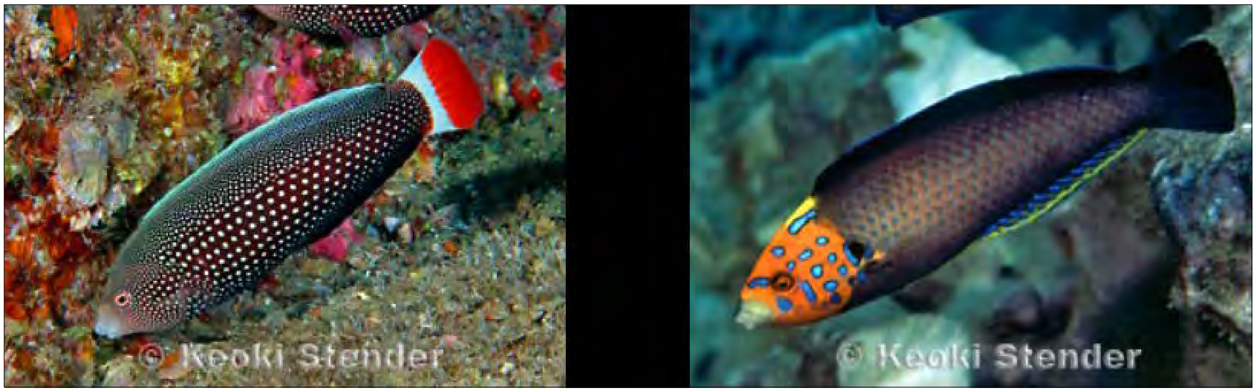


Figure 45. *Anampses chrysocephalus* female (left) and male (right).

Figure 46. *Cirrhilabris jordani* female at Kewalo Hump, O‘ahu.

Figure 47. *Macropharyngodon Geoffroy* at Kewalo Pipe, O‘ahu.

Figure 48. *Pseudocheilinus octotaenia* at Lanai lookout, O‘ahu.

Figure 49. *Pseudocheilinus tetrataenia* at Kahe Point, O‘ahu.

Hoover relates that “the general Hawaiian name hīnālea is applied to most, but not all; many of the smaller wrasses have no known Hawaiian names” (2007:158). Elbert and Pukui explain that “*hīnālea* may be qualified by the terms *‘ele‘ele* [very dark, black], *līpoa* [fragrant seaweed], *lolo* [lazy], *nī‘au* [coconut midrib or spleen], *nuku ‘i‘iwi* [bird wrasse], *nuku ‘i‘iwi ‘ula* [red bird wrasse], *nuku ‘i‘iwi uli* [dark bird wrasse], *nuku loa* [long snout], [and] *nuku loa ‘ele‘ele* [black long snout]” (1986:71).

Hīnālea are found primarily in shallow water, but are also known to live in waters seven to eight fathoms deep (Titcomb 1972). Their behavior, and the areas in which they dwell, are described in the *‘ōlelo no‘eau,* “*naueue ka hi‘u o ka i‘a lewa i ke kai*,” which literally translates as “the tails of the fish that move in the sea tremble” (Pukui 1983:250). Pukui goes on to explain that this expression was said of fish, such as the *hīnālea*, whose tails can be seen bending as they seek hollows in the corals for hiding during the cold month of Welehu (approximately Novemember).

Traditional fishing methods used to catch *hīnālea* included the use of a carefully curated stick used to attract fish known as *melomelo* (Kahā‘ulelio 2006) and poisoning. *‘Upena holahola* was the name given to a net that was used in conjunction with certain piscicidal plants that were crushed and placed around a *hīnālea* fish hole (Cobb 1902:734-735). The toxins released from the crushed plants diffused throughout the water thereby paralyzing the trapped fish and causing the *hīnālea* to float to the surface into the *holahola* net (1902:734-735). Another method involved the use of *kūkulu ‘upena* (standing nets) and *ke kāmākoi*—a fishing pole made of bamboo or *hau* (*Hibiscus tiliaceus*) measuring about eighteen feet long—for catching *hīnālea*. The *ke kāmākoi* method was used from the nearshore reefs where the fisher could cast a hook and line attached to the fishing pole into the sea from the shore (Manu et al. 2006).

As previously mentioned, *hīnaʻi* (basket traps) were also traditionally employed to catch *hīnālea*. In particular, Manu et al. relate a *moʻolelo* that describes the legendary origin of the use of *hīnaʻi* woven of fibers from the *ʻinalua* (*Cardiospermum halicacabum*) vine, which "has been the method of catching hīnālea ever since" (Manu et al. 2006:53). This legendary tale tells the story of Kalamainuʻu, a *moʻo* (lizard) goddess. While on Oʻahu, Kalamainuʻu enticed a young *aliʻi*, Punaʻaikoaʻe, and lured him to her cave on the island of Molokaʻi. Drawn by the beauty of Kalamainuʻu, Punaʻaikoaʻe became her obedient captive and remained in the cave until one day he longed for freedom and to be amongst other people again. Punaʻaikoaʻe overheard the cheers of people down below and became intrigued asking Kalamainuʻu about what he heard. She explained that it was the sounds of people celebrating their victories in the *Makahiki* games. He then asked if he could leave the cave to see the festivities for himself, to which she consented. While mingling with the people, Punaʻaikoaʻe met a man by the name of Hinale, who was the brother of Kalamainuʻu. As they conversed, Hinale discovered that Punaʻaikoaʻe was Kalaimainuʻu's lover and immediately began plotting to free Punaʻaikoaʻe from his sister. As Punaʻaikoaʻe began to carry out his escape from Kalamainuʻu, the *moʻo* goddess learned that the plan had been initiated by her brother, Hinale, and she sought revenge. When Hinale discovered that his sister was after him, he fled to the ocean where he transformed into a *hīnālea*. Kalamainuʻu followed after him, but eventually lost Hinale. She then learned from a hermit crab how to entrap her brother, so she followed his instructions and constructed a basket trap made from the *ʻinalua* vine. After several attempts, Kalamainuʻu eventually captured her brother in the trap.

Considered a popular fish of the Hawaiian diet, *hīnālea* are referenced in many *moʻolelo*. One origin story of this fish is associated with a female *ʻeʻepa*, or mystical being, who after being angered by two other supernatural beings for helping her unfaithful husband, tore her enemies to pieces and transformed the torn pieces into the *hīnālea* (Kamakau in Titcomb 1972). In the February 8, 1911, issue of *Ke Au Hou*, a Hawaiian language newspaper, John H. Wise published a *moʻolelo* that describes the importance of the *hīnālea* for the conception of a child. Two *hīnālea* fish were wrapped in *ti* leaves and cooked on coals as offerings to the *akua* Kū and Hina, whom are believed to be responsible for conception. The first fish was given to Kū and the second to his wife Hina, and a chant would be uttered to grant the woman an offspring—if a son was desired, the chanter would mention the duties of a man; for a daughter, the duties of a woman would be mentioned (Wise 1911).

Hīnālea are also mentioned in the account of ʻAiʻai, who was the son of Kū and Hina, key fishing deities worshipped by the ancient fishers of Hawaiʻi Nei (Fornander 1919-1920; Valeri 1985). Fornander (1919-1920) relates that in ʻAiʻai's attempt to replenish the fish that were taken from the sea by his parents—after being threatened by Kahoalii, a chief of Hāna, Maui—he seeks the help of his friend Pilihawawa. To restore the fish in the sea, ʻAiʻai orders his friend to weave a basket for catching *hīnālea*. After the basket was woven, it was taken to the rocky shore and ʻAiʻai summoned the help of his parents, calling forth the young *hīnālea* and *ʻōpule* fish. After hearing the calls of her son, Hina ordered her husband Kū to send fish to their son and as a result, droves of fish came onshore, some of which were collected by Pilihawawa. Kūʻulakai then sent in the surf which carried the fish back into the sea.

In a similar *moʻolelo* that featues *hinaʻi ʻinalua* and Kalamainuʻu, she resides at Makaleha, Mokuleʻia in Waialua on Oʻahu (Kamakau 1976:80). To the west of Makaleha is a ravine called Waileʻa where Kalamainuʻu lived with her tongue stretched to the back of the cave. Her tongue also served as a surfboard for Punaʻaikoaʻe, her lover, with whome she spent every with—night and day. Punaʻaikoaʻe did not know that his lover was a *moʻo* and after a few months, he grew pale and frail. One day he was able to hike to the ridge and saw the surf break at Puaʻena, Waialua. He longed to surf and Kalamainuʻu let him, but warned him not to talk to anyone on his way to the beach even if they called him by name. Punaʻaikoaʻe made his way towards the beach passing Puʻeʻa, Hinale's *heiau*, Makapuʻuhale, and Kanoa where two men—Hinale and ʻAkilolo—were cultivating their crops. The pair called out to Punaʻaikoaʻe but he ignored them as he was instructed by Kalamainuʻu. After several failed attempts of getting Punaʻaikoaʻe's attention, the two men ran towards the beach and said:

> "We speak to you of life; if you refuse to listen you will die."
>
> Punaʻaikoaʻe turned and looked at them and said, "My wife laid down her decree saying that I must speak to no one; but perhaps she does not know that I am talking to you two."
>
> The men said, "Your wife is an *akua*; we cannot hide our talking together. She is Kalamainuʻu, a *moʻo* of 'forty thousand' (*kini*) *moʻo*, a *moʻo* of 'four hundred thousand' (*lehu*) *moʻo*. Those are bodies of your wife. Because we pity you, we are telling you this. The surfboard you are carrying is your wife's tongue." (1976:80)

Puna‘aikoa‘e asked for advice on how to be saved and the two suggested he escape to Hawai‘i Island, bathe in fresh water and then see his wife, Kalamainu‘u. However, on his return to their cave, he encountered the mo‘o body of Kalamainu‘u. They had warned him, “When she shows you her akua forms, be courageous or you will die. Instead, she will come to kill the two of us” (1976:80). Puna‘aikanoa‘e was filled with terror but withstood it courageously. Kalamainu‘u traveled makai to Hinale and ‘Akilolo and chased them until they disappeared into the ocean floor. Tired from chasing the pair of men, two of her companions—Kuao and Ahilea—asked how they could be of assistance to Kalamainu‘u. She explained the story from beginning to end about Hinale and ‘Akilolo. Kuao and Ahilea offered Kalamainu‘u the following advice in detail:

> They were certainly in the wrong; they were supposed to be good brothers. You should kill them. They like *‘ohiki* crabs of this beach, to eat with the sweet potatoes which they cultivate in Kanoa, Keone‘ae, and the uplands of Makaleha, but they are unskilled in torch fishing. You can cause their deaths through the their fondness of *‘ohiki*. Go gather some *‘inalua* vines, observing a kapu, and on your return weave them into a trap. Begin at the entrance and when the part that goes in [the funnel] is finished, then bend [the warps] back to form the container. Spread apart (*pu‘umana a‘e*) the *‘inalua kukula* [the warps], and bend them to shape the round part of the basket. When you see that the container has filled out and is big enough, then decrease its size by pushing together (*hu‘e*) the *‘inalua kukula* until the *hina‘i* is completed. When the weaving of the *hina‘i* is completed, the kapu will be over. Then go and dig *‘ohiki* crabs, take the *hina‘i* into the sea, put in a crevice so that the sea runs in and out. The name of such a ‘good place’ is au [haunt]. Remove pebbles until the *hina‘i* is properly balanced. Then go to a coral head, chew the *‘ohiki*, dive into the sea and place them in the *hina‘i* and then go off to some distance. After a while dive again—Hinale and ‘Akilolo will have come to eat their favorite food and you will find your enemies there in the *hina‘i*. (1976:82)

Kalamainu‘u heeded their advice and followed their instructions. She killed Hinale and ‘Akilolo tearing them into pieces, which became the *hīnālea* fish. Kamakau adds that those who wove *hina‘i hīnālea* observed these *kapu* and *hīnālea* were plentiful. It is also said that because there was so much *hīnālea* caught by setting traps, the waters from Kumalaekawa to Ka‘ena had a distinct stench that emitted when they were dried. Kalamainu‘u became an *‘aumakua* for trap fishing (Kamakau 1976:82).

The *‘ōlelo no‘eau*, “*Ipukai hīnālea*” translates to “A dish of *hīnālea* fish” (Pukui 1983:136). It is a rude remark regarding one with bad breath or “one whose nose has the foul odor of catarrh.” The *hīnālea* was the favored fish for the dish called *i‘a ho‘omelu*. The preparation required the *hīnālea* to be slightly decomposed, which would emit a strong odor. It would then be seasoned with salt, *‘inamona* (relish made of the cooked kernel of the *kukui*), and chili pepper, which would mask the dish of its putrid scent.

The story titled *The Wind Gourd of La‘amaomao* (Nakuina 2005) also makes reference to *hīnālea* and notes that it was the preferred fish to cut through the bitterness of the drink known as *‘awa* (kava). This account relates how *hīnālea* were kept in small sea pools, and collected at the request of a chief. In the preamble to this story, Pāka‘a who was the beloved servant of Keawenuia‘umi, a chief of Hawai‘i Island, was unjustly cast out of the king’s court and replaced by two new, but inept, servants named Ho‘okeleipuna and Ho‘okeleihilo. These two servants knew very little about the chief’s likings, and overtime Keawenuia‘umi became aware of their incompetence. Longing for his beloved servant, Keawenuia‘umi and his entourage set out in search of Pāka‘a, who by this time had relocated to Moloka‘i with his wife and son, Kūapāka‘a. After the king’s arrival on Moloka‘i, Kūapāka‘a invoked a mystical storm through the use of the sacred wind gourd of La‘amaomao, which thwarted the king’s plan to return to Hawai‘i Island. To win the compassion of Keawenuia‘umi, and to gain back his role in the king’s court, Pāka‘a taught his son everything he knew about the chief, including his fondness for consuming *hīnālea* after downing a cup of *‘awa*, his favorite beverage. The portion of the story describing the use of *hīnālea* is presented below (all mentions of *hīnālea* are presented in bold text for emphasis):

> When night fell and everyone was at ease, Keawenuia‘umi reminisced: “My love for Pāka‘a wells up in me. On evenings like this, my kauwā would bring me my cup of ‘awa and live **hīnālea**, and the intoxication would take effect; I would sit enjoying the intoxication of the ‘awa until I fell asleep; then I would sleep soundly all night long. How I miss Pāka‘a!”
>
> Kūapāka‘a heard these words of the ali‘i and reported to his father: “Kā! My haku desires some ‘awa. He spoke of his love for you; when you were his kahu, you brough him his ‘awa. He misses it.”
>
> Pāka‘a took out an ‘awa preparation bowl and a cup, some grass for straining the ‘awa, a piece of dried ‘awa root, and portions of ‘awa root already chewed, which he tied into bundles. He put

> everything into a piece of trimmed kapa, which he took out of the wind gourd of La‘amaomao,, and told his keiki, “Take this dried ‘awa to your ali‘i and show it to him. If he tells you to chew it, look for a dark place and hide the dried ‘awa there, then strain this portion of already chewed ‘awa into the bowl. He’ll be impressed with how quickly you’ve prepared the ‘awa for him. That’s the way I did it when I was with him. After pouring the ‘awa into the cup, serve the ‘awa to him, then run quickly to the beach to get the live **hīnālea** we put into the small pond, and give them to your haku as pūpū to cut the bitterness of the ‘awa.”
>
> When the ali‘i saw the large dried ‘awa root, he told the keiki, “You must chew my ‘awa.” The keiki turned away to a corner of the room and dropped the dried ‘awa root there, then poured water into the preparation bowl and put into it the ‘awa Pāka‘a had already chewed. He strained the juice out of the chewed ‘awa with the grass, then poured the juice into the cup and gave the cup to the ali‘i. Then he ran to the beach and returned with two **hīnālea** wriggling about in his hands. He put them on a dish and placed the live **hīnālea** before the ali‘i. (Nakuina 2005:68-69)

Canthigaster Coronata (*pu‘u ‘ōla‘i*) and *Canthigaster jactator (‘o‘opu hue*)

Canthigaster Coronata (Crowned Toby/Saddle Puffer; Figure 50) and *Canthigaster jactator* (Hawaiian whitespotted Toby; Figure 51) are two of twelve known species of pufferfish that inhabit Hawai‘i’s waters. The common name of *C. coronata* and *C. jactator*—Toby, originated from Australia to identify these diminutive puffers that measure less than four inches long and have a slightly elongated snout (Hoover 2007).

C. Coronata have dark saddles that extend along their spines (see Figure 50), which Hoover suggests, “may have reminded the old Hawaiians of lava flows for the Hawaiian name [*pu‘u ‘ōla‘i*] means ‘cinder cone’” (ibid.).

C. jactator are the most common Toby in Hawai‘i and are frequently seen in pairs. They are brown with white spots with a light green fluorescent color on the head and snout (see Figure 51and can be found in active reef areas or in “dead silty places where little else seems to live” (Hoover 2007:109).

Figure 50. *Canthigaster Coronata* at Waimea Bay, O‘ahu.

Figure 51. *Canthigaster jactator* at Hale‘iwa trench, O‘ahu.

In Hawai‘i, Puffers and Tobys are sometimes referred to generally as *makimaki,* “a term apparently not used in ancient times,” and possibly a variation of the word *make*, meaning death (Hoover 2007:107). Other names traditionally used for pufferfish were *‘o‘opu hue*, possibly an alteration of *ōpūhue* (calabash, gourd) or *kēkē* (potbelly), which refers to the rounded stomach of the fish that resembles a gourd when they inflate their bodies with air (Titcomb 1972). It should be noted that these fish should not be eaten and are known to be poisonous. Pukui states that Hawaiians rarely ate pufferfish of any variety, however, Malo points out that “the poisonous part is the gall, By carefully dissecting out the gall-bladder without allowing the escape of any of its contents, the fish may be eatern with impunity. Its flavour is delicious” (Titcomb 1972:131). Kepelino relates that there are two kinds of *‘o‘opu hue*, the *malani* and *manalo*. The former is edible while the latter is poisonous, Titcomb (1972) reports that both Chinese and Japanese in Hawai‘i eat the *‘o‘opu hue* because of its flavor. To determine the difference between the two, Kepelino shares:

> To tell them apart look at the teeth. If the teeth are yellow the fish is poisonous. But if the teeth are a bright, clear white the *‘o‘opuhue* is good to eat. The skin is rough and should be peeled off. The fish has much flesh and is good. It should never be eaten raw. (Titcomb 1972:131-132)

Titcomb then cites Beckley who further explains that the poison is contained in three sacs, which must be removed intact and because the skin is also slightly poisonous, one must skin the fish before consuming it (ibid.). Furthermore, *‘O‘opu hue* caught in the ocean are much more poisonous than those found in *loko i‘a* (ibid.).

Centropyge fisheri; Centropyge potteri

Species of the genus *Centropyge*, popularly known as angelfish, typically have a large backward-pointing spine on the gill cover. Of the five species in Hawai‘i, three are endemic, however, the review of historical literature conducted for this study did not reveal any specific Hawaiian name or any specific cultural information related to any of these species.

Centropyge fisheri (Fisher’s angelfish; Figure 52), is a small orange-brown fish trimmed in iridescent blue with a translucent tail. These fish are typically found in finger coral (*Porites compressa*) at depths of 80 feet. Known to be quick moving, they tend to stay close to cover and are not frequently seen (Hoover 2007).

The endemic *Centropyge potteri* (Potter’s angelfish; Figure 53) is the most frequently spotted angelfish in Hawai‘i. This species has a rusty orange color on its head and back, which transitions to a bluish black on the rest of the body. The body is “covered with irregular vertical gray-blue lines” with blue and black horizontal stripes on the rear fins (2007:3). The males tend to have more of a blue color than their female counterparts. These fish live in pairs or in small groups, and dwell in the clear water under ledges and on reef slopes with hollow spaces.

Figure 52. *Centropyge fisheri* at Mokulei‘a, O‘ahu.

Figure 53. *Centropyge potteri* female in sea cave on O‘ahu.

Chaetodon miliaris (*Lau/Lauahau wiliwili*) and *Chaetadon multicintus* (*kīkākapu*)

Chaetodon miliaris (milletseed butterflyfish; Figure 54) and *Chaetadon multicintus* (multiband butterflyfish; Figure 55), and other members of the genus *Chaetodon*, are broadly referred to as butterflyfish and are usually yellow or white in color with distinct markings (Kent 1986; Titcomb 1972). They grow to about six inches in length, and are distinguished by their compressed bodies (ideal for navigating narrow reef spaces) and small pointed mouths. Butterflyfish are known by a number of Hawaiian names including *kapuhili, kihikihi*, *kīkākapu, lauhau, lauwiliwili, lauhau wiliwili,* and *nukunuku* (Titcomb 1972). While sometimes eaten, butterflyfish appear to have been more commonly caught and used for certain rituals and ceremonies. Specific information related to four types of butterflyfish found in the culture-historical literature, *kapuhili*, *kīkākapu*, *lauhau* and *lau/lauhau wiliwili*, is presented below.

Figure 54. *Chaetodon miliaris* at Kewalo, Oʻahu.

Figure 55. *Chaetadon multicintus* at Mokuelia, Oʻahu.

Kapuhili

The term *kapuhili* has been translated by Elbert and Pukui as "…many taboos inherited from chiefly ancestors or from the gods; person with many taboos" (1986:133). Titcomb reports on an account written by S. K. Kamakau in 1845 while he served at the Lahainaluna seminary on Maui that describes how these fish received their distinct marks. In this account, *kapuhili* is the name of the person, or perhaps the deity, who marked each fish with their distinct colors. Kamakau notes:

> These islands of Hawaii were created by Kumuhonua (whose wife was Haloiho). He slept and when he awoke, the earth turned and this was called an earthquake.
>
> At that time the duty of each creature had not been apportioned, nor were names given to each…So all things were gathered together—animals, birds, crawling things, winged things that fly through the air, and man. The work of each was assigned…It was as Molea in Hamakua that all the fishes gathered, the big fish and the little fish. It was there that all the fishes were marked, and streaked ones, the red ones, the white ones, the yellow ones and all the kinds found in the ocean. **Kapuhili** was the overseer who marked them. The unmarked fish were spotted simply by having ashes sprinkled over them. Then the proper names were given to each variety of all the fishes in the ocean. (in Titcomb 1972:48)

Kīkākapu

The name *kīkākapu* is used to describe "various species of butterfly fishes of the genera *Chaetodon* and *Cheilodactylus*" and may be further qualified by terms such as "*alo lua* and *koʻa*" (ibid.:148). Titcomb (1972) relates that *kīkākapu* were also considered sacred, and makes reference to a chant presented in the account of Kihaapiʻilani, a 16th century chief of Maui (Fornander 1880). The portion of the chant referencing the *kīkākapu* (name bolded for emphasis) reads thusly:

He kakau kiko onio i ka lae,	With striped marks on the forehead,
Ke kiko o ke ki-kakapu,	Marks of the kikakapu,
O ka ia kapu hilia au awahia.	The sacred fish with the bitter gall.
(Fornander 1916–1917:241)	(Fornander 1916–1917:240)

Kīkākapu are also noted in a name chant composed for Kauikeaouli (Kamehameha III) that is duly titled *Mele no Kauikeaouli*. The portion of the *mele* that references both the *kīkākapu* and *kapuhili* (names bolded for reference) is presented below:

Ke kakau kiokii onio i ka lae	The forehead was marked with variegated stripes,
He kikoi kapu,	Indicating high kapu;
O ke kikakapu o ku ia kapuhili	The kikakapu was substituted for kapuhili,
Au wahiawahi ia lani.	The time that chief ended.
(Fornander 1919–1920:485)	

The use of *kīkākapu* to signify one's intent to challenge a group of people is described in an account titled, *Kaʻao no Kaipalaoa, ke Keiki Hoʻopapa* (Legend of Kaipalaoa, the Hoʻopapa Youngster) (Fornander 1916–1917). Fornander writes that Kaipalaoa's father, Halepaki, was killed by Kalanialiʻiloa, the *kapu* chief who was skilled in *hoʻopāpā*—a traditional art of riddling and debate. To avenge his father's death, Kaipalaoa sought to master the art of *hoʻopāpā* and compete against Kalanialiʻiloa, and eventually made his way to Hanalei, Kauaʻi. While at Hanalei, the boy came across two of the king's canoes that were filled with fish. The king gave the boy took two fish, an *oililepa* and a *kīkākapu*, and Kaipalaoa continued on his way to where the *kapu* chief Kalanialiʻiloa lived. Fornander relates the following details regarding the use of the *kīkākapu*,

> From this place he continued on to Anahola; thence on to Kealia and then on to Wailua where Kalanialiiloa resided, where was his bone fence, almost completed, built from human bones. When he arrived at the place he looked and saw the bones of Halepaki his father; they were still fresh, the bones not yet being bleached. At sight of this the boy bowed in sorrow and wept. After his weeping he approached the flagstaff and pushed it down and put up the oililepa, one of the fish brought along by him. He then next took the kapu stick and pushed it down and put up in its place the other fish, the **kikakapu**. By this action of the boy, it was meant as a challenge to the people that he saw come to meet them in a wrangling contest. When Kalanialiiloa and his instructor saw the action of the boy, they knew at once that he was challenging them to a contest of wits, so a messenger was dispatched to meet the boy showing the challenge was accepted. (1916–1917:576)

Lauhau and Lauhau wiliwili

The term *lauhau* has been translated as "brightly colored butterfly fish (*Chaetodon quadrimaculatus* and *C. umimaculatus)*" and may also be "qualified by the terms *kapuhili*, *kīkākapu*, *maha uli*, *nuku ʻiʻiwi* or *nuku ʻiwi*, and *wiliwili*" (Elbert and Pukui 1986:195). The milletseed butterflyfish (*C. miliaris*) ranges in length from one to six inches and is pale yellow in color with a black band on the head across the eye and another near the tail, "rows of pale blue spots string downward" along the sides of the body (Titcomb 1972:98). This variety of fish is known as *lau wiliwili* or *lauhau wiliwili*, meaning "*wiliwili* leaf," because its shape is believed to resemble the endemic *wiliwili* tree. The fourspot butterflyfish (*C. quadrimaculatus*) is termed *lauhau*. A characteristic of the *lauhau* is described in the *ʻōlelo noʻeau*, "*he lauhau, he iʻa hōkake kāheka*," which has been translated as "it is a lauhau, the fish that creates disturbances in sea pools" (Pukui 1983:80). Pukui goes on to elaborate on this saying, noting that it was in reference to "…a boisterous person" (ibid.). Manu et al. (2006) describe how *lauhau* were caught using the *kūkulu ʻupena* method, or a standing net, which was cast from the shore. They indicate that the types of fish commonly caught in the *kūkulu* nets were *ʻāloʻiloʻi* (*Dascyllus albisella*), *hīnālea*, and *lauhau*.

With respect to its value as a food fish, Titcomb reports that there was some disagreement as some informants reported that this fish was "bony, not worth eating" while others contend "sweet flesh, broiled on charcoal immediately, without scaling or cleaning" (1972:97). Titcomb adds that the *lauhau* was used in the *hoʻomelumelu* style of preparation (ibid.). Elbert and Pukui define *melu* as "…slightly decomposed, then salted and seasoned with kukui-nut relish, chili peppers, etc." (1986:246); this *ho'omelumelu* preparation of fish was also applied to *hīnālea.*

Ctenochaetus strigosus (*kole, kole makaonaona*)

Ctenochaetus strigosus (Figure 56), known in Hawaiian as *kole makaonaona* or *kole*, are characterized by their yellow-ringed eyes, and are the most popular variety of kole for eating. The eyes of this variety were described as beautiful, and the name *kole maka onaona*, bright-eyed *kole*, was often applied to them (Pukui and Elbert 1986). *Kole* are often found traveling in schools, and sometimes associate with the *pāku'iku'i*, or Achilles Tang (*Acanthurus achilles*).

Kole have very small scales, but have tough, thick skin. This trait has been poetically described in the *'ōlelo no'eau,* "*he nanea no ka lawai'a kole*," which means, "it is interesting to fish for *kole*" (Pukui 1983:91). Pukui adds, "it is interesting to gather and tell stories. The English word 'story' was Hawaiianized to *kole*, which is also the name of a thick-skinned fish" (ibid.).

Although *kole* is known as being tough-skinned, it is considered a favorite fish to eat raw. Malo indicates that *kole* have flattened bodies and are considered "good eating" (Malo 1951:46). *Kole* was also important for traditional practices and customs relating to the home, as it was believed to "*hole*," or "strip away," (Titcomb 1972) unwanted spiritual energy from the house. As documented by Titcomb, if a home that was under construction needed to be rid of "evil influences," *kole* or *'āholehole* (*Kuhlia xenura;* Hawaiian flagtail) were placed under the east-facing house post prior to it being set (1972:60).

Figure 56. *Ctenochaetus strigosus* at Mokapu, O'ahu.

In the March 8, 1923 issue of *Ka Nūpepa Ku'oko'a*, an article titled *Ka Ho'opakele Ana I Nā I'a*, offers insights into the traditional beliefs and practices related to catching *kole* and other similar fish. Presented below is a portion of this article concerning *kole* (bolded for emphasis), translated by Titcomb:

> Fish such as the Manini, the **kole**, the uhu, the kumu and the palani and the kala and many others went into sea pools to live until the tiny fish were grown. No kapus were imposed on them at the spawning season. The mullet, squid, aku, opelu and other fish bore their young in a place that was not sheltered…They were made kapu when the spawning season was near until the months for this duty were over. (Titcomb 1972:14).

Forcipiger Flavissimus (*lauwiliwili nukunuku 'oi'oi*)

The Longnose Butterflyfish (*Forcipiger flavissimus*; Figure 57), also known as the *lauwiliwili nukunuku'oi'oi* or forcepsfish, is a common 6-inch long reef fish recognizable for its intense yellow color, long snout, and quill-like dorsal spine (Hoover 2007). There are two species of the Longnose Butterflyfish—the *Forcipiger flavissimus* and the *Forcipiger longirostris*—which both take on the name *lauwiliwili nukunuku'oi'oi*. Per Hoover, The term *lauwiliwili* translates to "leaf of the *wiliwili* tree," *nukunuku* is "beak," and *'oi'oi* is "best" or "sharp" (2007:23). The name refers to the vibrant colors of the native *wiliwili* tree foliage and the shape of the forcepsfish's beak-like mouth, which they use to probe corals for food. These fish frequent walls, ledges, and overhangs at a depth of up to 350 feet (Stender and

Stender 2019). Although small in size, this fish was "good to eat, though there is little flesh" (Titcomb 1972:117) and was typically broiled. The review of culture-historical literature conducted for this study did not reveal any additional cultural information related to this species.

Figure 57. *Forcipiger flavissimus* pictured on Oʻahu.

Halichoeres ornatissimus (*lāʻō*)

Halichoeres ornatissimus (Ornate/Pinkface Wrasse Figure 58), referred to in Hawaiian as *lāʻō*, is a small, slender fish that ranges from five to six inches in length. Bright in color, *lāʻō* are distinguished by their salmon hue and iridescent green stripes that extend across the face (Hoover 2007). The dorsal, anal, and tail fins are blueish with green spots and stripes. Juvenile *lāʻō* are dark reddish brown with light green stripes and brown spots. The review of culture-historical literature conducted for this study did not reveal any specific cultural information related to this species.

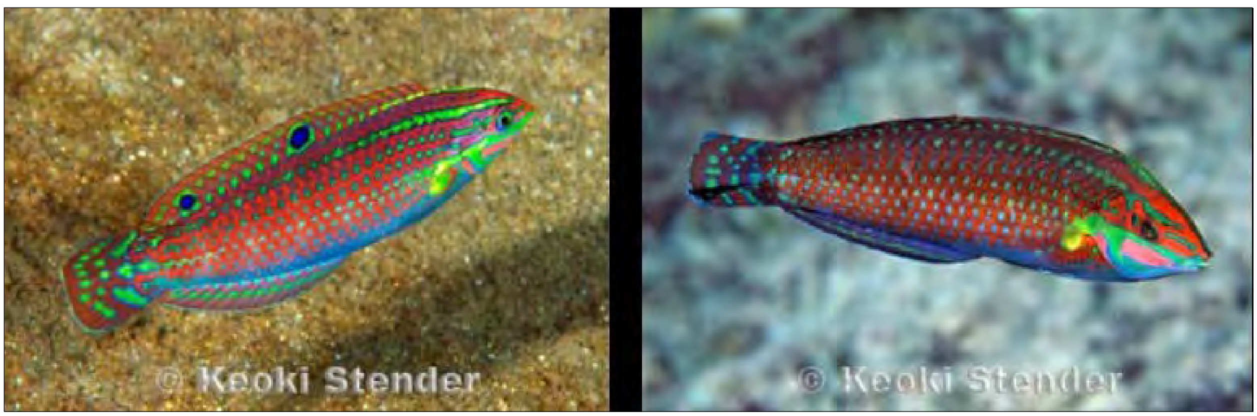


Figure 58. *Halichoeres ornatissimus* female at Waimea Bay (left) and male at Waikīkī (right).

Naso lituratus (*kala, umaumalei*)

A member of the surgeonfish family (*Acenthuridae*), *Naso lituratus* (Orangespine Unicornfish; Figure 59), known in Hawaiʻi as *umaumalei*, is common in shallow waters where it feeds upon algae, sometimes in schools. While the *umaumalei* is a specific species within the family *Acenthuridae*, some traditional accounts classify them under the name *kala* or *kala umaumalei* (Titcomb 1972). Hoover describes the most prominent features of this fish as follows:"bright orange lips, a graceful curve of yellow from eye to mouth (somewhat like a lei), and orange caudal spine identifies this attractive hornless unicorn fish" (Hoover 2007:148). Per Hoover, the orange markings tend to brighten in color when hunting; the colors are dull when these fish are in their juvenile stage, while large males are distinguished by thin tail streamers (ibid.). This species ranges in size from fourteen to eighteen inches long, but they have yellow tails when they are four to five inches long, and a spike near the caudal fin, which they use to defend themselves (Titcomb 1972).

Figure 59. *Naso lituratus* at Hanauma Bay, Oʻahu.

A chant submitted by S. Z. Kalaaukumuole (1866) to the November 24, 1866 edition of *Ka Nūpepa Kūʻokoʻa* states, "*O ka Umaumalei ke lii*," which translates as "the *umaumalei* is chief." The *umaumalei* is also referenced in the Kumulipo (Beckwith 1951; Glidden et al. 1997; Liliuokalani 1978), where it is paired with its land counterpart the *ʻūlei* (*Osteomeles anthyllidifolia*). In addition to their protruding horn, *kala* also have a caudal spine. An *ʻōlelo noʻeau* that describes this unique trait states, "*mālama i ke kala ka iʻa hiʻu ʻoi*," which translates as "watch out for the *kala*, the fish with a sharp tail," and is said as "a warning to beware of a person who is well equipped to defend himself" (Pukui 1983:230).

Kala in all of its forms was a popular Hawaiian delicacy for they were abundant and easy to catch; most often broiled over coals and rarely eaten raw (Titcomb 1972). Malo described the fish as being "greatly flattened" (1951:46). The soft parts of the fish are described as good *palu* (fish bait); and kala were often dried after skinning the fish with the flesh cut into strips, or with the skin on and the meat cut away from the spine (Titcomb 1972).. According to Titcomb (1972), an informant described this fish as best when broiled or baked, after it was about three-quarters dried, and not too stiff or hard..

The skin of the *kala* is tough and has no scales, which made it ideal for the covering on the *pūniu*, a small drum that was lashed onto the thigh of a *hula* dancer (Abbott 1992). The skin also produces a pungent odor, but its strong smell varied depending on the region it was from, which is a result of their diet (Titcomb 1972). A traditional custom to rid the pungent smell, was done in the same manner as for the *palani*, which was to lay the fish across both hands with the head on the left palm and the tail on the right palm, then breathe in over the fish, while turning the head from left to right, and then breathe out violently. This process was repeated on the other side of the fish (Titcomb 1972).

Per Titcomb, during the spawning seasons, certain fish were prohibited from being caught and consumed, which included *kala* (ibid.). In the March 8, 1923 issue of *Ka Nūpepa Kuʻokoʻa*, an article titled "*Ka Hoʻopakele Ana I Nā Iʻa*," offered insight into the traditional beliefs and sustainable practices of *kala* and other similar fish. Presented is a portion of this article concerning *kala*, translated by Titcomb:

> Fish such as the Manini, the kole, the uhu, the kumu and the palani and the kala and many others went into sea pools to live until the tiny fish were grown. No kapus were imposed on them at the spawning season. The mullet, squid, aku, opelu and other fish bore their young in a place that was not sheltered…They were made kapu when the spawning season was near until the months for this duty were over. (Titcomb 1972:14).

Although already touched upon in the traditional fishing methods discussion, further details about the use of *hīnaʻi* and *holoholo* nets are provided below as they were used to catch *kala*. Manu et al. (2006) described the *ʻie kala* (lit. *kala* basket) as the largest type of *hīnaʻi*. These baskets were round and flat, and about four to five feet long and two and a half to three feet deep with a one-and-a-half-foot opening. Near the large end of the opening, a small wicker cylinder or cone is attached and turned inwards towards the bottom of the basket with the free end of the cone small enough for the *kala* to fit through. Use of the *ʻie kala* is described as follows:

> Immediately below the end of this cone, on the bottom of this basket, is placed the bait, properly secured, which in the case of the kala is limu kala (a course brownish-yellow algae on which this fish feeds and from which it takes its name), ripe breadfruit, cooked pumpkins, half-roasted sweet potatoes, and papayas. This basket is called ‘ie lawe (taking basket). The fishermen generally feed the fish at a given place for a week or more before taking any, using large feeding baskets, similar to the ‘ie lawe, but without the inverted cylinder and wider at the mouth to allow the fish free entry and exit. After a week or two of feeding, the fish become very fat and fine-flavored, and also very tame, so that baskets full of fish can be drawn up in the ‘ie lawe without in the least disturbing the fish which are still greedily feeding in the feeding baskets. The ‘ie kala are occasionally used to catch other kinds of fish, substituting bait known to attract particular kinds, but the technique is never as successful as with kala. (Manu et al. 2006:96)

When the *hīna‘ī* were used it was an event for the village—all would gather at the shore. The first *kala* went to the *ali‘i* of the area, while the fisherman was allowed to take a few from the *akua* basket. After distribution of the fish, an *imu* (underground oven) would be ashore and ready for cooking. Preparation methods include *pūholo* (steam), *kālua* (to bake), *hākui* (to steam), and *laulau* (wrapped in ti leaves and baked). Once the *kala* was cooked, the first *hīna‘ī* was for the gods and head fishermen along with his crew and the *ka honua ‘āina* (heads of the land). It is said that the land of Ka‘ena was the “land abounding in *kala* fish, but perhaps by now their heads are as hard as coral, *ko‘a ka lae* [past full maturity, not having been caught]” (Kamakau 1976:85).

Additional methods for catching *kala* included the use of a *holoholo*, a net tied to a twelve-foot-long piece of *alahe‘e* (*Canthium odoratum*) wood. The net was lowered down in an area with swift-ebbing tides with one person holding the net and the other corralling fish into it (Manu et al. 2006). *Hina‘i pai kala*, was a method of using a plaited basket as a net. The basket was filled with *limu kala* (seaweed), *kalo*, and pumpkin and then let down for the fish to feed. This process was continued until the fish became plump and accustomed to feeding in the basket, then a dipnet or scoop net was used to collect *kala*.

Kala was also used for ceremonial purposes. The *kahuna ‘aumakua* and *kahuna po‘oko‘i* were the most notorious and demanding in terms of sacrifices and offerings needed to proceed with the healing process (Kamakau 1964:96). The food items requested included a black sow, eight *kala* fish, eight *kumu* fish, eight *he‘e*, a *weke* fish, a mullet, an *awa* fish, *‘ōpae* from *mauka* streams, *ho‘io* shoots, a red chicken, a white chicken, a black chicken, a young coconut, *kapa*, a dog, sugar cane, spring wter, a *lei*, body adornments, sweet potatoes, *kalo*, *‘uala palau* (sweet potato and coconut milk pudding), bananas (*popo‘ulu* and *iholena* varieties), *‘awa*, and *poi*. These items were for the patient and his relatives to eat, but if the *‘ohana* (family) extended the offer for the *kahuna* and his family to join in on the feast they would oblige.

Pseudanthias bicolor

Pseudanthias bicolor (Bicolor Anthias; Figure 60) are commonly encountered by divers in Hawai‘i (Hoover 2007:75). Their back and upper side are orange, while the underside ranges from a pale lavender to white. Males are larger than females and have an elongated second and third dorsal spine bearing a small fleshy yellow flap at the tip. These fish prefer depths of 40 ft. or more and live in colonies along walls or isolated coral heads. However, they have been spotted at depths of 15-20 ft. at Mākua, O‘ahu. They can grow in length up to 4.5-inches. The review of culture-historical literature conducted for this study did not reveal a Hawaiian name or specific cultural information related to this species.

Figure 60. *Pseudanthias bicolor.*

***Thalassoma duperrey* (*hīnālea lauwili*)**

Thalassoma duperrey (saddle wrasse; Figure 61) also known as the *lauwili* variety of *hīnālea* is said to have been named after the *wiliwili* (*Erythrina sandwicensis*) tree; a dryland tree whose flowers are of a bright orange hue. This variety is said to be the most commonly observed of the *hīnālea* species. *Hīnālea lauwili* are small coral reef fish that are very abundant in Hawaiian waters. The *lauwili* is referenced in traditional fishing practices as "the proper fish to eat as an aftertaste to *ʻawa* [a mildly narcotic drink made from the chewed *Piper methysticum* plant]*"* (Titcomb 1972:77). The scales of the fish were hard to remove so it was usually skinned, before or after cooking, or broiling, but was mostly eaten raw. This type of fish was also good for *iʻa hoʻomelumelu,* which is the practice of removing the entrails, head, tail, and spine, followed by scraping off the scaly skin, then dressing it with condiments (Titcomb 1972:77). Beyond these details, the review of culture-historical literature conducted for this study did not reveal any additional cultural information related to this species.

Figure 61. *Thalassoma duperrey* male at Kewalo, Oʻahu.

***Zanclus cornutus* (*kihikihi*)**

Zanclus cornutus (Moorish Idol) is the only member of the family Zanclidae (Hoover 2007:90). This classic coral reef fish, known in Hawaiian as *kihikihi,* translated as "corners, curves, angular" aptly describes this fish's body shape and markings (Pukui and Elbert 1986:147). Hoover reports that *kihikihi* can grow up to eight inches long and are reported to be "difficult to maintain in captivity, being active and high-strung, hard to feed, and surprisingly aggressive."

(2007:90). Their white and yellow-gold bodies are striped with thick jet-black bands, while their snouts are long and striped with orange and white. They are easily identified by a wispy, long white filament that extends from their dorsal fin. In describing additional qualifiers, Titcomb notes that other varieties of *kihikihi* were known by the terms "*kihikihi launui* (big-leafed), or *mane'one'o* (irritating), *k. alo-'ula* (red breast), silvery, *k. pohaka* (big spot), and *k. halena* (yellowish)" (1972:88).

Figure 62. Zanclus cornutus at Kewalo Pipe, Oʻahu.

Typically traveling in pairs or schools, these fish can be found in deep waters but are commonly observed grazing on sponges in shallower waters. Although Hoover (2007) contends that their diet consists primarily of sponges, which likely produces a bad taste, Titcomb provides conflicting accounts regarding its consumption. Titcomb relates that it was "not eaten much, too little flesh" but also states that *kihikihi* was "A delicious fish when broiled, not only to the back-country people; it is considered delicious in the courts of the chiefs, delicious to Panahaʻeka (Panaha-the-humble)" (1972:88). Native Hawaiian author, David Malo, noted that this flat bodied fish was one amongst almost two dozen (although he adds that the list was not exhaustive) considered to be good eating ((1951:46).

Zebrasoma flavescens (*lāʻī pala, lauʻīpala*)

Zebrasoma flavescens (Figure 63) are most commonly known as yellow tangs and referred to in Hawaiian as *lauʻīpala* or *lāʻī pala*. It is an inshore fish that grows up to approximately seven inches. A bright-colored yellow, the *lāʻī pala* has no scales; rather, they have a combination of rough and soft skin (Titcomb 1972). Per Titcomb (1972), Although small, these fish were considered a delicacy were prepared for consumption by broiling; the skin was edible when cooked, but was removed if eaten raw.

In *The Epic Tale of Hiʻiakaikapoliopele*, Hiʻiaka spoke of a healing ritual that includes the consumption of the *lauʻīpala*:

> Listen to me, this grandchild of ours will be troubled no more. When we depart, you fetch the blossoms of the maʻo in abundance, then mash them soft, make a ball of it, and affix it to the soft spot on the head of our grandchild. Before high noon, he will awaken, and will be healed. And if he hungers for food, then feed him warm potato, along with *lauʻipala*, the fish called the yellow tang. That fish will make for abundance of food, like the bounty of Makaʻukiu. This grandchild of ours is no longer ill. (Hoʻoulumāhiehie 2006:131-132)

Figure 63. *Zebrasoma flavescens* at Kahe Point, Oʻahu.

It is evident from the information presented above that a large majority of these species were utilized throughout the Precontact and Historic era as they are mentioned in traditional legendary narratives and a variety of historical accounts. Collectively, these narratives provide a baseline understanding of the beliefs associated with some of these species and the ways in which these fish have been utilized in Hawaiian culture.

THE ARRIVAL OF WESTERNERS AND THE TRANSFORMATION OF MARINE RESOURCE MANAGEMENT PRACTICES IN HAWAIʻI

By the mid-18th century, Kamehameha had directed his efforts towards consolidating Hawaiʻi Island under his rule. To accomplish this feat, Kamehameha continued to train under his more experienced kin, namely Kalaniʻōpuʻu, who held the title of *aliʻi nui* of Hawaiʻi Island (Ii 1959). During Kalaniʻōpuʻu's reign, the first foreign vessels captained by the British explorer, James Cook arrived in Hawaiian waters. Cook first landed at Waimea, Kauaʻi in 1778 and on January 17, 1779, he anchored in Kaʻawaloa Bay, Kona (Kamakau 1992). Aboard these foreign ships were innovative technologies and diseases unknown to the original inhabitants of the Hawaiian Islands. Items such as metal, nails, guns, canons, and the large foreign vessels themselves, stirred the interest of the Kānaka Maoli. Acquisition of these technological advancements came through barter. This ultimately resulted in the *aliʻi* gaining possession of foreign items that ultimately set traditional Hawaiian warfare in new trajectory, one forged by Kamehameha himself. By the late 18th century, wars were occurring regularly between intra-island and inter-island polities, and by 1810, Kamehameha had unified all of the Hawaiian Islands under his rule. Following this unification, Kamakahonu in Kailua, Kona became his seat of government until his death in 1819 (Kamakau 1992).

The year 1778 marks the end of what is often referred to as Hawaiʻi's Precontact Period and the beginning of the Historic Period. While 1778 signifies an important date in Hawaiian history, the Hawaiian chiefs still held outright rule over the land and its resources and maintained strict adherence to the *kapu* system throughout the Early Historic Period, despite the Western influences. At the outset of the Historic Period, there was a continued trend toward craft and status specialization, intensification of agriculture, *aliʻi*-controlled aquaculture, the establishment of upland residential sites, and the enhancement of traditional oral history. The veneration of traditional gods and the strict observation of the *kapu* system were also at their peaks (Kent 1983; Kirch 1985).

Some researchers have argued that the abrogation of the *kapu* system in 1819, under the rule of Kamehameha's son, ʻIolani Liholiho (Kamehameha II) undermined the foundation upon which traditional Hawaiian society was built, and altered not only the relationship between the *aliʻi* and the people, but also the Hawaiian people's relationship to the land (Else 2004; Kameʻeleihiwa 1992). Such cultural changes were bolstered by the arrival of Missionaries, beginning in the aearly 1820s. These early missionaries introduced monotheistic Christian beliefs, established Hawaiian orthography, and generally promoted a Euro-American lifestyle and political system. During this same time period, the first commercial fishing ventures were underway in the islands as British and American whaling fleets began to arrive in Hawaiian waters. These early whalers established Hawaiʻi as their provisioning and trading headquarters (Schug 2001). The whaling industry lasted for several decades, and by the 1850s had reached its peak, with some five hundred whaling vessels operating out of the various island ports. Many Kānaka Maoli men, who were skillful on the ocean, became employed in this industry.

With the influx of foreigners, many of whom were quick to introduce the idea of trade for profit and fee simple ownership of land, Hawai'i's traditional culture and sociopolitical economy began to shift to meet the demands of the foreign population. Kānaka Maoli began to engage in commercial fishing, which lead to the establishment of fish markets by the early 1830s (Schug 2001). As Schug explains, "commercial fishing provided Hawaiians an early opportunity to participate in the new island economy with a relatively small capital outlay and without abandoning their own customs and skills" (2001:17). Schug provides the following account of Hawaiian fishers' adaptations to newly introduced Western materials:

> As new goods and materials became available, Hawaiian fishermen modified their fishing accoutrements. Steel hooks, for example, replaced those carved from pearl-shell, and wooden spears were tipped with iron. But the Hawaiians0 retained many of the long-established fishing techniques that were so well adapted to Hawai'i's marine environment. Also retained were various ancient rituals to ensure safety at sea and a bountiful catch. Fishermen continued to pray to the traditional deities for success and appease them with offerings of fish. (2001:17)

Fishing Rights Codified in the Hawaiian Kingdom Government Constitutional Laws of 1839 and 1846

Traditionally, Hawaiian land stewardship practices and philosophies were centered around the natural resources that extended from the mountain tops to the deep ocean, which were held in "trust" by the *mō'ī* (King) and his *ali'i* (Maly and Maly 2003). Under the ancient system, land use rights included access to fisheries and natural resources that were within the lands, which were then given to the *hoa'āina* (native tenants). In 1839, under the administration of Kamehameha III (Kauikeaouli) a set of laws were drafted that were known as *Ke Kumukānāwai, a me Nā Kānāwai O Ko Hawai'i Pae 'Āina* (The Constitution and Laws of the Hawaiian Islands). These laws proclaimed the rights of the people, and ensured equitable protection for the people and chiefs (Achiu 2002). By October 8th, 1840, Kamehameha III and Kekāuluohi, the *Kuhina Nui* (Premier), had enacted the 1840 constitution that "…organized the parts and the functions of government at that time," and included the creation of the *'Aha'ōlelo* (House of Representatives) as part of the legislative body, thereby allowing the voice of the people to be heard in governmental matters (2002:35). Kamehameha III officially defined the ancient fishing rights and practices of the people in the Constitution and Laws of 1839 and reconfirmed them in 1840 (2003:26). With respect to the fisheries, these laws permitted Kamehameha III to distribute the fishing grounds and resources between the *ali'i* and the people of the land. Maly and Maly, further emphasize that "fisheries on coral reefs fronting various lands were for the landlords (*konohiki*) and the people who lived on their given lands (*ahupua'a*) under the *konohiki*" (2003:243). Maly and Maly (2003) compiled the Hawaiian laws enacted between the years of 1833-1842 from archival records located at the Hawai'i State Archives. These laws identified the responsibilities and rights of the *konohiki* and the people pertaining to various types of fishing grounds and resources. As can be seen below, the laws also acknowledged the practice of *kapu*, or restrictions, with respect to fishing customs and specific fisheries. Those laws pertaining to fishing rights related to the *noa* or free fishing grounds are excerpted verbatim below:

> **No na Kai noa, a me na Kai kapu.**
>
> **(Of free and prohibited fishing grounds) (1839-1841)**
>
> **I. —Of free fishing grounds. (No ka noa ana o ke kai)**
>
> His majesty the King hereby takes the fishing grounds from those who now possess them, from Hawaii to Kauai, and gives one portion of them to the common people, another portion to the land-lords, and a portion he reserves to himself. These are the fishing grounds which his Majesty the King takes and gives to the people; the fishing grounds without the coral reef. viz. the Kilohee grounds, the Luhee ground, the Malolo ground, together with the ocean beyond.
>
> But the fishing grounds from the coral reefs to the sea beach are for the landlords, and for the tenants of their several lands, but not for others. But if that species of fish which the landlord selects as his own personal portion, should go onto the grounds which are given to the common people, then that species of fish and that only is taboo. If the squid, then the squid only; or if some other species of fish, that only and (1842:36) not the squid. And thus it shall be in all places all over the islands; if the squid, that only; and if in some other place it be another fish, then that only and not the squid.
>
> If any of the people take the fish which the landlord taboos for himself, this is the penalty, for two years he shall not fish at all on any fishing ground. And the several landlords shall give immediate

notice respecting said fisherman, that the landlords may protect their fishing grounds, lest he go and take fish on other grounds.

If there be a variety of fish on the ground where the landlord taboos his particular fish, then the tenants of his own land may take them, but not the tenants of other lands, lest they take also the fish tabooed by the landlord. The people shall give to the landlord one third of the fish thus taken. Furthermore, there shall no duty whatever be laid on the fish taken by the people on grounds given to them, nor shall any canoe be taxed or taboo'd.

If a landlord having fishing grounds lay any duty on the fish taken by the people on their own fishing grounds, the penalty shall be as follows: for one full year his own fish shall be taboo'd for the tenants of his own particular land, and notice shall be given of the same, so that a landlord who lays a duty on the fish of the people may be known.

If any of the landlords lay a protective taboo on their fish, when the proper fishing season arrives all the people may take fish, and when the fish are collected, they shall be divided—one third to the fishermen, and two thirds to the landlord. If there is a canoe full, one third part shall belong to the fishermen, and two (1842:37) thirds to the landlord. If the landlord seize all the fish and leave none for the fishermen, the punishment is the same as that of the landlords who lay a duty on the fish of the people.

If, however, there is any plantation having fishing grounds belonging to it, but no reef, the sea being deep, it shall be proper for the landlord to lay a taboo on one species of fish for himself, but one species only. If the parrot fish, then the parrot fish only; but if some other fish, then that only and not the parrot fish. These are the enactments respecting the free fishing grounds, and respecting the taking of fish. (2003:244-246)

The next excerpt includes the laws related to fishing in the *kapu* fishing grounds:

2.—Respecting the taboo'd fishing grounds. (No na kai kapu)

Those fishing grounds which are known by the people to have shoals of fish remaining upon them, shall at the proper season for fishing be placed under the protective taboo of the tax officers, for the King. The fishing grounds on Oahu thus protected, are 1, Kalia; 2, Keehi; 3, Kapapa; 4, Malaeakuli; 5, Pahihi. On Molokai, as follows: I, Punalau; 2, Ooia; 3, Kawai; 4, Koholanui; 5, Kaonini; 6, Aikoolua; 7, Waiokama; 8, Heleiki. On Lanai the Bonito and the Parrot fish. On Maui, the Kuleku of Honuaula and other places.

On Hawaii, the Albicore.

On Kauai, the Mullet of Huleia, Anehola [Anahola], Kahili and Hanalei, and the squid and fresh water fish of Mana, the permanent shoal fish of Niihau, and all the transient shoal fish from Hawaii to Niihau, if in sufficient quantity to fill two or more canoes, but not so small a quantity as to fill one canoe only. But if the fishermen go and borrow a large canoe, that all the fish may be put into one, then there shall be a duty upon them. (1842:38)

On the above conditions there shall be a government duty on all the transient shoal fish of the islands. The tax officer shall lay a protective taboo on these fish for his Majesty the King, and when the proper time for taking the fish arrives, then the fish shall be divided in the same manner as those which are under the protective taboo of the landlords.

If the tax officer seize all the fish of the fisherman, and leave none for those who take them, then he shall pay a fine of ten dollars, and shall have nothing more to say respecting the royal taxes. But if the order for seizing all the fish of the fishermen was from the Governor, then he shall no longer be Governor, though he may hold his own lands, and the tax officer shall not be turned out of office. At the proper time the tax officer may lay a protective taboo on all the King's fish, and the landlords' all around the island. But it is not proper that the officer should lay the taboo for a long time. The best course is for the officer to give previous notice to the fishermen, and then the common people and the landlords to fish on the same day. Thus the rights of all will be protected.

But no restrictions whatever shall by any means be laid on the sea without the reef even to the deepest ocean. Though the particular fish which the general tax officer prohibits, and those of the landlords which swim into those seas, are taboo. The fine of those who take prohibited fish is specified above. (1842:39) (ibid.)

Maly and Maly (2003) also report that on May 31st, 1841, several changes were made and signed into law regarding fisheries by the King and *ali'i*. One such section revised the punishment of a fisherman who breaks a *kapu* to state, "for two years he shall not fish at all on any fishing ground" and "if he take one fish criminally he shall pay five, and always at that rate. And if a canoe full be taken then five canoes full shall (1842:85) be paid, according to the amount taken, even to the farthest extent (1842:86)" (Maly and Maly 2003:245-246). In 1846, Article V of the "Statute Laws of His Majesty Kamehameha III" was published, which relates to fisheries and includes *kapu* on specific fish and/or entire fisheries, and is reproduced below:

ARTICLE V.—OF THE PUBLIC AND PRIVATE RIGHTS OF PISCARY (1846)

SECTION I. The entire marine space, without and seaward of the reefs, upon the coasts of the several islands, comprising the several fishing grounds commonly known as the Kilohee grounds—the Luhee grounds—the Malolo ground, and the fishery of the ocean, from said reefs to the limit of the marine jurisdiction in the first article of this chapter defined, shall be free to the people of these islands. The people shall not be molested in the enjoyment thereof except as hereinafter provided.

SECTION II. The fishing grounds from the reefs, and where there happen to be no reefs from the distance of one geographical mile seaward to the beach at low water mark, shall in law be considered the private property of the landlords whose lands, by ancient regulation, belong to the same; in the possession of which private fisheries, the said landholders shall not be molested except to the extent of the reservations and prohibitions hereinafter set forth.

SECTION III. The landholders shall be considered in law to hold said private fisheries for the equal use of themselves and the (1846:90) tenants on their respective lands; and the tenants shall be at liberty to use the fisheries of their landlords, subject to the restrictions in this article imposed.

SECTION IV. The landlords shall have power, each year, to set apart for themselves one given species or variety of fish natural to their respective fisheries, giving public notice by viva voce proclamation to their tenants and others residing on their lands, and signifying to the minister of the interior, in writing, through his agents in their districts, the kind and description of fish which they have chosen to set apart for themselves. The landlords shall respectively pay for such notification, the fees prescribed by the third part of this act; and it shall be the duty of the minister of the interior yearly to furnish the director of the government press with a list of said landlords, the districts and island of their residence, and the kind of fish specially set apart by each, in the form of a catalogue; which catalogue the said director shall cause to be once inserted in Hawaiian and English languages, in the Polynesian newspaper, for public information, at the expense of said minister to be included by him, according to a fixed rate, in the fees to be received at his department from the respective landlords.

SECTION V. The specific fish so set apart shall be exclusively for use of the landlords, if caught within the bounds of his fishery, and neither his tenants nor others shall be at liberty to appropriate such reserved fish to their private use; but when caught, such reserved fish shall be the property of the landlord, for which he shall be at liberty to sue and recover the value from any fisherman appropriating the same; and more over, if he take one fish criminally he shall pay five, and in the proportion shall he pay to the full amount of what he may have taken wrongfully. Whoever may have taken fish in violation of this law, without paying as about, shall be fined fifty dollars for each offence.

SECTION VI. The landlords shall not have power to lay any tax or impose any other restriction upon their tenants regarding the private fisheries that is in the preceding section prescribed, neither shall such further restrictions be valid. (1846:91)

SECTION VII. It shall be competent to the landlords, on consultation with the tenants of their lands, in lieu of setting apart some peculiar fish to their exclusive use, as hereinbefore allowed, to prohibit during certain indicated months of the year, all fishing of every description upon their fisheries; and, during the fishing season to exact of each fisherman among their tenants, one thirds part of all the fish taken upon their private fishing grounds. In every such case it shall be incumbent on the landlords to comply in like manner with the requirements of the fourth section of this article.

SECTION VIII. The royal fish shall appertain to the Hawaiian government, and shall be the following, viz:

1st. The bonito when off any part of the coast of Lanai.

2nd. The albacore of Hawaii.

3rd. The mullet of Huleia, Anehola [Anahola], and Hanalei; the squid and freshwater fish of Mana on Kauai.

4th. The shoal fish taken at the following places, noted for the abundance of fish frequenting them; off Oahu: 1, Kalia; 2, Keehi; 3, Kapapa; 4, Malaeakuli, and 5, Pahihi.

5th. Off Molokai: 1, Punalau; 2, Ooia; 3, Kawai; 4, Koholanui; 5, Kaonini; 6, Aikoolua; 7, Waiokama, and 8, Heleiki.

6th. And off Maui; the kuleku of Honuaula; and the same whenever found off said island.

7th. All the following transient fish, viz:—1, the kule; 2, the anaeholo; 3, the alalauwa; 4, the uhukai; 5, the kawelea; 6, the kawakawa; 7, the kalaku.

These shall be divided equally between the king and fishermen. But on all the prohibited fishing grounds the landlords shall be entitled to one species of fish, and those who have walled fish ponds shall be allowed to scoop up small fish to replenish their ponds. If the prohibited fish of the landlord be mingled with the royal fish, then the landlord shall be entitled to one third of the whole of the fish taken, though this applies only to Molokai, Oahu and the rivers of Kauai.

All which shall be yearly protected by the king's taboo, to be imposed by the minister of the interior, by means of circular from his department, as prescribed in the act to organize the executive ministry; and during the specified season of taboo they shall not be subject to be taken by the people. (1846:92)

SECTION IX. At the expiration of the taboo seasons, all persons inhabiting these islands shall be at liberty to take the protected fish, accounting to the fishery agents of the respective districts off which the same shall have been caught, for the half or portion, so taken; and the minister of the interior shall make known through his agents by viva voce proclamation, the respective months or seasons of the year during which the said royal fisheries may be used and the said protected fish taken.

SECTION X. The minister of the interior shall appoint suitable and proper fishing agents in the several coast districts of the respective islands, to superintend the fisheries aforesaid, to whom he shall from time to time give directions through the respective governors, in regard to the sale or other disposition of the share of fish accruing to the government.

SECTION XI. It shall be the duty of the agents appointed, to exact and receive of all fishermen, for the use of the royal exchequer, during the legalized fishing seasons the one half part, or portion of all protected fish taken without the reefs, whether at the respective places in the eighth section of this article indicated, or in the channels and enclosed seas dividing these islands, or upon the high seas within the marine jurisdiction of this country. And if any officer or agent of this government shall exact more fish of the people than is in and by this section expressly allowed, he shall on conviction, forfeit his office, and be liable to pecuniary fine, in the discretion of the court, before which he shall have been convicted.

SECTION XII. It shall be competent for His Majesty, by an order in council, from time to time, to set apart any given portion, or any definite kind of the said protected fish, or any proportional part of the avails therefrom arising, for the use of the royal palace, to be delivered or paid over to the chamberlain of his household, created by the third part of this act.

SECTION XIII. It shall be incumbent on the minister of the interior to provide, by instructions to the respective governors, for the sale and disposal of all fish received by the said fishing agents, and to pay the avails thereof to the minister of finance. (1846:93)

SECTION XIV. If any person shall, in violation of this article, take out of season the fish protected by the king’s taboo, or if any person shall, within the free fishing seasons, take any of the protected fish, without delivering to the agent appointed for that purpose the proportion accruing to the royal exchequer, he shall, on conviction, forfeit all fish found in his possession, and shall, in addition, pay fivefold for all fish thus taken, or he may be put in confinement, at the discretion of the court condemning him. (1846:94; HSA collection KFH 25 .A24 1825/46) (Maly and Maly 2003:246-248)

Soon, questions concerning the rights of the *konohiki* and the restrictions upon the *hoaʻāina* in the matters of fisheries arose. Maly and Maly relate that “a number of communications clarifying the Laws cited above, were published” (2003:250). Among the communications was an Interior Department document (detailed below), which sought to resolve the issue:

> FISHING RIGHTS, RESTRICTIONS AND LIBERATION
>
> Interior Department Document Number 148
>
> That, to whomsoever it may concern, the catching with hands of fishes and shrimps, etc., from the specified seas call, “Fishing grounds”, for human consumption only are hereby liberated.
>
> That, is the King or the Konohiki are lack in having the catch of a certain fish and wish to prohibit some of these fishes (unspecified fish: but freely given to citizens), it is well in doing so.
>
> That, the Konohiki is hereby ordered to take only one fish; and that the main coral fishing grounds, or other coral fishing grounds are under the jurisdiction of the government. That, the Konohiki is hereby allowed to take only one fish from these coral fishing grounds; and that he is not to take two or three; not that much.
>
> If the overseer or the Konohiki who is in charge of a fishing right knows that he is out of fish, and wishes to have some by sending his brother out to fish, it is at his discretion in doing so; but, not to accuse him after the fish is caught. (Maly and Maly 2003:250-251)

THE LEGACY OF THE *MĀHELE ʻĀINA* OF 1848

By the mid-19th century, the growing population of Westerners in the Hawaiian Islands forced socioeconomic and demographic changes that promoted the establishment of a Euro-American style of land ownership. By 1840, the first Hawaiian constitution had been drafted and the Hawaiian Kingdom had shifted from an absolute monarchy into a constitutional government. Convinced that the feudal system of land tenure previously practiced was not compatible with a constitutional government, King Kamehameha III and his high-ranking chiefs decided to separate and define the ownership of all lands in the Kingdom (King n.d.). In 1845, the legislature created the Board of Commissioners to Quiet Land Titles (more commonly known as the Land Commission) to adopt guiding principles and procedures for dividing the lands and granting land titles, and to act as a court of record to investigate and ultimately award or reject all claims of private individuals brought before them (Cannelora 1974). The influence of Western businessmen and missionaries furthered the change in land tenure, because they were generally hesitant to enter business deals on leasehold lands that could be taken from them at any time. This period of land tenure transformation is known as the *Māhele ʻĀina*.

The *Mōʻī* and some 245 *aliʻi* spent nearly two years trying unsuccessfully to divide all the lands of Hawaiʻi amongst themselves before the whole matter was referred to the Privy Council on December 18, 1847 (King n.d.; Kuykendall 1938). Once the *Mōʻī* and *aliʻi* accepted the principles of the Privy Council, the *Māhele ʻĀina* was completed in just forty days (on March 7, 1848), and the names of all of the *ahupuaʻa* and *ʻili kūpono* of the Hawaiian Islands and the *aliʻi* who claimed them, were recorded in the Māhele Book or Buke Māhele (1848; Soehren 2005). As this process unfolded, Kamehameha III, who received roughly one-third of the lands of Hawaiʻi, realized the importance of setting aside public lands that could be sold to raise money for the government and or to his subjects to live on. Accordingly, when the name the last chief was recorded in the Buke Māhele, Kamehameha III commuted about two-thirds of the lands awarded to him to the Hawaiian Kingdom Government (King n.d.). The lands surrendered to the government by the *Mōʻī* and *aliʻi* became known as “Government Land,” while the lands retained by Kamehameha III became known as “Crown Land,” and the lands received by the chiefs became known as “Konohiki Land” (Chinen 1958); all three types of land were subject to the rights of the native tenants therein.

The *aliʻi* and *konohiki* were required to present their claims to the Board of Commissioners to receive a Land Commission Award (LCAw.) for lands provided to them by Kamehameha III. They were also required to provide commutations to the government in order to receive royal patents on their awards. The lands were identified by name only, with the understanding that the ancient boundaries would prevail until the land could be surveyed. This process expedited the work of the Land Commission and subsequent land transfers (Chinen 1961). Native commoners could also register claims for land they actively lived on or farmed with the Land Commission, and if substantiated, they would receive a LCAw., often referred to as a *kuleana*; upon confirmation of a claim, a survey was required before the Land Commission could issue a *kuleana* award.

Kuleana claims had to be submitted during a two-year period that expired on February 14, 1848 to be considered. All of the land claimants were required to provide proof of land use and occupation, which took the form of volumes of native registry and testimony. The claims and awards were numbered, and the LCAw. numbers, in conjunction with the volumes of documentation, remain in use today to identify the original owners and their use of the *kuleana* lands. The work of hearing, adjudicating, and surveying the claims required more than the two-year term, and the deadline was extended several times for the Land Commission to finish its work. In the meantime, as the new owners of the lands on which the *kuleana* were located began selling parcels to foreigners, questions arose concerning the rights of the native tenants and their ability to access and collect the resources necessary for sustaining life. The "Enabling" or "Kuleana Act," passed by the King and Privy Council on December 21, 1849, clarified the native tenants' rights to the land and resources, and the process by which they could apply for fee-simple interest in their *kuleana*.

According to Maly and Maly, as a result of the *Māhele ʻĀina* 646 of the *kuleana* claims made by native tenants mentioned fisheries (2003:252); a summary of the relevant claims that detail the use and unique methods employed to raise and gather marine resources is presented below. These claims include the following resources: *loko iʻa* (fishponds); *kio pua* (ponds for fish fry); *puʻuone* (dune-banked ponds); government ponds; *muliwai* (estuarine systems); ocean fisheries (with defined limitations, such as to where the surf breaks at the reef); fish markets; coral flats; *loko kalo* (ponds where fish and taro are cultivated); *loko akaʻakai* (bulrush ponds); *ālialia paʻakai*, *kai paʻakai*, and *haha paʻakai*, and *āina paʻakai* (salt beds); *loko hoʻoholo iʻa* (a pond where fish are released); stream fisheries; *heʻe* (octopus) fisheries; *uhu* (parrot fish) fisheries; *lua hanai* (holes where fish are fed); *loko kai hinana* (ponds for young *ʻoʻopu* fish); *wahi paʻakai* (salt making places); *kāheka paʻakai* (salt making ponds); *loko koele* (ponds worked for the king); *kai kapu* (prohibited fisheries); *hā ʻoʻopu* (lattice traps for *ʻoʻopu*); and *loko manu* (ponds where birds rest and feed) (Maly and Maly 2003).

Concentrated areas of fishponds could be found in Waikīkī and ʻEwa. Many of the Waikīkī claims yielded their use of *kiʻo pua* making it easy to access fish when needed. Wailupe at Waikīkī was the only area on Oʻahu with claims to a *loko hoʻoholo iʻa* or a holding pond for fish prior to release (Maly and Maly 2003:280). Many of the claims were centered in the *ʻili* of Kālia as many fishponds could be found here but have since been filled in for development. Central Oʻahu claims consisted of more *puʻuone* or nearshore ponds. These claims were concentrated in the Moanalua, Waikele, and Kalihi areas.

Some claims included fish that were protected and set boundaries of protection. For example, Helu 387 to the American Board of Commissioners for Foreign Missions (ABCFM) were awarded land in Waialua, Oʻahu. However, the land came with stipulations such as, "…The steam [sic] is not conveyed with the land. It is, however, the boundary on this side. If the supplies of the school are taken on the stream this is not wrong, however, the fish are protected…" (Maly and Maly 2003:275). In other instances, certain species such as *ʻoʻopu*, *ʻōpae*, *limu kala*, and *āhole* were allowed to be collected by individuals at any time. Whereas others such as the *ʻanae*, *heʻe*, and *āhole* could only be collected "in the windy times" (see Helu 2699, 7404, 7406, 8050, and 10199)(Maly and Maly 2003:281).

Other claims included the right to take fish under the *konohiki* such as Helu 2363 (Kukaaipahu at Waialeʻe, Oʻahu) and Helu 2365 (Kailiuli at Waialaeiki, Oʻahu). Others were allowed to take fish under these conditions, but included clauses (such as Helu 2366 Kahanu at Waialaeiki, Oʻahu) which states, "…The trees of the *kuahiwi* and the right to fish under those of the *konohiki* fall under my claim…" (Maly and Maly 2003:280). Helu 2940 was awarded to Kahoohano (at Puaena, Waialua, Oʻahu), which had the rights to claim fish from ʻUkoʻa pond, but also established quantity restrictions on certain species and their habitats such as *lua ula* (lobster holes), *lua kūmū* (goatfish holes), *lua heʻe* (octopus holes), and *koʻa ʻōpelu* (*ʻōpelu* fishing stations) (Maly and Maly 2003:282). Other claims gave the claimant the flexibility to choose which fish they wanted to protect, such as Helu 3159 awarded to Lapa in Waialua, Oʻahu (Maly and Maly 2003:283). Some claims outright put restrictions on fisheries (Helu 10215 to Mauae at Waimānalo, Oʻahu). In this case, the *kai kapu* (prohibited fishery) of Awaawamalu and Paka, banned collection of *uhu* at the former and *heʻe* at the latter (Maly and Maly 2003:292).

Another unique finding was the inclusion of fish markets to land claims. For example, Helu 777 awarded to Keala (w) in Honolulu, states the following: "…Claimant has lived in this house, making a business of selling fish…Keala and her husband, who was Paki's man, continued to live there, appropriating part of the house to a fish market…" (Maly and Maly 2003:275). Other claims traded land labor for provisions such as Tute at Manoa, Oʻahu (Helu 3322), whom accepted payment of "two *lau* of *weke*; one *lau* of *uhu*; one *lau* of *kahala* and *ulua*" (Maly and Maly 2003:283).

In addition to the 646 *kuleana* claims awarded during the *Māhele*, thirty-one *aliʻi* awards were made which cover 568 *ahupuaʻa* spanning across the entire *pae ʻāina* (Hawaiian archipelago). The *helu* or claim number and the corresponding claimant's name, as well as the location of the award and the resources claimed for the 23 *aliʻi* awards located on Oʻahu are listed in Table 5, below.

Table 5. *Ali'i* awards of O'ahu.

Helu	*Claimant*	*Location on O'ahu*	*Resources*
135	Iona Pi'ikoi	Pualoalo, Honolulu; Kaluaoopu, Waiau; Mikiola, Kāne'ohe	Lands and fisheries
812	Asa Kaeo	Laimi, Honolulu	Lands and fisheries
4452	H. Kalama (w)	Unspecified	Lands and fisheries
5368	Akahi (w)	Kaaipu, Waikīkī	Lands and fisheries
5525	L. Konia (w)	Kalauao, O'ahu	Lands and fisheries
7712	M. Kekuanaoa	Unspecified	Lands and fisheries
7713	Victoria Kamamalu	Unspecified	Lands and fisheries
7714B	Moses Kekuaiwa	Unspecified	Lands and fisheries
7715	Lot Kapuaiwa Kamehameha	Unspecified	Lands and fisheries
7716	R. Keelikolani (w)	Unspecified	Lands and fisheries
8241	John 'Ī'ī	Waipi'o, 'Ewa	Lands and fishery
8452	A. Keohokalole (w)	Unspecified	Lands and fisheries
8516B	Kamaikui (w)	Halawa, 'Ewa	Lands and fisheries
8520	Iosua Kaeo	Unspecified	Lands and fisheries
8525B	Julia Kauwa Alapai (w)	Unspecified	Lands and fisheries
8559	C. Kanaina	Unspecified	Lands and fisheries
8559B	Wm. Lunalilo	Unspecified	Lands and fisheries
9971	Wm. P. Leleiohoku	Unspecified	Lands and fisheries
10474	N. Namauu for M. Kekuanaoa	Unspecified	Lands and fisheries
10613	A. Paki	Unspecified	Lands and fisheries
10806	Iona Pi'ikoi for Kauikeaouli, Kamehameha III	Unspecified	At least 159 Crown Lands spanning the *pae 'āina* along with fishing rights on all islands
11215	Kealiiahonui	Unspecified	Lands and fisheries
11216	M. Kekauonohi (w)	Unspecified	Lands and fisheries

COMMERCIAL FISHING AFTER THE *MĀHELE* AND INTO THE TWENTIETH CENTURY

In the decades following the *Māhele 'Āina*, Kānaka Maoli sought to navigate their way through major transitions from their fisheries being strictly managed by appointed *ali'i* and *konohiki* to fee-simple ownership and broader public access rights (Maly and Maly 2003). As the foreigners began to own property in fee-simple many Kānaka Maoli were displaced from their ancestral lands, which severely disrupted the ancient system of land management (Kame'eleihiwa 1992). Glazier suggests that during these challenging times, subsistence fishing remained an important part of the lifestyle of Kānaka Maoli, "certain beliefs and ways of living were not abandoned in full, but rather subverted" (2007:66), as fishing laws continued to be redefined to address a wide range of fishery-related issues including access rights, *konohiki* rights, and taxation. Maly and Maly report that by 1850, the traditional method of using plant-based poisons, specifically *'auhuhu* "or other substance deleterious to fish" (2003:312) was made illegal. Despite these changes, for close to 100 years—through the whaling era (1820-1865) and well into the 20th century—Kānaka Maoli continued to play the leading role in Hawai'i's commercial fishing industry and adapted their subsistence lifestyle and culture to meet the demands brought about by a market economy (Cobb 1905; Glazier 2007; Schug 2001).

The shift to fee-simple ownership of land ultimately paved the way for large-scale commercial sugar cultivation, which brought successive waves of American, Chinese, Portuguese, Filipino, and Japanese migrant contract laborers. Schug, who conducted historical research on Hawai'i's commercial fishing industry, reports that in 1872 the non-indigenous population of Hawai'i numbered around 5,366, but that by the turn of the 20th century, that number had increased to some 114,345 individuals of foreign descent (2001:17). Of all of the ethnic groups to arrive in Hawai'i to support the burgeoning sugar industry, the Japanese became the most involved in Hawai'i's commercial fishing industry. Schug explains:

> When their plantation contracts expired many Japanese who had previously been skilled commercial fishermen in the coastal areas of Wakayama, Shizuoka, and Yamaguchi Perfectures remained in Hawai'i and turned to the sea for a living. The earnings of these fishermen were on average higher than those of plantation workers. (2001:17)

Many of the first generation Japanese migrant laborers, known as *issei*, become deeply invested in Hawaiʻi's commercial fishing sector. Gradually, these Japanese fishers introduced fishing gear and methods that were well suited for deep-sea and nearshore fishing. Some of the more popular technological introductions included long line fishing and the sampan fishing vessel, originally propelled by oar or sail (Glazier 2007; Schug 2001). Sampan fishing vessels were later outfitted with an engine, which gave access to previously unexploited deep-sea fisheries. Additionally, the introduction of the Japanese cast net (Figure 64) sometime around 1890, which was well-suited for nearshore fishing, was quickly adopted by Kānaka Maoli fishers, who then later dubbed it the *ʻupena hoʻolei*, or throw net (Mitchell 2001; Pukui and Elbert 1986). During the late 19th century, Hawaiʻi's political system underwent a series of monumental changes as the Hawaiian Kingdom became a U.S. Territory. In summarizing the political climate of the islands during this time, and its impact on local fisheries, Maly and Maly write:

> This system was radically altered in 1893, when the Hawaiian Monarchy was overthrown by foreign residents and American forces. Subsequently, the leaders of the parties responsible for the overthrow, made a steady move towards annexation of the Hawaiian Islands by the United States, which occurred in 1898. Then in 1900, the Hawaiian Islands became a "Territory" of the United States, and the resulting "Organic Act" set in place the legal parameters for freeing up the fisheries of Hawaiʻi. (2003:viii)

In 1901, John N. Cobb, Agent of the United State Fish Commission visited the islands to investigate the condition of the islands' commercial fisheries. Cobb (1905) compiled his findings in his 1903 report titled, *The Commercial Fisheries of the Hawaiian Islands*, which provided details about fishing practices of this time, as well as the changing cultural tapestry of the islands. In relating the demographic changes he observed among the fishers during his visit, Cobb wrote:

> In numbers the native Hawaiian fishermen surpass all others combined, but this is partly because so many women and children engage in the hand fishery for octopus, algae, etc., and these have been counted in total. Some of the natives are at the head of quite important fisheries, and for many years held a monopoly of the industry, but more recently the Japanese have been engaging in it in large numbers and now occupy second place. The natives fish spasmodically, as a rule, while the Japanese give to it their whole time and attention, and as a result are profiting much more. They are especially numerous on Oahu and Hawaii, most of them being engaged in deep-sea line fishing, which they virtually monopolize. They have several companies at Honolulu, Lahaina, and Hilo, and in this way control certain features of the fishing industry, thus enhancing the cost of the products to the general public. (1905:718)

Furthermore, Cobb (1905) reported that much of the same fishing methods and apparatus used in early times were still being employed by Kānaka Maoli fishers in the early 1900s. These methods included fishing from canoes and from the shore using nets of various types, spears, basket traps, lures, hand lines, snares, and poles as presented earliet in this chapter. While Cobb provides a variety of statistical information on Hawaiian fisheries during the turn of the 20th century, most interesting is perhaps his detailed list of catch yields sorted by island. His detailed list indicates that nearshore reef species, particularly on Oʻahu Island (2.7 million pounds), constituted a significant portion of the catch yields during 1900. Throughout the early part of the 20th century, the participation of Japanese in Hawaiʻi's commercial fishery continued to increase, while the participation of Kānaka Maoli gradually waned; and as the commercial fishing industry expanded to meet the demands of the growing consumer population in the islands, marine resources became scarce (Glazier 2007). Thus, as the twentieth century unfolded, marine resources were valued more for their economic potential, and little to no regard was paid to the myriad traditional mores that emphasized the spiritual, cultural, familial, and ecological significance of the fish and other marine species. Maly and Maly contend that "this trend has continued through the present-day and fostered the decline in health and well-being of the broad range and diversity of Hawaiian fisheries" (2003:ix).

Figure 64. Fisherman using the *'upena ho'olei* ca. 19th century (Source: Hawai'i State Archives Call No. PP-22-8-003).

Commercial Aquarium Fishing in O'ahu

This section echoes much of the introduction chapter but is included here as a means of refreshing the reader regarding the history of commercial aquarium fishing and subsequent legislation, which triggered the preparation of the current document. After the turn of the 20th century, on March 19, 1904, the Honolulu Rapid Transit and Land Company established the first public aquarium in Waikīkī, O'ahu. Known then as the Honolulu Aquarium, Frederick A. Potter (for whom the Potter's Angelfish; *Centropyge potteri* is named after), who worked as a clerk for the Honolulu Rapid Transit Company became the aquarium's first Director. During its early years, the Honolulu Aquarium showcased various marine animals that were collected by local fishermen (University of Hawai'i n.d.; Wiegel 2008). By the 1940s the collection of reef fish and other marine species to be used in aquariums had developed into a commercial fishery. Throughout the mid-20th century, the aquarium fish industry went through a period of expansion, moving from O'ahu to the outer islands. However, the industry wavered due to the lack of airline cargo connections and a lag in overseas flight times (Walsh et al. 2004:130).

In 1953, Act 154 was established by the territorial government of Hawai'i relating to Aquarium Fish and was later amended in 1979. The act authorized the then Board of Agriculture and Forestry to establish a permit system for the use of fine-mesh nets and traps for the taking of aquarium fish (Walsh 2000). Act 154 was amended several times, including in 1989, when a monthly count was required by the Board of Land and Natural Resources to monitor aquarium fish taken from Hawaiian waters for export. In 1959, the introduction of the commercial jet service made shipping aquarium fish easier for collectors. A decade later, there was a rapid increase in aquarium permittees with most permit holders citing non-commercial use. During this time, the aquarium fish industry went through an expansion period, moving from O'ahu to the outer islands, specifically Kailua-Kona on Hawai'i Island.

By 1973, commercial aquarium collecting on Oʻahu was well established and had become a controversial issue (Calado et al. 2017). Commercial aquarium collectors are required to report catches. Prior to 1973, commercial aquarium collectors and commercial fishermen reported catches on the same form, which resulted in unreliable data as it did not provide space for multiple species being collected. Due to growing public concern regarding the industry, a moratorium was placed on aquarium collecting by the Division of Fish and Game. In September 1973, the Division of Fish and Game met with marine scientists who recommended the establishment of marine sanctuaries and areas where collection was prohibited (Walsh 1999). After the moratorium was lifted, commercial aquarium collectors were required to report their catches monthly on a detailed form, if forms were not submitted in a timely manner, the penalty resulted in the revocation of the commercial permit and potential prosecution.

In 1973, after growing public concern over commercial aquarium practices, this prompted the Division of Fish and Game (now DLNR) to suspend the issuance of Aquarium Permits for one week while issues were considered and addressed (PIJAC 2018). As a result, Aquarium Permit holders were required to submit monthly catch reports. Because no studies were conducted at that time, there were also no protective measures in place. In 1987, a gentleperson's agreement between dive/snorkel operators and commercial aquarium fishers were established. In 1991, three MLCDs were established including Hanauma Bay, Pūpūkea, and Waikīkī. In addition, ten marine locations on Oʻahu have fishing restrictions: Waikīkī-Diamond Head Shoreline FMA, Ala Wai Canal, Kapālama Canal, Coconut Island—Hawaiʻi Marine Laboratory Refuge, Heʻeia Kea Wharf, Honolulu Harbor, Pōkaʻi Bay, Waialua Bay, and the ʻEwa Limu Management Area.

In August 2011, Oʻahu commercial aquarium fishers developed a rule proposal for the management of the Oʻahu aquarium fishery, which they presented to DAR; subsequently, in December 2012, a public hearing was held regarding the proposed measure and Hawaiʻi Administrative Rules (HAR) §13-77 was adopted in October 2014 (PIJAC 2018). This regulation is applicable to the collection of aquatic life for aquarium purposes from the nearshore waters of Oʻahu, within 3 nautical miles from the shore. Between 2000 and 2017, DLNR issued from 66 to 126 commercial aquarium permits annually, and aquarium fishers collected approximately 238 fish species (1,295,700 individual fish) under said permits in Oʻahu's nearshore waters.

As previously mentioned, because of a Supreme Court ruling, DLNR has not renewed existing permits or issued new permits for aquarium collection using fine meshed traps or nets since September 2017 (DAR 2017, EISPN). The FEA proposed a Finding of No Significant Impact (FONSI) for the issuance of commercial aquarium permits for the Island of Oʻahu. However, in July of 2018, DLNR disagreed with that finding and determined that the project could have a significant impact on the environment, and therefore required the preparation of an EIS (PIJAC 2018). In her review letter, Suzanne Case, Chair of the DLNR, specifically requested that the EIS include further analysis of several significance criteria under HAR § 11-200-12. Specifically, the take of aquarium fish as an irrevocable commitment to loss or destruction of natural or cultural resources, and the impact of the take of aquarium fish on cultural practices in the state. To that end, the section that follows presents the methods and results of the consultation effort put forth as part of the preparation of this study.

4. CONSULTATION

Gathering input from community members with genealogical ties and long-standing residency or relationships to the study area is vital to the process of assessing potential cultural impacts to resources, practices, and beliefs. It is precisely these individuals that ascribe meaning and value to traditional resources and practices. Community members often possess traditional knowledge and in-depth understanding that are unavailable elsewhere in the historical or cultural record of a place. As stated in the OEQC Guidelines for Assessing Cultural Impacts, the goal of the oral interview process is to identify potential cultural resources, practices, and beliefs associated with the affected project area. It is the present authors' further contention that the oral interviews should also be used to augment the process of assessing the significance of any identified traditional cultural properties. Thus, it is the researcher's responsibility to use the gathered information to identify and describe potential cultural impacts and propose appropriate mitigation as necessary.

In an effort to identify individuals knowledgeable about traditional cultural practices and/or uses associated with the current subject property, a public notice was submitted to the Office of Hawaiian Affairs (OHA) for publication in their newspaper, *Ka Wai Ola*. Although the notice was submitted via email on May 28, 2019 with the intent that it would appear in the June 2019 issue, the notice was not published until the July 2019 issue. As of the date of the current report, no responses have been received from the public notice. A copy of the public notice can be found in Appendix A of this report.

ASM staff contacted forty-two individuals via mail, email, and/or telephone with request for consultation. Table 6 (presented below) lists all the individuals and/or organizations contacted for consultation and presents brief comments concerning the outcome of the consultation effort.

Table 6. Persons/Organization contacted for consultation.

Name	***Initial Contact Date***	***Comments***
Ahupuaʻa ʻO Kahana State Park/Huilua Fishpond	9/10/2019	No response
Aila Jr., William	7/31/2019	Interviewed 8/22/2019
Aiwohi, Lopaka	9/26/2019	Referred by A.P. Connelly; no response
Akutagawa, Malia	9/10/2019	No response
Au, Kawika	10/11/2019	No response
Auwae, David	10/11/2019	No response
Beirne, Ululani	10/11/2019	No response
Christensen, Makani	8/12/2019	Interviewed 8/13/2019
Connelly, Alex Puanani	9/10/2019	Referred H. Kawelo, L. Aiwohi, and K. Kupihea declined to be interviewed
Cramer, Chris	9/9/2019	Interviewed 9/20/2019
Crowell, Dean	9/9/2019	Interviewed 9/22/2019
ʻEwa-Puʻuloa Hawaiian Civic Club	10/11/2019	No response
Farden, Hailama	9/10/2019	No response
Fukumitsu, Keoki	9/10/2019	Wrong address
Gomes, Domingo	9/9/2019	No response
Haleʻiwa Harbor	10/11/2019	No response
Hopfe, Hanale	10/11/2019	No response
Hui Mālama Loko Iʻa	9/10/2019	No response
Ito, Wally	9/10/2019	No response
Jellings, Carl	7/31/2019	No response
KAHEA	7/31/2019	No response
Kaluhiwa, Rocky	9/9/2019	No response
Kane, Shad	10/11/2019	Repelied via email on 11/20/2019: "I am opposed to aquarium fishing. [And] opposed to gathering aquarium fishes."
Kawelo, Hiʻilei	9/9/2019	No response
KUA (Kuaʻāina Ulu ʻAuamo)	9/9/2019	No response
Kupihea, Kehaulani	9/10/2019	Referred by A. P. Connelly; no response
Morgan, John	9/9/2019	No response
OHA	7/31/2019	No response
Pearl Harbor Hawaiian Civic Club	10/11/2019	No response
Puniwai, Noelani	9/10/2019	Interviewed 10/15/2019
Pyle, Richard L.	9/26/2019	Referred B. Bowen and the staff at Hawaiʻi Institute of Marine Biology on Moku o Loʻe; declined to be interviewed
Sedillo, Tony	9/10/2019	No response
Shirai Jr., Thomas	9/10/2019	No response
Solis, Kaʻahiki	9/17/2019	No response
Suzumoto, Arnold Y.	9/26/2019	No response
Thompson, Troy	10/11/2019	No response
Waialua Hawaiian Civic Club	10/11/2019	No response
Waiʻanae Hawaiian Civic Club	10/11/2019	No response
Waiʻanae Small Boat Harbor	10/11/2019	Harbormaster said he will forward to appropriate and interested parties; declined to be interviewed
Waikalua Loko Iʻa	9/10/2019	Interviewed 10/21/2019
Waimānalo Limu Hui	9/10/2019	No response
Wong, Ben	9/9/2019	No response

In all, a total of six individuals, representing various communities on Oʻahu and users of the FRCA (including cultural practitioners, aquarium collectors, subsistence and commercial fishers, divers, dive tour operators, and educators), participated in the consultation process. The consultation process commenced in July of 2019 with interviews being conducted in August of 2019 to October of 2019.

As part of the interview process and with the consent of the interviewees, ASM audio recorded some of the interviews for note taking purposes only (audio files are not available); ASM staff took detailed notes during the remaining unrecorded interviews. Upon completion of the interviews, ASM staff prepared interview summaries, and emailed them to the interviewees for review and approval before being included in the current document. The finalized versions of the interview summaries are presented below in chronological order by interview date.

WILLIAM J. AILA, JR.

On August 22, 2019, ASM staff, Teresa Gotay, completed an interview with Mr. William J. Aila, Jr., at the Department of Hawaiian Home Lands office in Kapolei, Oʻahu. Prior to initiating the interview, upon presenting him with the map showing the study area, Mr. Aila agreed to the interview as long as the following disclaimer was included: there is no legal basis for the yellow exclusion areas and that it doesn't make sense to him as an aquarium fish collector because there is no difference between one area and the area adjacent to it. Thus, it was decided that the discussion would focus on the whole coastline of Oʻahu.

William J. Aila, Jr., was born in Kapiʻolani Hospital in Honolulu and was raised on the Waiʻanae coast of Oʻahu. He added that he had "literally collected fish all around the island of Oʻahu." At the time of the interview, Mr. Aila, who was sixty-one years old, described being in the ocean since age three. His interest in the ocean began with family members. He was told that he would disappear all by his lonesome self to walk the reefs, and that his family would have to search for him. Mr. Aila went on to state "I was attracted to the ocean; it was in my genes" and that "as soon as I could pick up a bamboo pole I started collecting."

Mr. Aila shared that although his father was a cowboy and not a fisherman, many of his paternal uncles and grandfathers were. When asked if his uncles influenced him as a young fisherman, he said that later in life they did, but as a child he had learned more about fishing from other people (non-family) that he met at the beach. He first learned how to fish with a bamboo pole, then a spinning rod, and then an *ulua* rod. Later in life, he used gill nets, fence nets, bag nets, and hand nets, as well as a spear. Mr. Aila explained that as a child he often went fishing alone; but, as he got older and went further offshore he often went in groups, accompanied by friends and family. Then, as he got older, he bought himself a boat. He characterized this sequence of events as the general evolution that all fishers go through when they decide to put on a mask and jump in the water. He started fishing on the Waiʻanae coast, but also fished with friends on the neighbor islands.

Mr. Aila described a sort of transitional phase for fishers and explained that you reach a point when you decide to seek out the fish instead of waiting for the fish to find you, and that to do this one needs to learn fish psychology. He added that "if you know how certain fish act you can predict their movements, and then you can be efficient at capturing them." He expressed that in the early years, some of this knowledge was self-taught; but, as he grew up he would ask older folks for insight. According to Mr. Aila, some fishers shared their knowledge, and some didn't. He continued by saying that if it's a fishing technique that you've developed that gives you an advantage or a particular locale that has certain types of fish, you don't share that with just anybody; because if you do, the fish will be gone. Instead, you share that information with people you can trust to fish responsibly. When asked how he defines fishing responsibly, Mr. Aila replied, taking what you need for that particular time and then making sure you rotate your fishing spots so that you don't completely fish out an area. He explained that in the case of aquarium fishing, people use hand and fence nets because juveniles are the target fish, which led to the following discussion of the origins of the aquarium fish trade in Hawaiʻi.

Mr. Aila shared that the aquarium fish trade probably started in the 1960s (when he was a little boy) in Waiʻanae. Although he could not remember the fisherman's name, he remembered seeing his tanks at Pōkaʻi Bay. Mr. Aila explained that as demand grew for aquarium fish species, other folks got into the fishery and became wholesalers. He added that many of the fishermen themselves became collectors/wholesalers and some of them set up their own aquarium fish export systems. He added that some aquarium collectors got more sophisticated and began importing fish that were not collected enough locally to meet the demand, from Majuro in the Marshall Islands and the Philippines. These imported fish, one of which included flame angels (*centropyge loricula*), would be shipped to Waiʻanae before being exported elsewhere. When asked who purchased the aquarium fish he replied: some were locals, but most of the buyers were in the U.S. mainland and later in Asia.

When asked how aquarium fishing expanded from Wai‘anae in the 1960s, Mr. Aila explained that it developed around the island as people figured out that they could catch live fish and export them. He added that when there are strong trade winds most of the windward and northern coast of O‘ahu is not fishable, so the majority of the collectors would come to Wai‘anae to harvest aquarium fish. When asked if you have to fish where you live, he stated that where you fish is mostly determined by the weather. He added that the majority of aquarium fish continued to be harvested from the island of O‘ahu until hurricane Iwa swept over O‘ahu in late 1982 and destroyed a great deal of finger coral. Mr. Aila explained that shortly after Iwa, the demand for yellow tangs increased and there were not many in the nearshore waters of O‘ahu because their habitat was in the finger coral, which was largely destroyed by the storm. As a result, he recalled that the fishermen from Wai‘anae eventually relocated to the Kona (west) side of Hawai‘i Island to capture yellow tangs.

In addition to commercial fishing in nearshore waters (with hand lines and spearfishing with SCUBA) and for large pelagics in the deep, Mr. Aila formerly held an aquarium permit until late 2017 when the judge ruled that all existing aquarium permits were illegal and void. Prior to this ruling, Mr. Aila had been aquarium fishing for ten or more years with a 4-year stint in which he gave up his commercial and aquarium permits when he became the chair of the DLNR, as it was seen as a conflict of interest; although he personally did not see it as such. Mr. Aila shared that he initially got into aquarium fishing when his wife became pregnant thirteen years after their last son was born, and they decided she would not return to work. At that time, he was the harbormaster at the Wai‘anae boat harbor and aquarium fishing became a convenient way for him to support his family. Mr. Aila described how at the end of the workday he, along with two-four family members or friends, would pick a site as far away as Kailua, Kāne‘ohe, Hale‘iwa, or along the south shore and take the van to dive there. He stated that he pretty much went diving along every coastal stretch of the island of O‘ahu. He and his group would fill up tubs with water and then place the fish in the tubs and deliver them to wholesalers. During the week he would dive with 2-4 others for safety; while on the weekends, he often would dive alone because no one else was available—at such times he would dive with just a snorkel rather than SCUBA gear. When asked if the fishing techniques were the same or different from the techniques he learned as a boy when it came to targeting certain species for aquarium collection, he replied that aquarium collection is not that hard. He explained that it is a little bit easier because some aquarium fish are wide awake and some are not. He added that he applied the techniques he had learned for spearfishing but used nets instead of the spear on the night dives to collect aquarium fish.

Regarding life cycle knowledge, Mr. Aila shared the following information: there are generally two spawning times of year—summer and winter, depending on the species. The fish desired in the aquarium trade are generally those that spawn in late summer/early fall. After fertilization, the eggs get carried offshore where they develop. After they reach a certain size or stage, they return to shore at which time they are clear/transparent, with shiny stomachs, which Mr. Aila referred to as the pelagic stage of development. Mr. Aila also spoke of the importance of understanding the relationship between the pelagic and the nearshore species because their life cycles are in tune with each other. The fish that spawn in late summer/early fall, move offshore for eight months to a year where they mature, and come onshore (back into the nearshore waters) when the tuna and other pelagic fish come to lay their eggs. The reef fish feed on the eggs of the tuna and other pelagic fish; and the pelagic fish feed on the nearshore babies. He added that a lot of offshore fishers don’t realize how important the reefs are to them and offshore fishing in general. Mr. Aila shared that he learned the life cycle knowledge regarding times of the year from other people, but his knowledge of color variations during different maturation stages was gained through personal experience. For instance, he shared that during an offshore fishing trip he scooped up pelagic bait balls, which he kept alive for a week. During that time, he saw them change color. He also mentioned the *pāku‘iku‘i*, which like many other species are offshore and clear in the juvenile stage, and how they amazingly swim against the current to get to the reefs, and that over two to three days they take on their adult colors. He added that young fish show up in a number bigger than a trillion on the reefs and try to settle there, but almost all of them get eaten and only a few survive.

In regard to other species-specific knowledge, particularly within the top-fished species list, Mr. Aila shared the following information: the yellow tang is a popular aquarium fish species because it is one of the few yellow fish, besides butterflies, that people like for their tanks. Mr. Aila also stated that the prohibition against the small mesh nets is not a good thing because it results in mostly adults being taken, and it is better to take juveniles because most of them are going to die anyway. He explained that only three out of a million baby fish grow to adulthood, so if you’ve got billions of yellow tangs, taking 200,000 of them is not an issue. He also suggested that Potter’s angelfish (*Centropyge potteri*) should be on the top-fished species list immediately after yellow tangs, because based on his experience they are the second most-fished species. When asked about the accuracy of the Hawaiian fish names (see Table 4) or for any other names he would add to the list, he replied that different places have different names and that he was comfortable with what was listed.

When asked about specific knowledge regarding traditional, ritual, or medicinal uses of the aquarium fish species, Mr. Aila replied that all fish were eaten and that he did not know of any specific practices associated with any of the fish on the list. He went on to explain that the species that are generally offered for other ceremonies are not on the top-fished species list, such as *ʻāweoweo* (bigeye fish), and *ʻūʻū* (*menpachi*; the soldierfish). However, according to Mr. Aila, *kole* (goldring surgeonfish; *Ctenochaetus strigosus*), which is on the top-fished species list is traditionally a highly desirable fish; so, if he went spear-fishing and saw a *kole* he would poke it and offer it because it is a favorite fish.

In response to being asked if he had encountered fishing shrines or seen people engaging in traditional cultural practices in the coastal area or nearshore waters, he said he knew of active fishing shrines where he has seen people leave *hoʻokupu* (offerings). He then went on to highlight general locations of fishing shrines in places such as Makua, Pōkaʻi Bay, Nānākuli, Kahe Point, Haleʻiwa, Waialua, Kaʻena Point, Kahana Valley—the locations of which are depicted in Figure 65, below. Mr. Aila also described participating in such practices and shared that he learned the practice of making offerings as part of the traditional knowledge that was passed down to him from his great-grandmother who *hānai* (adopted) him at birth.

With respect to traditional fishing practices and beliefs, Mr. Aila spoke of the recognition of *ʻaumakua* (family deities) as a practice that Hawaiians used to do and something that he is proud to say, he continues to do today. He added that unfortunately, most people have lost the names of their personal *ʻaumakua*. However, with respect to this knowledge, he explained that he was strictly schooled by his great-grandmother, Maryann Francis Keumi. Mr. Aila shared that Maryann's parents were from Nāpoʻopoʻo on Hawaiʻi Island and that she grew up in Kalihi on Oʻahu but, when Mr. Aila was a young boy, she lived in Waiʻanae. He recalled that she saw, at a very early age, there was nothing that was going to keep him out of the ocean, so she decided to share their family's names and past practices including their *ʻaumakua*. He went on to say that his great-great grandmother's grandfather was the last *kahu* of Kamohoaliʻi at Nāpoʻopoʻo who conducted ritualistic feedings, which is Mr. Aila explained is a practice he carries on but from the Island of Oʻahu.

Mr. Aila recalled that his great-grandmother told him "this is what you need to know," which included the practice of providing *hoʻokupu* before he takes something from the ocean. He explained that the whole process is recognizing somebody who is looking out for you while you're in the ocean; it is also a recognition of a reciprocal relationship, for fishing isn't only one way—there has to be give and take. Mr. Aila shared that he is descended from his family's *ʻaumakua* who assumed a shark form and was tasked with protecting his family. He added that *ʻaumakua* reward you for good behavior and do not reward you for bad behavior like any parent or grandparent would do. Per Mr. Aila, *ʻaumakua* are related to you and you have to honor and maintain that relationship and providing *hoʻokupu* is one way to maintain that relationship.

Mr. Aila explained that *hoʻokupu* is typically something you wrap up and bring from your house as a general offering to Kanaloa, the *akua* (paramount deity) of the ocean, as a way to thank him for the opportunity. He added that the *hoʻokupu* is left on land prior to entering the ocean. When asked if he also provided *hoʻokupu* after fishing, he replied that it was complicated and further explained as follows: if you want, you can express gratitude by providing part of your catch on a good day of fishing, but not really in an aquarium fishing context. When in the context of fishing for pelagics, he would place a piece of the first ahi or marlin he caught for that year upon an *ahu,* a platform, a single large rock, or a temporary *lele* (altar or stand). When asked how he knows that a certain pile of rocks or a single upright stone is or isn't used as a fishing shrine on Oʻahu, he responded that such knowledge is partially shared with you, but part of it is gained through research (Hawaiian language newspapers and books like *Sites of Oʻahu*). He added that if there is no oral history you rely on your *naʻau* (gut) and if you are unsure, you look for your own spot to leave your *hoʻokupu*. He also stated that the traditional cultural information is out there, but often in fragments and that sometimes those fragments need to be brought together. He likened the process of weaving the separate bits of knowledge together as one would *haku* (to weave together/to compose) a *lei*, in order to more fully understand it.

He added that he was taught to leave the first fish that he spears. So, when spearfishing, after leaving the *hoʻokupu* on land and jumping in the water, he leaves the first fish he spears in the ocean wherever he speared it as an offering directly to Kamohoaliʻi his family's shark *ʻaumakua.* He often places his first fish under a rock because some of his *haole* friends do not understand the practice and they have been known to bring the fish back to him; so he waits until they leave to put it back. Thus, the locations of such offerings move with him and are dependent on where he speared the first fish. When asked if his great-grandmother had a term for that practice, he shared that he did not recall her using any certain word for offerings, or saying *hoʻokupu*; rather, the term *hoʻokupu* was something he learned later in life.

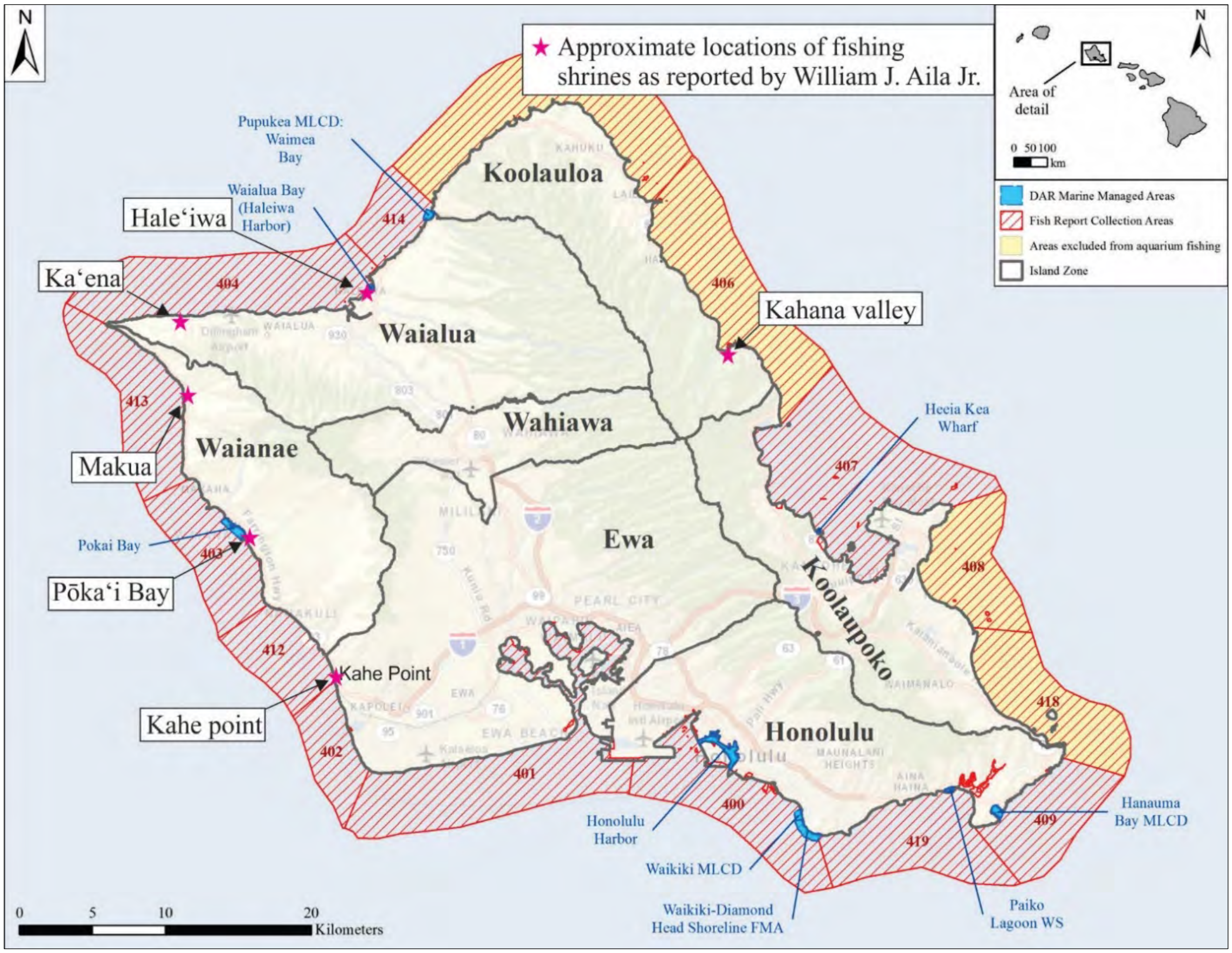


Figure 65. Locations of fishing shrines.

Mr. Aila further explained that in aquarium fishing the first offering would be on land because there was no fishing *koʻa* for long-nosed butterflies, they were not targeted, but the concept of the reciprocal relationship still remained. Thus, he would take fruit that was grown on his property wrapped in a *ti* leaf bundle and would leave it on land or in the ocean. Mr. Aila made such offerings on behalf of the group before each trip to collect aquarium fish. In contrast to spearfishing or deep-sea fishing, he stated that he would not offer an aquarium fish species to Kamohoaliʻi.

When asked if he had knowledge of *koʻa*, he said that they are typically species-specific spots in the open ocean, the locations of which he learned from other fishermen and through trial and error. He added that *koʻa* locations can change depending on the flow of the current. Mr. Aila stated that the concept of a *koʻa* can also work in nearshore waters. He then shared the following example regarding Potters angelfish and some of the *hīnālea* species, whose habitat can only be found at the bottom of drop-offs (typically at 40 or 80 feet below the ocean surface) in areas where coral rubble has accumulated. Some fish depend on food sources that reside in the rubble and these fish generally remain in the same place, much like a *koʻa;* and someone who has knowledge of the rubble patches can find certain fish species in great numbers.

When asked if he is engaged in sharing his knowledge of traditional cultural practices with his children, he responded that it is absolutely his responsibility to transmit his knowledge. His sons and grandsons (he has no daughters or granddaughters) have all been trained by him. He added that he shows each of them several times and if they want to keep the knowledge, they keep it and if not, that choice is up to them.

When asked about the indirect impact of modern technology for highly efficient catch methods on traditional harvest capabilities, Mr. Aila responded by providing an explanation of aquarium collection technique. He shared that people use hands nets and rely on fish psychology, or if there is a concentration of fish they will put up a fence net and then use the hand nets to collect the individual fish. He added that nobody uses slurp guns (vacuum-like contraptions) because they are too inefficient and that he does not consider SCUBA as modern technology. However, he did offer two instances in which modern technology impact catch efficiency. The first, is the use of GPS to relocate your fishing areas faster. The second is the use of rebreathers, which allow access to deeper waters and fish that are harder to find in shallower waters, such as the tinkers butterfly, which prior to rebreathers you might only see one in fifty years time. Per Mr. Aila, as a result of the use of rebreathers, species that we have little knowledge of their reproductive and growth rates are being harvested.

In response to whether the proposed action to reinstate the issuance of permits for aquarium collection would have any impacts on traditional cultural practices or traditional cultural properties, he responded that if the current effort remains the same, it will have no impacts on other traditional forms of fishing. He went on to explain that every year more than a trillion fish are redeposited along the shoreline; and even if you took out 200,000 fish of a certain species state-wide, there are still more than a trillion of those same fish out there in the ocean. He added that there is currently no aquarium fishing going on Maui, Kaua‘i, or Moloka‘i, so when one considers how much excess fish there is right now floating around there is minimal impact.

When asked to clarify if he was talking more about the impact on the fish population than the impact on traditional cultural practices, he responded that there is no impact on traditional customary practices. Mr. Aila then went on to explain that even in ancient times there was no prohibition against taking aquarium fish species. For instance, there was no prohibition against taking yellow tangs and that they were eaten all the time. The aquarium fishing of 200,000 yellow tangs taken annually out of the Kona coast of Big Island did not stop anyone from eating yellow tang, so in his opinion there is no impact on traditional customary practices. Mr. Aila emphasized that at the current effort, the number of fish that are available for traditional practices is and would still be available if commercial aquarium permits were reinstated.

Mr. Aila shared that he has read a lot about different fishing techniques and believes that Precontact Hawaiian fishermen were not opposed to eating juvenile fish in great numbers. For instance, during a certain time of year baby *manini* (convict tang) known as *hua* (young fish/also known as *‘ōhua*) show up in numbers larger than a trillion along the shoreline and tidepools before they transition from the clear state and become striped. Apparently, in ancient times, for one or two months, people would feast (dry them and cook them) on *hua* and it never had any impact on the resource. In his opinion, based on the numbers of fish collected by the aquarium fishing industry, the concept of harvesting juvenile fish for aquariums would not be something that early Hawaiians would consider an issue. However, Mr. Aila maintained that whether or not early Hawaiians would be opposed to keeping fish alive is open to interpretation. He added that early Hawaiians caught fish and put them in fish ponds to watch them grow; and opined that if someone had given King Kamehameha an aquarium and fish to put in it, he imagines Kamehameha would have loved to watch that fish swim around the aquarium.

When asked what would trigger an impact if at the current effort there is no impact, he replied “nothing other than people’s emotional objection.” He went on to say that in the ocean there is no emotion/no empathy and stated that there are just three rules: 1) eat; 2) avoid being eaten; and 3) if you are lucky enough, you live to create the next generation. He added that when a person jumps in the ocean, they agree to be part of the food chain, which is why you should always look behind you because you can be mistaken for prey and eaten. Mr. Aila went on to mention that the surrounding and capturing of adult fish, particularly the herbivores (*pāku‘iku‘i*, *pualu*, and *palani*) on the top-fished species list, has a greater impact on reef fish. In so doing, commercial fishing has a greater impact than aquarium collection because it removes the reproductive potential.

MAKANI CHRISTENSEN

On August 13, 2019, ASM staff, Teresa Gotay completed an interview with Mr. Makani Christensen at his home in Kaimuki, O‘ahu. Makani Christensen was born on Maui in 1980. He began fishing with his father at age two on Maui and took to it more than his siblings did. His father’s family were farmers; however, his mother’s side of the family (Wedemeyer, Kaono, Keaumoku, and Keawe) descends from a long line of fisherfolk from Puakō-Lālāmilo on Big Island. At age six, his family moved to the Big Island, and he moved to O‘ahu in tenth grade to attend Kamehameha Schools. Throughout those years he was involved in casting clubs and engaged in surfing and different fishing activities, including shoreline fishing. In 1998, he was accepted to the Naval Academy in Annapolis, Maryland and graduated with a B.S. in Oceanography in 2003. Shortly after, Makani joined the Marine Corps and fought in Iraq and Afghanistan and was active duty until 2008.

In 2004, Makani started commercial fishing around O‘ahu along the southeast coast of the Kona and Ko‘olaupoko districts. When asked if he had engaged in aquarium collection, he said no but that he has caught a lot of small fish, which could be considered aquarium fish. In 2008, after exiting the Marines, Makani started operating tours as his main source of income and continues to do so, running Keawe Adventures and Fly Fishing Hawaii.

In 2012/2013, Makani founded the Hunting Farming and Fishing Association (HFF) a volunteer organization that strives to bring balance between hunters, farmers, fishers, and environmentalists. Per Makani, the scales are currently tipped towards the environmentalists and conservationists who target commercial fishing and aquarium fishing. He added that conservationists have powerful backers and funding. These backers have utilized the media and educational outlets to push their agenda, which in his opinion, has caused a panic that there are "no fish" and led to the current state of things; including the proposed action that prompted the preparation of the current document. The HFF advocates for fishermen and seeks to mitigate the rules and regulations that put people out of business. According to Makani, since 1998, environmentalists have been setting the narrative without collaborating with the people who are on the ocean all the time and without a full understanding of the ocean. Thus, HFF use their limited resources, which consist primarily of knowledge based on data collected from fishermen, when they testify to fight regulatory constraints. Per the HFF's website www.huntfarmfish.com, their game plan "is pretty basic" and is called "the ACE plan: Advocate, Collaborate, and Educate" through which they advocate for all food producers. Makani also stated that "we are all environmentalists" and that "we do not want the resources to deplete" because people's livelihoods depend on it.

As an experienced commercial fisherman, when asked if he was familiar with the nearshore fishing areas within the study area, Makani indicated that since 2004, he has frequently fished in the following areas: from Pearl Harbor eastward around the southeastern tip of O‘ahu and along the Ko‘olaupoko coast to include He‘eia and beyond (Fish Report Collection Areas 401, 400, 419, 409, 418, 408, and 407—see Figure 1). When asked about ongoing or former traditional cultural practices along the southeastern and northeastern coast of O‘ahu, Makani replied that there were none that he knew of and continued by asking what was meant by traditional cultural practices. He then added that you don't see people using massive amounts of nets because those are illegal now. Upon clarifying the term to include traditional fishing techniques prior to the ban on small mesh nets and fishing shrines, etc., he replied "no, not one," and added that he is out in that area almost daily. Makani went on to question the definition of cultural practices and stated that it is a loaded term. Per Makani, if you are looking into the past when Hawaiians were 100 percent sustained by our own resources—everybody fishing and using fishponds to sustain a community—that's one thing; compared to today's fishponds that are set up and used to educate people. Makani then explained that unless you are using the fishpond to feed the people you are missing the big part of culture, which is to feed the people, and in turn sustain the community and perpetuate the culture.

Makani discussed how Hawaiian culture has evolved over time. In particular, he mentioned that Kamehameha ushered in the transition from "everyone needs to live off what they have" to "a money-driven economy" in the Hawaiian Islands. He continued by speaking of the subsequent arrival of commercial farmers and immigrant laborers that combined with huge population decline to change Hawaiian culture. Per Makani, during this time the dependence on the land for survival evolved into a surplus of sugar and pineapple for export; then, when Hawai‘i became a state, they had to import more food to support the surplus of people, which increased the islands' dependence on imports from the outside for survival.

According to Makani, all Hawaiians fished in prehistory (even those who were farmers) and people continue to survive off the ocean: "anytime you see somebody fishing in the area—that is part of culture; the methods have changed but it's still a part of Hawaiian culture." When asked if fishing is an expression of culture, he responded "fishing is culture." He emphasized the evolution of fishing culture, and how Hawaiians are currently engaged in feeding the people through commercial fishing. Per Makani, modern Hawaiians are getting into commercial fishing to generate money to feed and provide for their families. He insisted that one has to look at it that way—not separate culture and fishing, because fishing is culture that sustains livelihoods and families. Makani also mentioned that when fisherfolk testify at legislative sessions and community meetings they do not talk about traditional practices being impacted by regulations, they talk about the potential impacts to their lives, families and livelihoods.

When asked about ongoing spiritual customs that fed into fishing practices, Makani responded that people have different belief structures and learn such customs on an individual basis. He shared how his family had been seen to call in fish using their *‘aumakua* on the Kona coast of Big Island. He recalled that when his great-great-grandfather used to call in fish at Pūako it was more a thought or feeling than an actual prayer. Makani further explained that his great-great-grandfather would chant and the fish would come right in; and that he would bring two stones together as part of his practice. These stones were not referred to as *kū‘ula* specifically, but they held *mana* and were passed down through Makani's family over several generations. He then went on to say that he does not know of anyone that does it on O‘ahu; but if they do, they are not going to broadcast it to everybody. Makani then spoke of the essential need to really "be in touch with the ocean" because without a certain deep level of understanding of the ocean you can have *kū‘ula* stones, but they will just be stones. Makani also shared that from personal experience (on Big Island and O‘ahu) there are signs that put things into perspective. For instance, during his waking life Makani reports that he has had thoughts/visions about fish coming in, and his intuition is made manifest on the same day or the day after the vision. In another instance, he saw one of his *ʻaumakua* in a dream and the next day "a 1,400-pound marlin found us 22 miles outside of Maui." Upon sharing that experience he emphasized that the spiritual side is the individual's story.

Makani was also knowledgeable about *koʻa*, which he referred to as fish-houses. When asked how he finds them—if he had been taught or just went out to look for them, he responded that the most important thing is to know how to find them. He continued thusly, one must "unlock what fish associate with other fish" in order to find the fish-house and stressed that it can take a long time to find a fish-house. He stated that he has experience using points on the land to triangulate the location of known fish-houses and said that it is best to take four points (buildings or natural landforms), located right behind each other and not too high so clouds won't block them. He said relocating *koʻa* this way was much easier than finding them and that there were plenty fish-houses in the study area. He also mentioned how nowadays people use GPS to relocate the fish-houses. When asked if he shares fish-house information with others, Makani responded no, and explained that you keep that knowledge close to protect the assets and you don't boast of it because you would be giving up something that it might have taken you years to find.

When asked about the cultural knowledge regarding the fish on the top-fished species list, Makani said he had not seen any references that included them. He added that Hawaiians ate *hīnāleas* and that "it didn't mean anything to them [early Hawaiians] to eat small fish." When asked if he knew of any traditional/medicinal uses of the fish species, he suggested that some of the fish may have been *ʻaumākua*; specifically, the *humuhumunukunukuāpuaʻa*, which is how Kamapuaʻa travelled between islands according to legendary accounts; he added that other fish species, such as the table boss or *ʻaʻawa* (Bodianus bilunultus) were also believed to be *ʻaumākua*. Makani also brought up the concept of *pono* and how the mentality seemed to have changed over time. He explained that there were times when Hawaiian fishers would bring in nets and eat thousands upon thousands of baby fish, all while maintaining harmony and balance between the people and the resources. He added that traditionally, the whole village got involved in the gathering of marine resources. He maintained that they were *pono* but the survival of the people was the center of it.

When asked how important the knowledge of the lifecycle of the different fish is to the fishers, he replied that it is "super important" and reported that some of that knowledge was passed down to him; or gained through experience. For instance, one learns the proper intervals to harvest the same fish-house and awareness of the max capacity for fish-houses. In addition to the life cycle knowledge (spawning times), Makani also mentioned the importance of understanding the tides, the differences between summer and winter, and understanding the reefs when catching fish, and how that knowledge informs fishers on when and where to go to fish.

When asked about the proposed action's potential impacts to traditional cultural practices or properties, Makani replied that the only cultural impact he could think of would be if you rid individuals of the opportunity to use the resources to provide food for their families. He added that in the hundreds of testimonies he had witnessed, not once had he heard anyone mention *ʻaumākua* or the use of certain marine species for medicinal or traditional purposes. He also expressed concern over protecting the environment to a point at which you forsake the people and their needs; and asked, "Where in Hawaiian culture does it say we are going to protect the environment so much that our people won't eat?" He went on to say that although some folks might argue that aquarium fishing isn't for eating—you can eat them, and that the amount of fish that aquarium fishers catch is negligible. Makani suggested that it is actually good for the environment to have fish and dolphins in captivity, because they are kept alive and one can see the wonders of Hawaiʻi and be inspired to learn from them. He also expressed concern that denying permits for aquarium fishing will be just one of many such actions that will spread to impact commercial fishing and result in 100% dependency on another land.

Makani opined that the proposed action to reinstate permits for aquarium fishing is not going to have a negative impact on culture or traditional cultural practices. The negative impact would be getting rid of aquarium fishing and not issuing the permits. He explained that although some aquarium fishers have other jobs, for some of the permit holders, aquarium fishing is all they know how to do. Furthermore, some aquarium fishers are older (in their sixties and seventies) and have no safety net because it is so expensive to live here. He suggested that as aquarium fishers they contribute to the culture and society, but if their livelihood is taken away, they will become a drain on society, which would not be *pono.*

When asked about the indirect impact of modern technology for highly efficient catch methods on traditional harvest capabilities, Makani responded that technology results in less bycatch. He further explained that now, one is able to target their catch more efficiently compared to back in the day, when folks used huge nets to catch everything. Using masks and fins and SCUBA gear helps fishers zero in on aquarium fish. Thus, modern technology had a positive impact overall. In contrast, he mentioned how the banning of small mesh nets has resulted in people using larger gauge nets, which often leads to unintended bycatch and causes injury to the fish. Thus, in his opinion, outlawing small mesh nets is wrong.

When asked for an alternative to mitigate potential impacts if the State chooses the no action option or if there is some sort of middle ground that could be reached between the aquarium fishing industry and the State, Makani stated "there is no middle ground for this." He went on to say that it is all or nothing, because they lose everything and have already lost a lot during the last legislative session.

CHRIS CRAMER

On September 20, 2019, ASM staff, Nicole Ishihara, met with Chris Cramer of the Maunalua Fishpond Heritage Center (MFHC) at the Kānewai Spring and Loko Iʻa located *makai* of Kalanianaʻole Highway in the Niu-Kuliʻouʻou area of Oʻahu. Mr. Cramer serves as the president, a teacher, and historian of the fishpond and heritage center that *mālama* (to take care of, tend) Kānewai and Kalauhaʻihaʻi. The organization educates youth on the fishponds, but also the *mauka-makai* connection that is necessary for the *loko* to thrive.

Kānewai Spring (Figure 66) was recently acquired by MFHC through a partnership with the Trust for Public Land, and fundraising effort. MFHC is also the *kiaʻi* (guardian, caretaker) of Kalauhaʻihaʻi and is working on funding to allow for long term stewardship. Following their efforts which included the passage of Act 210, prohibiting sale of state-owned *loko iʻa*, they became the *kiaʻi* of Kalauhaʻihaʻi .They are currently working with the State of Hawaiʻi on restoring the freshwater flow into the pond by drilling *mauka* of the highway as it was cut off by the Kalanianaʻole Highway widening project in the mid-1990s.

Kānewai Spring consists of one *mākāhā* that enters into Kānewai Loko Iʻa, which eventually empties into Paikō Lagoon. Although Paikō Lagoon is part of the State of Hawaiʻi's - Division of Aquatic Resources (DAR) Marine Managed Area, it is excluded from this study as a region to collect aquarium fish. Mr. Cramer noted that he does not see marine collection occur during the daytime. However, he has seen boats come in the evening with lights in the water outside the reef. One morning he came upon hundreds of *loli* (sea cucumber) scattered along the grass at nearby Kawaiku'i Beach Park from people night harvesting. *Loli* is a food resource and traditionally used in *lāʻau lapaʻau* (Hawaiian healing medicine). The *loli* is being harvested, dried, and shipped to China. He has spoken with scientists who collect the Hawaiian bobtail squid, known for its bright glow, for specimen samples. Mr. Cramer relates that the Paikō area is being targeted by continental research labs as well as local scientists to collect the Hawaiian bobtail squid. It should be noted that both animals—the *loli* and the Hawaiian bobtail squid—are not on the Top 20 Species list for Oʻahu.

Mr. Cramer related that starting in World War II, military landing craft turned swathes of coral reef into rubble along the nearshore of Maunalua Bay. This was followed by large dredging projects that erased hundreds of acres of coral reef and fishponds. Later development projects on the land and hillsides overlooking the area, also greatly impacted the nearshore environment.

The purpose of the *huakaʻi* (trip, voyage) was to visit the *wiliwili* (*Erythrina sandwicensis*) grove that can be observed on Kūlepeamoa Ridge and *wiliwili* scattered throughout the sides of the ridge that separates Niu from Kuliʻouʻou. Mr. Cramer pointed out the *mauka* to *makai* connection of the *lauwiliwili* (Milletseed [Lemon] Butterflyfish) and *wiliwili* tree and highlighted the vanishing *wiliwili* trees in the valley. In 2005, the tree was on the brink of possible extinction from the Erythrina gall wasp. The insect is known to sting young leaves and stem tissue infecting the tree, drying it out, and eventually leading it to its death (Heu et al. 2008; Native Plants Hawaiʻi 2009). Three years later, the State of Hawaiʻi's, Division of Forestry and Wildlife (DOFAW), Native Ecosystems Protection & Management project released a biocontrol agent—the *Eurytoma erythrinae*--to counteract with the gall wasp which proved to be successful. The Eurytoma is also a wasp that is a natural predator to the Erythrina wasp. However, Mr. Cramer shared two resin blocks made by Sean Moura which contain *wiliwili* seeds with black specks of a different invasive pest (Figure 67). Some of the bright orange-red seeds appear to be healthy, but upon closer inspection contain borings from a tiny, black beetle. Mr. Cramer shared that this bug was identified as the bruchid beetle.

Although the Kūlepeamoa Trail is overgrown below, once we hit a clearing, the view boasts a commanding 180-degree view of Paikō Lagoon and beyond (Figure 68). Other native plants observed on the trail include *anapanapa* (*Colubrina asiatica*), *ʻilima* (*Sida fallax*), and *ʻaʻaliʻi* (*Dodonaea Viscosa)*). *Haole koa* (*Leucaena Leucocephala*) was also spotted along the trail.

Figure 66. Photo of Kānewai Spring that feeds into Kānewai Loko Iʻa located within the Paikō Lagoon Wildlife Sanctuary, view to the southeast.

Figure 67. Photo of bruchid beetles and infected *wiliwili* seeds.

Figure 68. Photograph of Paikō Lagoon, view to southeast.

Figure 69. Photo of *wiliwili* leaf in Niu Valley, view to east.

Upon closer inspection, the *wiliwili* appeared dormant with bare branches and sparse leaves. Although there was a minimal amount of leaves, the connection to the *lauwiliwili* is evident. The leaves are the same ovate shape (Figure 69) as the fish and are similar in color with a striking yellow-green (Figure 70). Mr. Cramer offered insight that the leaves were most likely visible from the shoreline, especially in this area as the hillside is arid and the contrast of the bright yellow-green would be an indicator of some sort, whether a change of season, spawning phase, etc. He shared the following annotated *ʻōlelo noʻeau*: "When the *wiliwili* tree blooms, the shark bites." An expanded version can be found below:

> Pua ka wiliwili nanahu ka manō; pua ka wahine uʻi nanahu ke kānāwai.
>
> *When the* wiliwili *tree blooms, the sharks bite; when a pretty woman blossoms, the law bites.*
>
> A beautiful woman attracts young men—sharks—who become fierce rivals over her. The law prevents, the rivalry from getting out of hand—it can "bite." It is said that when the *wiliwili* trees are in bloom the sharks bite, because it is their mating season. (Pukui 1983:295)

Figure 70. Photo of *lauwiliwili* (courtesy of Waikīkī Aquarium, n.d.)

Mr. Cramer shared that the wood from the *wiliwili* was used for surfboards and fishing net floats as it is incredibly light and buoyant. He also pointed out an *ahupuaʻa* boundary wall that is located at the summit of the Kuliʻouʻou Ridge. It begins approximately 100-ft. prior to the Board of Water Supply tank that is perched on the ridge and stops about 1/3 of the way towards the Koʻolau.

As we reviewed the Top 20 Species list for Oʻahu, Mr. Cramer shared that the *kala* and *kole* are fish that are traditionally and currently gathered for consumption. He stated that he is unsure if the *kala* on the list is the same species that is being gathered for eating. He adds that *limu kala* (*Sargassum echniocarpum*) is associated with bait for the *kala* fish. Over the last five years he has watched the *limu kala* disappear from a once plentiful reef in Portlock. He can no longer find it in Maunalua Bay. He shared that *kala* is also used for *lāʻau lapaʻau* purposes but did not indicate how it is utilized. The skin of the *kala* is used for *pahu* (drum) but the fish needs to be particularly large. The fish is enjoyed grilled on the *hibachi* (Japanese barbecue grill). He sees the juvenile *kala* come to shore to feed on a soft brown wispy *limu*, possibly *L. Majuscula*. The *hīnālea* were broiled and used in some *lāʻau* remedies, but also did not indicate what it treated or the modalities.

In terms of where fish from the list can be found, Mr. Cramer indicated that he occasionally sees species such as *kihikihi* in the area along shore. Usually he sees them by rock jetties in low quantities of 1-2. Many of the species are also seen at Hanauma Bay, which is excluded from the study due to it being a DAR Marine Managed Area that is also a Marine Life Conservation District (MLCD

Regarding impacts and recommendations, Mr. Cramer is concerned about *mauka* to *makai* connections. He is particularly concerned with the *mauka* region as it affects what is *makai*. He recalls a large storm that passed through the Maunalua area a few years ago, which caused "chocolate water" (brown water) to lay idle along the southeastern shores up to the breakers (approximately 0.5-miles out to sea). He adds that cementing streams cause the water from *mauka* to travel faster to the ocean, which transports silt quickly and settles atop of the reef. Due to the geological formation of the east side, the brown water remains stagnant on the reef. Mr. Cramer adds that it took approximately 1.5-years after the last storm for the brown water and silt to settle and the water to clear. He points out that there are *mauka* counterparts to *makai* resources and it should be observed closely. If a resource is extinct, it loses its meaning and significance to the counterpart.

DEAN CROWELL

On September 22, 2019, ASM staff, Nicole Ishihara, met with Dean Crowell at Starbucks in Kailua, O‘ahu. Mr. Crowell was born and raised in Waimānalo Hawaiian Homestead. His parents are Harold and Mary Ann Crowell. The youngest of four children, Mr. Crowell has two brothers and one sister. He is the only child of the Crowell’s born in Waimānalo at the homestead, while his older siblings were born in Kaimukī. Today he teaches carpentry at Hawai‘i Community College and is the Cultural Advisor to the Waimānalo Limu Hui.

Mr. Crowell remembers spending a lot of time with his mother while growing up, often producing Hawaiian crafts; visiting and learning about *wahi pana* (storied and celebrated places); and would regularly *mālama* Ulupō Heiau in Kailua prior to it being a part of the State of Hawai‘i’s Division of State Parks. His mother also taught him *lā‘au lapa‘au* (Hawaiian healing medicine) and they would often visit Keaīwa Heiau located at Keaīwa Heiau State Recreation Area in the *mauka* region of ‘Aiea. The *heiau* is considered a *heiau ho‘ōla* or a place for treating sick patients. He recalls the *heiau* once having a variety of medicinal plants surrounding the perimeter. However, in recent years *lā‘au* plants are now sparse around Keaīwa Heiau. He once had a conversation at the park with a *kupuna* (elder) who lived nearby and asked if he could replant *lā‘au* plants in the area. The *kupuna* replied that visitors take the plants home for personal use leaving the area bare, which made Mr. Crowell question if it was worth reestablishing a *māla* (garden) for its intended use.

It wasn’t until Mr. Crowell was a little older that he joined his brothers and father to *holoholo* (to go for a walk, ride, or sail; to fish). He learned how to fish, dive, and gather aquaculture from his father with Waimānalo being their primary grounds. He continues to practice traditional subsistence methods and has since passed this knowledge onto his own children.

Mr. Crowell first learned about the Waimānalo Limu Hui through various community members. He learned about their mission, which is to restore *limu* in Waimānalo Bay and rebuild Pāhonu Pond. Feeling that he could be an asset to the team based on his past experiences in *limu* restoration and *pā* construction, he joined the *hui* (club, association) and now serves as the Cultural Advisor. During the 1980s, he was part of a *limu* replanting project and worked on restoring fishponds.

Although Areas 408 and 418 are excluded from the proposed project, Mr. Crowell was able to share his *‘ike* (knowledge) and insight regarding the project, as well as background on the Limu Hui. The *hui* is currently propagating *limu manuea* (*Garcilaria coronopifolia*). He adds that the *limu līpoa* (*Dictyopteris plagiogramma*) and *limu kala* (*Sargassum echinocarpum*) varieties were once prevalent in Waimānalo but are no longer present. Many *limu* varieties can be used for *lā‘au* and consumption. For example, *limu kohu* needs to be washed thoroughly until there is no sand then it is salted and chopped. Mr. Crowell prefers to mix *limu kohu* with his favorite fish, *enenue* (pilot fish; *Kyphosus bigibbus*), to create a *poke* (to slice into pieces, as fish). *Limu hā‘ula* is a little more cleaner than *limu kohu* in terms of retaining sand but still needs to be washed and cleaned. *Hā‘ula* is eaten as a *pūpū* (relish, appetizer). *‘Ele‘ele* is very fine and hair-like, which makes it difficult to clean. Once clean, it can be eaten as a *pūpū* or as a side dish to stews, soups, and curries.

In regard to the varieties of fish on the Top 20 Species list, Mr. Crowell has seen *hīnālea*, *kala*, *kole*, *lauwiliwili*, *kihikihi*, and *lā‘ī pala* at Kaiona Beach Park, where the *hui* gathers regularly. Although this is an exempt area, Mr. Crowell has seen people in the area gathering marine life but he is unsure if it is aquarium collectors or not. He recalls when he resided on Moloka‘i during the 1990s to the early 2000s that he would be at Kaunakakai Harbor in the evenings and would see aquarium collectors scooping fish with ease. Because Moloka‘i has a relatively small population of residents, he pointed out that he did not recognize the aquarium collectors and indicated they were not local. Mr. Crowell took it upon himself to police the collectors and “had to act authoritative” so there was some type of checks and balances as there were no game wardens or DOCARE (Division of Conservation and Resource Enforcement) officers present because it was off hours. He recalls the collector’s schedules: fly in for a few days; collect aquarium fish in the evenings; and then they would ship the fish out before leaving the island.

In terms of uses for fish on the Top 20 Species list, he pointed out that *kole* and *kala* are food items. *Kole* is prepared by frying. *Kala* can be broiled, grilled, or dried in a dry box followed by frying. If *kala* is dried, it needs to be treated similar to *pipi kaula* (jerked beef)—half dried then fried. The skin of the *kala* is also used for the *pūniu* (knee drum).

In general terms of Waimānalo's ocean life, he adds that it is good squid grounds, but fish are not as prolific as before. Mr. Crowell states the decline of fish can be attributed to overfishing and bad practices. He notes that many fishermen and divers are taking illegal sized fish (below the State of Hawaiʻi's, Division of Aquatic Resources regulations) for consumption. Because of this, a neighborhood watch has been created to oversee that park goers are practicing *pono* (right, correct or proper procedure) behavior in and out of the water. Another issue are invasive species that wipe out native populations of aquaculture, such as the roi (Peacock Grouper; *Cephalopholis argus*). One roi can eat 150 native fish per year. Mr. Crowell describes the roi as a cannibal and a very aggressive fish that eats anything including the *ʻūʻū* (*Myripristis spp.*), commonly known as *menpachi* which is a favored eating fish. He pointed out that roi most likely eat the aquarium fish on the Top 20 Species list and in general, all of the aquarium fish listed are docile and easy prey. Roi can grow up to 18" in length and is known to cause ciguatera poisoning when ingested. Mr. Crowell states the meat of the roi is good but knows people who have contracted ciguatera from eating it. Ciguatera can cause pain, nausea, and can affect the neurological system. He recalls a friend's wife being hospitalized and sick for a few months. He suggests testing the fish for ciguatera prior to consumption, but personally avoids eating the fish all together. Tournaments such as the Roi Roundup, where each island hosts their own event, helps control invasive species that compete with native species for habitat and food resources.

Mr. Crowell feels that all Native Hawaiian fish should not be allowed to be harvested for aquarium purposes, especially the state fish, the *humuhumunukunukuāpuaʻa* (*Rhinecanthus rectangulus)* and the *lauwiliwilinukunukuʻoiʻoi* (Forcepsfish, Common longnose butterflyfish; *Forcipiger flavissimus*). The latter is on the Top 20 Species list. He points out that there are many other Native Hawaiian reef fish that have significant cultural and religious purposes to Native Hawaiians that was not listed, such as the *moi* (threadfish; *Polydactylus sexfilis*), *ʻāweoweo* (*Priacanthus*), and *ʻūʻū*. He adds that reef fish for consumption include the *kala*, *pualu* (surgeonfish; *Acanthurus xanthopterus*), *uhu* (parrot fish; *Scarus perspicillatus*), *kūmū* (goatfish; *Parupeneus porphyreus*), *kole*, *manini* (convict tang; *Acanthurus triostegus*), *kūpīpī* (*Abudefduf sordidus*), *maiko* (surgeonfish; *Acanthurus nigroris*), etc. Because these fish are considered a food resource, he feels they should not be collected for aquarium purposes. He indicates that there are other fish such as the *taʻape* (snapper; *Lutjanus kasmira*), roi, and *toʻau* (blacktail snapper; *Lutjanus fulvus*)—all of which are invasive to Hawaiʻi—that could be collected for aquarium purposes. These three fish are not on the Top 20 Species list. He adds that if he were to allow at least one native fish to be collected for aquarium purposes, it would be the *hīnālea* because they are abundant. There are multiple varieties of *hīnālea* on the Top 20 Species list.

Mr. Crowell finds it acceptable to exhibit Native Hawaiian fish in aquariums for educational purposes, however, he finds it unacceptable for native fish to be displayed in private collections and after much contemplation, concluded that the fish population will be depleted if allowed to be used for any aquarium purpose. He closed his interview with the following statement, "Again, I oppose all Native Hawaiian fishes for aquarium purpose."

NOELANI PUNIWAI

Noelani Puniwai was interviewed via video conference call on October 15, 2019 by ASM Affiliates Cultural Specialist, Nicole Ishihara. Ms. Puniwai was born and raised in the Puna District on Hawaiʻi Island. She grew up in Kapoho and spent a considerable amount of time diving in the tidepools of Waiʻōpae and camping with her *ʻohana* (family). Ms. Puniwai's father was a scientist and her mother was a teacher. She emphasized that her parents felt it was important for their children to experience the different landscapes of Hawaiʻi, therefore, they spent much of their time outdoors. Ms. Puniwai's love for the *ʻāina* and *kai* are woven throughout her personal and professional experience. She holds a B.A. in Marine Science from the University of Hawaiʻi at Hilo; a M.S. in Environmental Science from Washington State University; and a Ph.D. in Natural Resources and Environmental Management from the University of Hawaiʻi at Mānoa. She was also a Research Assistant with the West Hawaiʻi Aquarium Project (WHAP) where she served as a SCUBA diver and data collector. She was also the Marine Gap Coordinator for the Hawaiʻi Natural Heritage Program where she was responsible for processing marine data statewide. She is currently an Assistant Professor at Kamakakūokalani Center for Hawaiian Studies at the University of Hawaiʻi at Mānoa. Her current work focuses on Mālama ʻĀina/Kai (to take care of the land and ocean) and striving to create healthy ecosystems. Her experience and body of scholarly work touch on traditional Hawaiian knowledge, coastal ecosystems, *aloha ʻāina* (love of the land), and methodologies to conduct *pono* science practices.

After reviewing the Top 20 Species list, Ms. Puniwai was asked if she was aware of any information on traditional Hawaiian knowledge and/or practices of each fish. Topics covered include, but were not limited to, knowledge of *moʻolelo*; religious and/or spiritual beliefs associated with any of the species listed; *lāʻau lapaʻau* uses; *mauka* to *makai* connections; use of fish in *hula* practices and subsistence purposes.

In regard to subsistence use, she explicitly stated that the *na'ena'e*, *hīnālea*, *kole*, and *kala* are used in this manner. With respect to the *hīnālea,* Ms. Puniwai explained that larger wrasses were more commonly consumed. In reflecting on the subsistence use of *kole*, she shared that there are some O'ahu families who consistently fish for and eat *kole.* She added that many of the *'ōhua* (young fish stage) were also used for food purposes as well as bait to catch larger fish. Ms. Puniwai also shared that there were some fish that were not typically consumed, such as the small wrasses as well as the butterflyfishes.

When asked if she knew of any *mauka* to *makai* connections of the fish, she related that there are many counterparts as stated in the Kumulipo. One of them being the *lauwiliwili* fish (which is on the Top 20 Species list) and the *wiliwili* tree (*Erythrina sandwicensis*). She reiterated that although many of these small reef fish may not be utilized for food purposes, they are integral to a healthy marine ecosystem. Referring back to the Kumulipo, she explained how this genealogy provides a framework for understanding the importance of existence and function within the ecosystem. She went on to add that "The fact that they are present says something about the entire area. So without their presence…you can't have an *'āina momona* (fertile lands)..."

Ms. Puniwai shared that the *kala* is another culturally important fish and noted that it is specifically used in the customary practice of *ho'oponopono* (conference where relationships were set right through prayer and open discussion), *lā'au lapa'au*, and *hula* (traditional dance). She noted that the word "*kala*" has multiple meanings, with one of them being "to release." She went on to add that the *kala* is an important component of *ho'oponopono* practices as it symbolizes the act of releasing different energies or *ma'i* (sickness, illness) from the afflicted individuals. Ms. Puniwai also specified that the cultural use of *kala* varies according to the nature of the ceremony. With respect to its use in *hula*, she shared that tough skin found on larger *kala* are used to make *pūniu*, a small coconut shell knee drum. She explained that while the tough skin of the *kala* is suitable for the *pūniu* covering, it is also used because of its cultural symbolism and meaning.

In terms of *mo'olelo*, Ms. Puniwai shared that the cultural value of *hīnālea* is often overlooked, however, she explained that this fish is a *kinolau* of Kanaloa. She indicated that Kanaloa is a central figure in the Kū'ula story and although the *hīnālea* may not be a common food source, it is recognized in *mo'olelo* and in the *mo'okū'auhau* (genealogy) of the Kumulipo. She pointed out that many of the fish on the Top 20 Species list are in the Kumulipo.

Another topic that was discussed was the ceremonial uses of the fish on the Top 20 Species list, which she has also connected to genealogy. Ms. Puniwai indicated that the species used as an offering at the *ko'a* was dependent upon the nature and purpose of the ceremony or the function of that specific *ko'a*. She continued:

> If it's a *ko'a* dedicated to Kanaloa, in general, then these species that are his *kinolau* would be used. Yeah, the skin of the *kala* is important in a lot of different ceremonies and it has a similar quality as the *manō* (shark) does and so they're interchangeable a little bit that way…Just as we've revived a lot of our land-based practices, we're looking at a lot of these ocean-based practices as well…Without those ceremonies and practices we can't think of abundance happening…I think until you call them out, people may not highlight these species but that doesn't mean they're not important. You know those things that you take for granted may not be written about all the time, but it doesn't mean they are any less important than species that are sought for food.

Ms. Puniwai also spoke about the ongoing practice of building and maintaining relationships with Hawaiian *akua* such as Kanaloa, and posed the question: How do you bond with these energies that are the *akua*? In order to answer the question and understand how Kanaloa can be activated, Ms. Puniwai emphasized that one must have a more holistic point-of-view. This includes striving to have a fully functioning marine ecosystem available with various species including small fish like *hīnālea* and large fish such as the *manō* and *koholā*. She shared that when you begin to examine each species through the lens of how Kanaloa works, we have a macro understanding of function and our own interactions with places and ecosystems. Without all these factors—an abundant, fully functioning ecosystem, and understanding these synergies—"we don't have that natural, cultural experience with Kanaloa."

Ms. Puniwai also discussed the biological effects on reef fish from run-off, pollutants, and diverted water. Regarding the fish on the Top 20 Species list, Ms. Puniwai shared that each species live in specific, complex habitats during the various stages of their lives and each habitat is greatly affected by what occurs on land. She shared that runoff from land, the presence of freshwater, and water health are key factors that impact the survival of fish larvae, especially during the recruitment process (referring to when a juvenile fish joins a population via birth or migration.) She explained that fish are most vulnerable when they are in the zooplankton stage where various chemicals and water constituents can hinder growth or possibly lead to death. Another biological *mauka-makai* connection described by Ms. Puniwai was the importance of freshwater input which promotes fish growth. She explained that some fish species spend their larval stages within the estuarine, where freshwater and saltwater mix. Freshwater flowing from the land carries nutrients to the ocean. However, Ms. Puniwai presents the challenges and impacts of pollution. She explained that chemical fertilizers and other pollutants are known to leach into freshwater sources thereby introducing excess nutrients into the ocean. Another issue regarding freshwater is water diversion, which inhibits the natural flow of freshwater to the ocean. She added that sites of freshwater in the ocean are areas of abundance and without those sites, “the ocean can’t be healthy.”

Ms. Puniwai went on to explain that depending on the species, some fish may have three to four different larval stages before reaching the stage where they are clearly identifiable. She added that culturally, “That’s why there’s so many names for these specific fish,” as each name represents the different life stages. She explained that there are certain things that these fish are vulnerable to during each life stage. When fish are in their larval stages they are impacted within three nautical miles (the current project boundaries) on Oʻahu and should be protected as they recruit back inshore naturally by gyres (ring-like ocean currents that rotate clockwise and counterclockwise). However, she indicated that there are many determining factors for each species spanning from the distance zooplankton travels inshore to the ocean currents. Normally fish will spawn and stay out to sea for approximately three months in the zooplankton before they recruit back to the reef. However, Ms. Puniwai mentioned that to better understand these intricate ecosystems researchers are still examining fish larval stages and recruitment off the shores of Oʻahu. She provided insight on the recruitment process explaining that fish are not static and that where fish grew at one larval stage may not necessarily be where they were originally sourced from:

> It’s a very, very connected ecosystem and if you’re fishing in one spot and you’re taking the adults from one spot, you might be impacting the ability to recruit to another site. And they don’t study these species enough to know these types of life cycles…So I think we don’t even understand the impact that we have by fishing at one site. Say we’re fishing like North Shore—yeah, there might be an MLCD (Marine Life Conservation District) where you can’t fish and you can’t collect aquarium fish, but maybe that’s a sink site where fish are being recruited to but it might not be the place where they’re coming from and so being able to collect aquarium fish from somewhere else might impact the ability to actually have fish at the MLCD if that’s not where its larvae go. And I don’t know of any larval studies of these specific aquarium fish to know if we know what’s happening. I think—West Hawaiʻi has had some because of the aquarium industry has been so much more active there for the last 30 years that they’ve been doing some of these studies but I don’t believe they’ve done any of these studies on Oʻahu to know what the recruitment and the transport of the larvae around the island.

She explained that in general there has been minimal marine research conducted. Most of the ocean research pertaining to Hawaiʻi has been conducted at Kāneʻohe Bay, which covers half of the Koʻolaupoko District study area. Ms. Puniwai shared that Kewalo Basin is another area where chemical pollutant studies have been conducted and is part of the Honolulu District study area. She emphasized that the Division of Aquatic Resources (DAR) has never had the capacity to execute that type of specific research but she feels that it is necessary for certain industries, including the commercial aquarium fish collection industry, to have access to that data. Ms. Puniwai expressed that because fish are collected at a young stage with varying life spans and depending on the species needs to be examined individually as each fish is different. An example that Ms. Puniwai shared was the life cycle of a *menpachi* that can live up to 50 years, however, she pointed out that a *hīnālea* does not live as long. Because fisheries are incredibly complex, Ms. Puniwai spoke about the difficulties in assessing direct impacts because the island-wide scale is just too large of an area to thoroughly and effectively assess.

Ms. Puniwai knows of a student at the University of Hawaiʻi at Mānoa who has been conducting research to identify various land-based pollutants in fish tissue, as fish can accumulate and store these toxins in their bodies. Sadly, the results are yielding that toxins are present in fish bodies and are identifiable. The conversation lead to the topic of ciguatera as it is a common issue with reef fish in Hawaiʻi. Ms. Puniwai shared that ciguatera is a dinoflagellate, a single celled protist, that is a naturally occurring toxin in the water. However, she emphasized that “metals or carcinogens or estrogens, different kind of human and land-based” substances are contributing factors that can be accumulated in fish bodies “that you may not get sick from but it still doesn’t mean that they won’t affect you.” She juxtaposed ciguatera to mercury in pelagic fish:

> So just like how they talk about mercury in the open ocean. So open ocean fish accumulate those in their bodies. So the more *ahi* you eat, that’s from the open ocean, the more mercury you have in your body. But they haven’t really done those similar kind of studies in reef fish, because they figure *ahi*s are more bigger, they have a lot more body mass. But if you’re eating *kole* regularly, on a weekly level—I don’t think we even know what our exposure is to those toxins yet. And the potential for that exposure. So on Oʻahu it is these issues that no one has been really paying attention to, I

think they just look at fisheries and they study fisheries a lot but they're not really studying the health of these ecosystems enough. And the health of the individual species.

In regard to the condition of Hawai'i reefs, Ms. Puniwai shared her personal experience on knowing what a healthy reef looks like. She reminisced about her time diving as a youth seeing the coral reefs of O'ahu and Wai'ōpae. She recalled the interactions of various species and their soundscapes and stated, "By taking away all these key pieces of that, of these ecosystems you're really leaving a hole in understanding the entire ecosystem."

Continuing our conversation on reef health, she expressed that we should not blame the aquarium industry or overfishing for the decline of fish. Instead, attention should be directed to the larger, overarching issue: the ecosystem.

> If it was all to do with overfishing—then why is there isn't any *hīnālea* on the reef? Why isn't there *lauwiliwili* on the reef? Why don't we have all these butterfly fish and *anthias*, which people aren't eating but they're still not present and you can't blame them on fishermen. So that's one thing that—like I'm not going to blame aquarium fishermen why we don't have wrasses on the reef. We don't have wrasses on the reef because the reef is unhealthy. Because the *'āina* is unhealthy, but that doesn't mean we can still continue to collect these things because how do we start rebuilding the reefs. We need all of these different players. So I think most of the impacts on O'ahu is land-based….we talk about it but we haven't actually figured out how to deal with the source of the impact being land-based. The other major impact I feel is that we've forgotten to have those interactions with these species and in these areas. And a lot of what Hawaiian cultural values show is, you need to give respect and be present for these things to continue. And so we haven't been present in a lot of these spaces because they are not healthy. But because we aren't there, they haven't had the ability or need to become healthy again. And so reconnecting people to these species, in their places, is very important in securing their abundance in the future….it's really sad to see how empty the reefs are on O'ahu. Compared to what I grew up seeing and knowing what should be present and abundant.

To create a healthy ecosystem, mitigation begins with the prevention of runoff. She pointed out that all drains lead to the ocean. Instead, runoff needs to be filtered and cleaned. In addition, the time frame of what is occurring on land before reaching the ocean is so short, there is no mediation for the pollutants. When the topic on the recent ban of oxybenzone came up, Ms. Punwai presents the dilemma of other chemicals still present in sunscreen and how that still greatly affects our reefs:

> Sunscreen was an easy thing for people to target and understand. It took a long time…It's all those different kind of chemicals, that we're putting that and we're still, if you still use sunscreen, you're still putting other kind of chemical pollutants in the ocean. And we just never thought of that being serious before but none of those chemicals were present and they're all really important in the larval and…in the reproduction of every species pretty much in the ocean when they're larval—before they hit the egg and sperm stage, it cannot even combine into eggs if there's too much of these chemical pollutants around there.

She closed her interview with the following statements in regard to impacts on traditional Native Hawaiian cultural practices and traditions,

> I do believe that the practice of aquarium fishing will have an impact on traditional cultural practices in these areas. And I think with the ocean—and it's not just the ocean—I think in general, traditional and cultural practices is not really a site assessment that I can give. It's just that broader impact and the ability for these things to be considered abundant…The value of the ability for a species to live in its own environment. I have a hard time seeing how taking a *hīnālea* and putting it in a tank in Nevada can allow that being to continue being a *hīnālea*. So the traditional practice of our species being able to have their own *'ōiwi* is being affected through the practice of aquarium collecting and having live pets.

ROSALYN "ROZ" DIAS CONCEPCION

On October 21, 2019, ASM staff, Nicole Ishihara, conducted a telephone interview with Roslyn "Roz" Dias Concepcion. Since 2011, Ms. Concepcion has worked with Waikalua Loko I'a as the Alaka'i Loko I'a Manager and serves as the primary *kia'i* of the fishpond where she oversees the daily operations. Waikalua Loko I'a is located in the southern portion of Kāne'ohe Bay nestled between Kāne'ohe Stream to the north and Kawa Stream to the south. Prior to working at Waikalua Loko I'a, Ms. Concepcion was an Operations Manager at Bank of Hawai'i for fifteen years. She explained that the change from a corporate position to *'āina*-based (land-based) stewardship was motivated by her need to work outdoors, to be more connected with the land, and to work with children. After working at a *lo'i* (irrigated terrace) in Waipi'o Valley on Hawai'i Island, Ms. Concepcion made the decision to transition full-time into *'āina*-based stewardship. She shared, "I'm a Hawaiian, a Hawaiian woman with this education and I'm not really applying it to my culture in any way and so it was that lightbulb that went off and I went to a fishpond shortly after." Ms. Concepcion met with Ka'ohua Lucas, who was managing Waikalua Loko I'a at that time and in 2011, Ms. Lucas retired from the *loko i'a* and Ms. Concepcion assumed her role.

Ms. Concepcion's mother is from Maui and her father is from Hawai'i Island, specifically the Hāwī area in the Kohala District. Her maternal grandparents are of Hawaiian and Filipino ancestry and her paternal grandparents are of Puerto Rican and Spanish ancestry. She grew up in Pālolo and later moved to Hawai'i Kai where she resided until she graduated from high school. Ms. Concepcion has been living in Kāne'ohe for the last decade.

When asked if she grew up learning traditional Hawaiian cultural practices, she pointed out that her parents came from a generation when they were taught not to speak Hawaiian and learn Hawaiian ways of life. Ms. Concepcion shared that the idea back then was that "it was better for them to connect to the Western part of the world" as it was believed that this would help them "get ahead in life." Because of this, she was also raised without learning Hawaiian values or exposed to traditional Hawaiian cultural practices. She shared that she eventually began to paddle canoe for Hui Nalu in her adolescent years and because of this connection to the ocean, Ms. Concepcion began to fish and pick *limu* (general name for seaweed). Eventually these newly acquired skills would stay with her for the remainder of her life.

As a self-taught fisher, Ms. Concepcion engages in onshore and offshore fishing and recalled episodic fishing trips with an uncle who often invited her to fish on his boat. In describing those fishing experiences, Ms. Concepcion shared:

> I'd meet him like 5PM and we'd go out and he'd troll. Or he'd go out to a certain point, out at the harbor at night. And we'd just drop our lines and fish for *akule* (big-eyed scad; *Selar crumenophthalmus*) and stuff like that. Come back at the next morning at like 5. I used to love to do that. But as a little kid I would just whip or use floater. And then that kind of evolved to go fishing with my uncle on his boats. And then go to Alaska to go fishing for salmon, halibut, and codfish. Yeah, so I can clean my fish. I don't have a problem with doing that. I can make my own hooks. But working at the fishpond, it's funny cause I'm just so busy at the pond, I really don't have the time to fish. Unless I stop and make a point to do it, you know? I just don't really have that chance. I can throw net too if I wanted to. It's all self-taught.

She also shared that another uncle who was a "big-time fisherman" taught her how to cast her line and how to mend her throw net. Because she paddled, she often saw him at Ala Moana Beach Park and the Sand Island area. She shared that this uncle (as well as her own mother) spent a lot of time at Mokauea, a traditional fishing village and fishery, and would often reminisce about the island. Mokauea Island is the last Hawaiian fishing village in Ke'ehi Lagoon, between Honolulu Harbor and the Daniel K. Inouye Airport.

Even as a recognized cultural practitioner, Ms. Concepcion pointed out that prior to assuming her position at Waikalua Loko I'a she did not know anything about fishponds. She shared that she learned through the practice of *kilo* (observation), talking to *kūpuna*, and being exposed to other cultural practitioners associated with Kua'āina Ulu 'Auamo (KUA), a grassroots organization that supports community initiatives. She added, "I've learned like, the science part of it and then really nailed down the cultural practices associated to the *loko i'a*." Ms. Concepcion shared that prior to 1995, the *kia'i* of Waikalua Loko I'a was Uncle Henry Wong, who is related to Kumu Hula Frank Kawaikapuokalani Hewett a *kama'āina* (native-born) of Kāne'ohe. She explained that Uncle Henry obtained the land from the former Kaneohe Ranch Management Limited, a company that managed the real estate of Harold K. L. and Alice H. Castle, in the late 1950s-early 1960s. Uncle Henry was one of the key supervisors at the time for Kaneohe Ranch. After Uncle Henry passed away in the 1980s, the fishpond fell to the wayside and in 1995, The Pacific American Foundation (PAF) came across the *loko i'a* by sheer luck. Ms. Concepcion explained that:

> My ED (Executive Director) at the time was working with Bay View Golf Course, so whoever the golf course owners were then…came to the backside of the golf course and came across the fishpond and it was in that moment felt that he had this responsibility, this *kuleana* to take care of the pond. So yeah, 1995 is when the Pacific American Foundation…formed the 501(c)3, they didn't really become landowners, they didn't get title until this year. That's how long it's taken.

After sharing a bit about her background, Ms. Concepcion was then asked to review the Top 20 Species list. After reviewing the list, she was asked if she was aware of any traditional cultural knowledge associated with any of the fish species. These include (but are not limited to) knowledge of *mo'olelo* regarding each species; religious and spiritual beliefs and practices associated with any of the fish species listed; *lāʻau lapaʻau* uses; *mauka* to *makai* connections; use of fish in *hula* practices; and food resources. In light of this inquiry, Ms. Concepcion mentioned that most of her *kilo* is done while she is working on the fishpond wall. She noted that the *ʻoʻopu hue* or Hawaiian Whitespotted Toby is a species that can be found within and just outside the fishpond. She also describe seeing an occasional *kala* in the pond on occasion. Although has not observed any angelfish in the fishpond or in the vicinity of the fishpond, she described seeing the following fish as well as an abundance of *limu* during the summer months:

> When I'm walking around the wall, the main ones that I see are *manini* (convict tang; *Acanthurus triostegus*), *moi* (threadfish; *Polydactulus sexfilis*), pufferfish…There's a lot of tilapia around our bay and in the stream and in the pond…We have *pāpio* (juvenile crevalle) from time to time that we'll see. And the *pāpio* we get is the *paʻopaʻo* (a species of crevalle; *Caranx spciosus*). So we do have that.

Ms. Concepcion spoke extensively about tilapia, which poses several issues to fishpond managers. The first is issues of disposal. Ms. Concepcion shared that aquarium owners often throw their tilapia and other fish into the stream, which eventually makes its way downstream into the *loko iʻa* and the ocean. She shared that the majority of tilapia are the Blackchin variety, but the Hawaiian Gold variety is present as well. Prior to her time at the *loko iʻa*, she recalled when an aquaculture specialist felt compelled to add tilapia into the pond. In June 2019, a *paepae* (support, prop) activity was employed to get a sampling of fish species in the pond. The activity yielded a total of approximately 220-pounds of fish with 200-pounds being strictly tilapia, thus demonstrating that there are far fewer native fish in the fishpond. She continued describing the *paepae* sampling activity:

> So although we know what kind of fish, we have a good idea of what type of fish we have in the pond... So we did a sampling and we're going to do another sampling on November 30th... And it was a 50% sampling, just to see what we had in the pond…So we definitely had a lot of tilapia, we had a lot of barracuda. *ʻōʻio* [bonefish; *Albula Vulpes*], surprisingly. We had a lot of *ʻōʻio* and umm…not too much mullet, sadly. And then we didn't catch anything else because all of the smarter fishes [giggling], they you know, went straight to where our mangrove is and they kind of hid there. And that's what we kind of got in the first sampling and we did get some pufferfish so that's how I know we have that for sure.

When asked if any of the fish on the Top 20 Species list were used for subsistence purposes, Ms. Concepcion shared that the only fish that she knows of used as a food resource are the *kala* and *ʻoʻopu hue*. She shared that *kala* can be prepared on the grill using "..a fish cage that you just put the fish inside. You just put the fish inside and then put it straight on the grill, salt and pepper. The skin is tough. So once you get past the skin, the meat is nice and white and it's *ʻono* (delicious, tasty). That's how I eat it." In regard to the *ʻoʻopu hue*, it is to her understanding you need to know how to clean the fish very well as it known to contain toxic sacs. When asked how this fish was prepared, she shared:

> …you eat it like *sashimi* (Japanese delicacy consisting of fresh raw fish) but you would have to remove the chemical—like a poison bag in the fish that you will have to be very careful before cutting out and removing before you eat it. Cause if you didn't do it properly, that [poison] would get released into the fish meat…it's a delicacy in Japan for sure. I don't know about culturally how we ate pufferfish but I assume it's the same thing. They probably did the same thing—like Japanese, you know? Ate it sashimi style.

Ms. Concepcion shared that in addition to being raised in Waikalua Loko Iʻa, *ʻoʻopu hue* was also raised in Moliʻi Fishpond in Kualoa. She expressed that between the 1960s and 1970s the former owners of the Waikalua Loko Iʻa raised pufferfish for food, however, with the onset of development and urbanization they stopped cultivating the fish.

Regarding the Top 20 Species being used for spiritual and religious practices, Ms. Concepcion was aware that the *ʻāweoweo* (Priacanthus), *menpachi* (Holocentridae), and *kala* are fish that are typically placed on a *koʻa* or *ahu* as an offering. Although the *ʻāweoweo* and *menpachi* are red reef fish that are not on the Top 20 Species list, she added that the *ʻāweoweo* is a *kinolau* of Kanaloa. She also knows of an *ʻohana* on the windward side of Oʻahu that continues to leave offerings at a *koʻa*, thereby exemplifying that certain fish are still used in traditional Native Hawaiian cultural practices today.

Ms. Concepcion also described a *mauka-makai* relationship associated with the *kala* fish sharing that this fish has a land counterpart, the *kala* plant, commonly known as Hawaiian prickly poppy. Other names for the *kala* plant include *naule* and *puakala*. She did not specify the use of the plant or any specific connections.

Ms. Concepcion offered no comments or concerns, nor identified any impacts from the proposed permit issuance.

5. IDENTIFICATION AND MITIGATION OF POTENTIAL CULTURAL IMPACTS

The OEQC guidelines identify several possible types of cultural practices and beliefs that are subject to assessment. These include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs. The guidelines also identify the types of potential cultural resources, associated with cultural practices and beliefs that are subject to assessment. Essentially these are natural features of the landscape and historic sites, including traditional cultural properties. A working definition of a traditional cultural property is provided.

> "Traditional cultural property" means any historic property associated with the traditional practices and beliefs of an ethnic community or members of that community for more than fifty years. These traditions shall be founded in an ethnic community's history and contribute to maintaining the ethnic community's cultural identity. Traditional associations are those demonstrating a continuity of practice or belief until present or those documented in historical source materials, or both.

The origin of the concept of traditional cultural property is found in National Register Bulletin 38 published by the U.S. Department of Interior-National Park Service. "Traditional" as it is used, implies a time depth of at least 50 years, and a generalized mode of transmission of information from one generation to the next, either orally or by act. "Cultural" refers to the beliefs, practices, lifeways, and social institutions of a given community. The use of the term "Property" defines this category of resource as an identifiable place. Traditional cultural properties are not intangible, they must have some kind of boundary; and are subject to the same kind of evaluation as any other historic resource, with one very important exception. By definition, the significance of traditional cultural properties should be determined by the community that values them.

It is however with the definition of "Property" wherein there lies an inherent contradiction, and corresponding difficulty in the process of identification and evaluation of potential Hawaiian traditional cultural properties, because it is precisely the concept of boundaries that runs counter to the traditional Hawaiian belief system. The sacredness of a particular landscape feature is often cosmologically tied to the rest of the landscape as well as to other features on it. To limit a property to a specifically defined area may actually partition it from what makes it significant in the first place. However offensive the concept of boundaries may be, it is nonetheless the regulatory benchmark for defining and assessing traditional cultural properties. As the OEQC guidelines do not contain criteria for assessing the significance for traditional cultural properties, this study will adopt the state criteria for evaluating the significance of historic properties, of which traditional cultural properties are a subset. To be significant the potential historic property or traditional cultural property must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

- a Be associated with events that have made an important contribution to the broad patterns of our history;
- b Be associated with the lives of persons important in our past;
- c Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;
- d Have yielded, or is likely to yield, information important for research on prehistory or history;
- e Have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity.

While it is the practice of the DLNR-SHPD to consider most historic properties significant under Criterion d at a minimum, it is clear that traditional cultural properties by definition would also be significant under Criterion e. A further analytical framework for addressing the preservation and protection of customary and traditional native practices specific to Hawaiian communities resulted from the *Ka Pa'akai O Ka 'Āina* v Land Use Commission court case. The court decision established a three-part process relative to evaluating such potential impacts: first, to identify whether any valued cultural, historical, or natural resources are present; and identify the extent to which any traditional and customary native Hawaiian rights are exercised; second, to identify the extent to which those resources and rights will be affected or impaired; and third, specify any mitigative actions to be taken to reasonably protect native Hawaiian rights if they are found to exist.

This study focused on the culture-historical context of O‘ahu’s nearshore waters and the Top 20 Collected Aquarium Fish Species for O‘ahu. Six oral interviews were conducted with individuals from various communities and areas of expertise including (but not limited to) cultural practitioners, aquarium collectors, subsistence and commercial fishers, charter boat operators, *loko i‘a* managers, and educators. Many of the consulted parties identified with more than one area of expertise and may identify with another user group not listed above. Based on a review of background research in concert with the results of the consultation efforts, the nearshore waters of O‘ahu have served as a foundation for a subsistence lifestyle of Kānaka Maoli since Precontact times and continues to be a resource amongst Native Hawaiians, *kama‘āina*, and visitors today. Kānaka Maoli of all ages and genders practiced *lawai‘a* in various capacities. Women and children congregated at the nearshore collecting *limu*, shellfish, and urchins while men tended to the nearshore and offshore fisheries. Traditional harvesting methods varied from carefully engineered *loko i‘a*, to small handheld apparatuses such as *hīna‘i*, *‘upena* of various shapes and sizes, hand collection, hook and line, plant-based poisons, snaring, and spearing. While all of these harvesting methods are still employed, the apparatuses used in that process have certainly evolved from their original prototypes. Through the consultation efforts, it was expressed that *loko i‘a* today are not used exclusively for sustainability but serve as important culture-educational resources, especially on the island of O‘ahu where many fishponds are being restored and actively cared for. Although the methods described above are tangible, as demonstrated in the background research, there is also a spiritual element to the practice of *lawai‘a* and to O‘ahu’s nearshore waters. Additionally, the naming of eco-zones from the mountain peaks to the seashore and out to the distant horizon demonstrates the intimate connection Kānaka Maoli had with nature. Their sole reliance on local fisheries necessitated deliberate and careful resource management strategies that were reinforced at a sociopolitical and familial level.

Kānaka Maoli anchored their beliefs in the natural elements—*‘āina*, *wai*, *lewa*, and *kai*. As discussed in the culture-historical background, Kānaka Maoli believe that each natural element was a physical embodiment of an *akua*. The ocean is considered a pathway for the ancient *akua* and early inhabitants who migrated from Kahiki to Hawai‘i. Research and consultations yielded that the ocean is an embodiment of the deity Kanaloa, one of the four paramount male gods worshipped in Hawai‘i and throughout Polynesia, who also assumes various *kinolau* including the *‘āweoweo*, *he‘e*, *mūhe‘e*, *koholā*, and *palaoa*. These species are also mentioned in the Kumulipo, a cosmogonic chant consisting of sixteen *wā* or eras deriving from a time of darkness and progresses to the introduction of cosmic energies, light, and living organisms. In the second *wā*, fish and their forest counterparts are enumerated, however, Kānaka (humans), according to the Kumulipo are not born until the eighth *wā*. This informs the reader that Kānaka evolved from the same source as other living creatures but arrived much later thereby establishing them as subordinate to the natural elements. The Kumulipo serves as a reminder of the symbiotic relationship between *‘āina*, *kai*, and their worldly inhabitants. The consulted parties also pointed out the validity of the Kumulipo today as it highlights the importance of the natural elements to the fecundity of all life and illustrates the importance of maintaining balance with nature.

The practice of offering *ho‘okupu* for *akua* and *‘aumakua* was another attribute of maintaining spiritual balance. The nearshore waters were associated with various deities including the goddess Hina (Hinapukui‘a), Kū‘ula (Kū‘ulakai), and their son ‘Ai‘ai, all of whom contribute tremendously to the spiritual aspect of Hawaiian fishing practices and the creation of *loko i‘a*. The traditional practice of leaving the first catch at a *ko‘a*, *ahu*, or on the shore for a deity or *‘aumakua* is still exercised as mentioned by a number of interviewees. This practice honored *akua*, spiritual forces (such as *‘aumakua*) that protect you while in the ocean, and recognized the reciprocal relationship of giving and taking. Interviewees acknowledged *ko‘a* and *ahu* that are still used today in Wai‘anae and Kāne‘ohe in the water and on land, although there may be others in use that are undocumented or not widely discussed. Another ritual of maintaining balance was through *pule* and *oli* with consulted parties also employing thoughts, visions, and intuition to the practice of *lawai‘a*.

The practice of *kilo* or observation was a traditional method still used today to locate schools of fish and to record changes in elements, distinctions, and correlations. *‘Ōlelo no‘eau* shared by a consulted party regarding the *lauwiliwili* fish and *wiliwili* tree demonstrates how Kānaka Maoli used the art of *kilo* to deduce the interconnections of land, ocean, and balance. The taking of resources was implemented on an as-needed basis and traditional laws imposed conservation-stewardship practices governed by the *kapu* system that maintained law and order. Although the *kapu* system was abolished in 1819, these traditional practices that were established set the foundation for customary gathering rights that were later codified into some of the early laws. A majority of the consulted parties continue to practice the art of *kilo* with the inclusion of community policing to enforce *pono* resource management practices in conserving and protecting natural resources and the environment. One reason for the community policing was due to the fact that conservation and resource enforcement officers are inadequately staffed and were unable to police on a regular basis. Besides policing the overtaking of resources, examples relayed in consultation pertaining to environmental issues on land impacting the ocean include run-off entering the *kai* affecting reef health; water diversions prohibiting stream nutrients from entering the ocean to assist with the spawning process; and pollutants hindering fish populations. It should be noted that although these factors are impacting the ocean's ecological system, this is a larger issue outside of the study's current scope of work. One interviewee discussed the biological effects on reef fish stemming from pollution and insufficient data to truly understand each of the species listed in terms of habitat, life spans, and their recruitment processes (referring to when a juvenile fish joins a population via birth or migration). This led to the discussion that fish are not static and that they move through their growth stages in different parts of the nearshore waters. Another consulted party shared that fish are redeposited annually along the shoreline and took into consideration that there is no aquarium collecting in Maui County hinting that there is an excess population. Invasive species such as roi and tilapia were addressed in consultation as these species prey on native fish, reproduce at a rapid rate, and are sometimes used as aquarium fish that are later dumped into streams that carries them to the ocean.

Based on the summary of findings described above, it is evident that the nearshore waters of Oʻahu, along with all of its contributing tangible and intangible elements and associations, could be considered a traditional cultural property significant under Criteria a and e. Additionally, *loko iʻa*, which were also identified as another significant cultural resource could also be considered significant under Criterion c. Having a comprehension of the traditional cultural significance of the nearshore waters of the Island of Oʻahu by all of its user constituencies, is a first step in ensuring that the activities of any one user group does not in any significant way conflict with the activities of another user group. As part of any future permitting processes associated with the nearshore waters of Oʻahu, it is recommended that DLNR-DAR provide to potential permit holders a document that provides a synopsis of the traditional cultural significance of the fishery.

As previously mentioned, this study focused on the Top 20 Species. The list was created from data collected under commercial aquarium permits spanning from 2000 to 2017. The fish listed on the Top 20 list make up 80% of what is gathered off the shores of Oʻahu with the remaining 20% of unknown collected species. A review of background research and information provided by consulted parties resulted in the identification of traditional names, and/or past and/or ongoing cultural uses for thirteen of the Top 20 Collected Aquarium Fish Species of Oʻahu. Identified cultural uses for marine resources include subsistence, medicinal, ritual, ceremonial, and *hula*. Some of the consulted parties identified that all of the fish on the Top 20 list were once used for subsistence purposes, while others made explicit reference to certain species including *naʻenaʻe*, *kala*/*umaumalei*, larger *hīnālea*, *kole*, and *ʻoʻopu hue*. The *ʻoʻopu hue* was later banned for sale and consumption due to it being poisonous and the possible health risk if not prepared properly and ingested. The *kala/umaumalei* was discussed at length amongst several of the consulted parties as a culturally significant fish as the skin is used as the covering for the *pūniu* (knee drum) which is used in certain *hula* performances; it is used in *hoʻoponopono* practices to signify the releasing (another definition of *kala*) of unwanted energies; in *lāʻau lapaʻau* practices; subsistence; and as a *hoʻokupu*. The *kole* was also mentioned frequently in consultation, and was identified as being used for subsistence and as *hoʻokupu*.

Given that the species described above are important to maintaining and perpetuating the above-described cultural practices, if the issuance of commercial aquarium permits leads to a significant depletion of the populations of the species mentioned above through direct or indirect habitat distruption, then the result would be a cultural impact. Conversely, if the biological assessments (conducted by qualified biologist) indicate that the issuance of the twenty commercial aquarium permits will not have a signigicant impact on either the fishes or their habitat, then the issuance of the commercial aquarium permits would not result in a cultural impact.

All interviewees expressed a connection to the ocean; shared a degree of traditional knowledge involving the ocean; and that they continue to engage in traditional cultural practices associated with the ocean (whether nearshore or offshore). Many of the consulted parties recalled their introduction to the nearshore waters of Oʻahu from a young age and generally with family members who provided guidance on how to employ traditional fishing apparatuses and sustainable harvesting practices. As a result, interviewees shared that during their youth they were taught to some degree about traditional cultural knowledge and values. Many continued to learn about the ocean and gain a deeper understanding of traditions and practices from non-family (i.e. community members, *hui*, academia, professions) throughout the years adding to their breadth of knowledge. It is apparent that all participants continue to apply traditional methods to the practice of *lawaiʻa* today with evolved prototypes and techniques. Some participants expressed specific cultural concerns related to the Top 20 Collected Aquarium Species of Oʻahu, while others discussed reef species not on the list. Interviewees stressed the ecological importance of fish, life cycles, and ecosystems/reef health; the overtaking of resources; and the issue of invasive species that feed on and compete with native species for resources and habitat. One interviewee expressed her concern when fish are removed from their native habitat they lose their *ʻōiwi*, but also their ecological purpose. Some expressed frustration with the lack of studies to understand the ecological importance of each fish species; inadequate staffing of DOCARE officers to assist in the policing, management, and conservation of aquatic resources; and acknowledged a division between different user groups.

If the analyses in the EIS determine that the conditions of effect are met with respect to the potential cultural impacts described above, then the following recommendations for mitigation are offered. As stated by an interviewee, there is a lack of data and studies to understand the habitat, life spans, recruitment processes, etc. for each species listed on the Top 20 list. If the public and the decision making authorities are privy to this information to comprehend species, increase fish populations, and improve the overall management and sustainability of the Oʻahu fishery, then it could potentially lend to an improve understanding of the various fish species and inform decision makers on appropriate and sustainable management strategies. It is therefore recommended that PJAC and DLNR-DAR develop partnerships with other organizations, institutions, and governmental agencies to support the undertaking of additional studies of the fish on the Top 20 list.

To further curtail the potential for cultural impacts and to assist in the overall management of the Oʻahu fishery, it is recommended that existing bag limits and no-take areas within the study area remain in effect. However, with respect to bag-limits, it is recommended that such limits be adjusted periodically to account for changes in local fish stock. Additionally, to improve inter-user group relations and management of Oʻahu's nearshore fishery, it is recommended that DLNR-DAR consider developing a local fisheries council that would be tasked with developing a list of approved species similar to the "white-list" that has been created by the West Hawaiʻi Fishery Council. Reducing the species from the estimated 238 would allow for more detailed species specific studies and inform decision makers on the appropriate management strategies. As discussed in the background section of this report, underreporting (i.e. DAR confidentiality statute) and inconsistent catch data reports (i.e. general group reporting rather than species-specific reporting) are current fisheries management issues that should be rectified. Improving the existing reporting system so that catch data is more accurately represented is necessary to sustainably manage Oʻahu's fishery.

DLNR-DAR plays a significant role in managing and enforcing the rules and regulations intended to support the sustainability, viability, and productivity of the Oʻahu nearshore waters. As voiced by several of the consulted parties, the lack of support and funding has hampered DLNR-DAR's ability to fulfill its fiduciary duty, namely to enhance, protect, conserve, and manage Hawaiʻi's natural resources. Various ocean user groups have observed the shortage of DOCARE officers and have either taken advantage of this shortcoming by not complying with rules, while other communities have taken matters into their own hands by enforcing the rules themselves. While it is everyone's responsibility to utilize Hawaiʻi's marine resources responsibly, having adequate enforcement remains a crucial component of proper management. To minimize conflict within the various user groups and the community, it is recommended that additional funding to improve DOCARE's capacity be allocated to better manage Oʻahu's fisheries.

In summary, the recommendations provided above are intended to ensure that the proposed issuance of twenty commercial aquarium permits for Oʻahu considers the knowledge, concerns, and thoughts shared by the consulted parties and identified through the culture-historical background research. Overall, all consulted parties are users of the ocean and desire the same outcome for the nearshore waters, which is for it to be abundant. If all ocean user groups assume ownership of their *kuleana* to utilize marine resources in a sustainable way through the acts of *mālama* and enriching the resources, then potential cultural impacts will be lessened. Understanding the cultural resources, cultural practices, cultural beliefs, and current issues will ultimately help ensure that no such resources, practices, or beliefs are adversely affected by the proposed issuance of the twenty aquarium permits for Oʻahu's nearshore waters.

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APPENDIX A

KA WAI OLA PUBLIC NOTICE

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HO'OLAHA LEHULEHU
PUBLIC NOTICE
Iulai 2019 18

PUBLIC NOTICE

ASM Affiliates is preparing a Cultural Impact Assessment (CIA) in advance of the preparation of an Environmental Impact Statement for the proposed issuance of commercial aquarium permits for the Island of O'ahu, excluding the following areas: Pūpūkea Marine Life Conservation District (MLCD), Hanauma Bay MLCD, expanded Waikīkī MLCD, Coconut Island Hawai'i Marine Laboratory Refuge Fisheries Management Area (FMA), Waikīkī-Diamond Head Shoreline FMA, Ala Wai Canal, Kapālama Canal, He'eia Kea Wharf, Honolulu Harbor, Pōka'ī Bay, Waialua Bay, and the 'Ewa Limu Management Area, as well as report collection areas 405 and 406, extending from Pūpūkea Ahupua'a to Kualoa Point, and report collection areas 408 and 418, extending from the easternmost point of the Kāne'ohe Marine Corp Base to the Makapu'u lighthouse.

We are seeking consultation with any community members that might have knowledge, or who are involved in, any ongoing cultural practices that may be occurring in any of the places outside of the restricted areas listed above. If you have and can share any such information please contact Teresa Gotay tgotay@asmaffiliates.com, phone (808) 439-8089, mailing address ASM Affiliates 820 Mililani St. Suite 700, Honolulu, HI 96813.

WAIKĪKĪ AHUPUA'A

Persons having information concerning an unmarked burial on a portion of TMK: (1) 3-6-023:006 in the Waialae Iki portion of Waikīkī Ahupua'a, Kona District, Island of O'ahu. Interested parties are requested to contact Bob Rechtman, ASM Affiliates, (808) 969-6066, 820 Mililani Street, Suite 700, Honolulu, HI 96813, and/or Regina Hilo, DLNR-SHPD Burial Specialist (808) 692-8026, 601 Kamokila Blvd., Rm. 555, Kapolei, HI 96707.

Appropriate treatment of the remains will occur in accordance with HRS, Chapter 6E, respective to this burial site in consultation with any identified descendants and with the approval of the O'ahu Island Burial Council. All interested parties should respond within thirty (30) days of this notice.

APPENDIX B

Collection Data for Additional SGCN Species

Appendix B: Collection data for additional SGCN species

As stated in the EIS, the analysis in the EIS focused on the Psychedelic Wrasse, Fisher's Angelfish and Bandit Angelfish. However, additional SGCN have been collected on O'ahu (but are not in the top 20 fish species collected or otherwise regulated), and the collection data are summarized in Table B-1 below.

Table B-1.Summary of additional SGCN species collected by commercial aquarium collectors from O'ahu since 2000 (DAR 2018, 2019b), including the average (including only years with reported catch) and maximum annual collection for all fishers and for the 20 fishers who would be issued Aquarium Permits under the Preferred Alternative (who released all their catch data from 2000, including data previously protected by non-disclosure). n.d. = Not Disclosed (Section 5.1 of the EIS)

Species Name	Hawaiian Name (DLNR 2015)	Number of years collected		Number of years with data	Number of years n.d.	Average collection per year		Maximum collection per year	
		All fishers	20 fishers	All fishers	All fishers	All fishers	20 fishers	All fishers	20 fishers
Spotted Cardinalfish (*Apogon maculiferus*)	*'upāpalu*	8	6	0	8	n.d.	29	n.d.	56
Hawaiian Orbicular Velvetfish (*Caracanthus typicus*)	none	5	2	0	5	n.d.	2	n.d.	2
Hawaiian Flame Angelfish (*Centropyge loricula*)	none	17	18	16	1	45	22	182	185
Bluestriped Butterflyfish (*Chaetodon fremblii*)	*kīkākapu*	18	18	18	0	340	190	713	388
Tinker's Butterflyfish (*Chaetodon tinkeri*)	none	16	14	9	7	16	9	40	28
Hawaiian Morwong (*Cheilodactylus vittatus*)	*kīkākapu*	2	1	0	2	n.d.	1	n.d.	1
Chocolate-dip Chromis (*Chromis hanui*)	none	13	6	7	6	59	28	125	58
Oval Chromis (*Chromis ovalis*)	none	15	13	6	9	132	51	320	162
Yellowstripe Coris (*Coris flavovittata*)	*hilu*	18	16	16	2	76	12	759	47
Elegant Coris (*Coris venusta*)	none	18	17	17	1	147	63	351	200
Hawaiian Knifefish (*Cymolutes lecluse*)	none	7	1	0	7	n.d.	1	n.d.	1

Species Name	Hawaiian Name (DLNR 2015)	Number of years collected		Number of years with data	Number of years n.d.	Average collection per year		Maximum collection per year	
		All fishers	20 fishers	All fishers	All fishers	All fishers	20 fishers	All fishers	20 fishers
Redstripe Pipefish (*Doryrhamphus baldwini*)	none	18	17	3	15	38	46	60	95
Marbled Blenny (*Entomacrodus marmoratus*)	*pāo'o*	4	0	1	3	309	0	309	0
Masked Angelfish (*Genicanthus personatus*)	none	3	3	0	3	n.d.	2	n.d.	2
Steindachner's Moray (*Gymnothorax steindachneri*)	*pūhi*	7	0	0	7	n.d.	0	n.d.	0
Blackside Razorfish (*Iniistius umbrilatus*)	*lae-nihi*	15	11	5	10	6	2	12	5
Hawaiian Flagtail (*Kuhlia xenura*)	*āholehole*	2	0	0	2	n.d.	0	n.d.	0
Sunset Bass (*Liopropoma aurora*)	none	1	1	0	1	n.d.	1	n.d.	1
Whitesaddle Goatfish (*Parupeneus porphyreus*)	*kūmū*	5	0	0	5	n.d.	0	n.d.	0
Hawaiian Rock Damselfish (*Plectroglyphidodon sindonis*)	none	1	0	0	1	n.d.	0	n.d.	0
Hawaiian Anthias (=Thompson's Anthias) (*Pseudanthias thompsoni*)	none	17	16	11	6	538	229	1,039	908
Hawaiian Turkeyfish (*Pterois sphex*)	*nohu pinao*	18	17	15	3	39	11	132	27
Titan Scorpionfish (*Scorpaenopsis cacopsis*)	*nohu*	11	7	2	9	9	2	13	5

APPENDIX C

Comments and Applicant Responses

DAVID Y. IGE
GOVERNOR OF
HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
FIRST DEPUTY

JEFFREY T. PEARSON, P.E.
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

July 26, 2018

Mr. Scott Glenn
Office of Environmental Quality Control
State of Hawai'i
235 S. Beretania Street, Room 702
Honolulu, Hawaii 96813

Re: HRS Chapter 343, Final Environmental Assessment, Notice of Determination
Project: Issuance of Commercial Aquarium Permits for the Island of O'ahu
Applicant: Pet Industry Joint Advisory Council (PIJAC)
Applicant Contact: Jim Lynch, KL Gates LLP, 206-370-6587
Approving Agency: Department of Land and Natural Resources
Location: Throughout the nearshore region (to 3 nautical miles from shore) of the island of O'ahu except in those areas already designated as no collection areas such as Marine Life Conservation Districts.
Proposal: Issuance of Commercial Aquarium Permits ensuring lawful, responsible, and sustainable commercial collection of various aquarium fish species from nearshore habitats pursuant to Aquarium Fishing Permits issued under HRS §188-31

Dear Mr. Glenn,

Attached and incorporated by reference is the Final Environmental Assessment prepared by the Applicant for the Project. Based on the significance criteria outlined in Title 11, Chapter 200, Hawaii Administrative Rules, we have determined that the project may have a significant impact on the environment and therefore the preparation of an Environmental Impact Statement is required. Further analysis is necessary on the following significance criteria under HAR §11-200-12 for the issuance of O'ahu aquarium permits:

(1) The take of aquarium fish as an irrevocable commitment to loss or destruction of natural or cultural resources. The take of individual fish itself is loss or destruction of natural resources; the sustainability question is whether the annual take of cumulative numbers of fish as a percentage of estimated population results in irrevocable loss or destruction of populations of fish;

(2) The manner in which the take of aquarium fish curtails the uses of the environment, including aquatic invasive algae control, the tourism industry, and the overall integrity of diverse aquatic ecosystems;

(3) The extent to which the take of aquarium fish conflicts with the state's long-term environmental goals;

(4) The impact of the take of aquarium fish on cultural practices in the state; and

(8) The cumulative effect of the commercial take of aquarium fish using fine mesh nets when combined with the effects of:
(a) the commercial take of aquarium fish by other legal methods;
(b) the take of aquarium fish for recreational purposes; and
(c) the commercial and non-commercial take of aquarium fish species for consumption as food, particularly including Achilles Tang and kole;

It is also necessary to analyze the potential impacts under the no action alternative resulting from non-issuance of aquarium permits, including the increased take of larger, reproductively mature aquarium fish using legal mesh nets.

The FEA identifies the scope of analysis as one year and states that an EA with updated data and analysis would need to be completed on an annual basis. This improperly segments the analysis which must include the long-term and cumulative impacts over time of aquarium collection.

There is no statistical analysis of population growth compared to the life span of each fish and the number of years to and size of first reproduction against which this annual proposed take can be measured for purposes of estimating sustainable take.

With regard to proposed levels of sustainable catch, using "5% to 25%" annual take of estimated populations as proposed in several research papers, we note that 5% to 25% is a wide range, and the precautionary principle calls for applying the lowest estimated percentage of sustainable take in the absence of scientific certainty.

We note also that there are no bag limits for most species, and that the fishery as currently regulated does not limit the number of permits, so that the annual take as a percentage of estimated population could rise significantly. Alternatives of overall annual take limits, a limited entry aquarium fishery program, and restrictions including full moratoria on the take of herbivores, species of special concern, and species evidencing severe population declines have not been proposed or analyzed.

The FEA asserts that certain types of fish such as Flame Wrasse, Psychedelic Wrasse, and Fisher's Angelfish inhabit waters deeper than the CREP monitoring studied, resulting in populations being underestimated and thus the annual take as a percentage of estimated population being overestimated.

In addition, we note the proposed alternatives for reduction in bag limits for Flame Wrasse, but do not see a scientific basis for concluding that the proposed reduction would be sufficient to sustain the population.

We note the proposed alternative for an expansion of the Waikīkī Marine Life Conservation District, but do not see a scientific review of the beneficial impact of Fishery Replenishment Areas on restoring populations, such as has been demonstrated in West Hawaiʻi, nor an analysis of the optimal placement of Fishery Replenishment Areas on Oʻahu to protect and restore populations of aquarium fish.

Cultural impacts of aquarium fishing need significantly more analysis than provided in the FEA. The OEQC guidelines should be followed for assessing cultural impacts, including consulting with traditional cultural practitioners and other knowledgeable informants and sources about cultural resources, cultural practices, and the proposed action's potential impacts. Traditional Hawaiian practices and subsistence uses, local place-based and life-cycle knowledge, and traditional Hawaiian cultural significance of each type of aquarium fish taken should be reviewed. The indirect impact of modern technologies for highly efficient catch methods on traditional harvest capabilities should be included in the analysis.

Enforcement and compliance needs and challenges are key factors in the effectiveness of fisheries management, and should be analyzed as part of the environmental analysis.

We appreciate that as an applicant action, the applicant can propose but not ensure regulations aimed at protecting and restoring populations of aquarium fish. We are interested in proposals for self-regulation by aquarium permit holders which could be incorporated into permit conditions even in the absence of or prior to establishing other regulations to accomplish the same purposes.

Overall, we appreciate that certain alternatives have been proposed, but believe they are more appropriately proposed as mitigation measures in an environmental impact statement to mitigate potential environmental impacts, rather than as alternatives in an environmental assessment which, if implemented, might result in a finding of no significant impact. The Department of Land and Natural Resources is obligated to ensure full analysis under HRS Chapter 343 of potential environmental impacts of its actions in issuing aquarium permits. We believe this is most appropriate in an environmental impact statement.

Based on the significance criteria outlined in Title 11, Chapter 200, Hawaiʻi Administrative Rules, we have determined that the preparation of an Environmental Impact Statement is required.

Please publish this FEA-EISPN in the next issue of the Office of Environmental Quality Control (OEQC) "Environmental Notice". We understand that publication in the Environmental Notice will initiate a 30-day public consultation period for parties to comment on the action and to request to become consulted parties in the preparation of the draft environmental impact statement.

We have enclosed one hard copy of the FEA-EISPN, as well as three Adobe Acrobat PDF copies on compact disc. We have also attached a completed OEQC publication form and Project summary, and we will submit the same publication form and Project summary via electronic mail to your office.

Please contact David Sakoda, State of Hawaii, Department of Land and Natural Resources, Division of Aquatic Resources, at (808)587-0104, david.sakoda@hawaii.gov, with any questions.

Sincerely,

Suzanne D. Case

Suzanne D. Case
Chair
Department of Land and Natural Resources
State of Hawaiʻi

Responses to comments received from the DLNR's Notice of Determination (NOD) on the Final EA
NOD dated July 26, 2018

Comment	Response
Based on the significance criteria outlined in Title 11, Chapter 200, Hawaii Administrative Rules, we have determined that the project may have a significant impact on the environment and therefore the preparation of an Environmental Impact Statement is required. Further analysis is necessary on the following significance criteria under HAR §11- 200-12 for the issuance of O'ahu aquarium permits:	Comment noted. A DEIS has been prepared. Responses to specific significance criteria are included in the DEIS and responded to below.
(1) The take of aquarium fish as an irrevocable commitment to loss or destruction of natural or cultural resources. The take of individual fish itself is loss or destruction of natural resources; the sustainability question is whether the annual take of cumulative numbers of fish as a percentage of estimated population results in irrevocable loss or destruction of populations of fish;	Comment noted. The impacts as they relate to this significance criteria have been summarized in Section 5.6 of the DEIS.
(2) The manner in which the take of aquarium fish curtails the uses of the environment, including aquatic invasive algae control, the tourism industry, and the overall integrity of diverse aquatic ecosystems;	Comment noted. The impacts as they relate to this significance criteria have been summarized in Section 5.6 of the DEIS.
(3) The extent to which the take of aquarium fish conflicts with the state's long-term environmental goals;	Comment noted. The impacts as they relate to this significance criteria have been summarized in Section 5.6 of the DEIS.
(4) The impact of the take of aquarium fish on cultural practices in the state; and	Comment noted. The impacts as they relate to this significance criteria have been summarized in Section 5.6 of the DEIS.
(8) The cumulative effect of the commercial take of aquarium fish using fine mesh nets when combined with the effects of: (a) the commercial take of aquarium fish by other legal methods; (b) the take of aquarium fish for recreational purposes; and (c) the commercial and non-commercial take of aquarium fish species for consumption as food, particularly including Achilles Tang and kole.	Comment noted. The impacts as they relate to this significance criteria have been summarized in Section 5.6 of the DEIS.
It is also necessary to analyze the potential impacts under the no action alternative resulting from non-issuance of aquarium permits, including the increased take of larger, reproductively mature aquarium fish using legal mesh nets.	Comment noted. The impacts of the No Action Alternative in the DEIS include an analysis of data on aquarium fish collection since the October 2017 ban on the use of fine mesh nets. The size class of fish collected cannot be analyzed, as, with only a few exceptions for certain species where fishers classify fish as "small", "medium" or "large", the size of fish collected under CMLs is not required to be reported to the DAR, and thus these data are not available. This language has been included in Section 5.4.2.1 of the EIS.

Responses to comments received from the DLNR’s Notice of Determination (NOD) on the Final EA
NOD dated July 26, 2018

Comment	**Response**
The FEA identifies the scope of analysis as one year and states that an EA with updated data and analysis would need to be completed on an annual basis. This improperly segments the analysis which must include the long-term and cumulative impacts over time of aquarium collection.	Comment noted. The analysis period for the DEIS is five years, and cumulative impacts of commercial aquarium collection are also included in Section 5.4.3.
There is no statistical analysis of population growth compared to the life span of each fish and the number of years to and size of first reproduction against which this annual proposed take can be measured for purposes of estimating sustainable take.	Comment noted. The ecology of each of the 23 species analyzed in the EIS is briefly described in Section 4.4, including information on size and fecundity where available. To the Applicant’s knowledge, this information is not known for all 23 species analyzed. Section 5.4.1.1, under the "Impact of Collection on Overall Fish Populations and Recruitment", discusses the general fecundity information of Hawaiian reef fishes, and why Ochavillo and Hodgson (2006) represents the best available science for establishing a sustainable threshold.
With regard to proposed levels of sustainable catch, using "5% to 25%" annual take of estimated populations as proposed in several research papers, we note that 5% to 25% is a wide range, and the precautionary principle calls for applying the lowest estimated percentage of sustainable take in the absence of scientific certainty.	Comment noted. As summarized in Section 5.5.1, under the Preferred Alternative, collection of 20 of the 22 species with population estimates available would be less than 2.5% of the island-wide populations. For the 2 remaining species with population estimates available (Yellow Tang and Flame Wrasse), collection is below 25%. However, collection of both these species may potentially be even lower due to uncertainty in the population estimates and is anticipated to be less than 1% of the Flame Wrasse population. While collection of the Yellow Tang may be above 5% of the population, this species displays high fecundity, and collection under the Preferred Alternative is a lower impact compared to the No Action Alternative. In addition, the Preferred Alternative has additional benefits over the No Action Alternative, including size limits on the Yellow Tang and bag limits on both the Yellow Tang and Flame Wrasse, as well as other species.

Responses to comments received from the DLNR's Notice of Determination (NOD) on the Final EA
NOD dated July 26, 2018

Comment	Response
We also note that there are no bag limits for most species, and that the fishery as currently regulated does not limit the number of permits, so that the annual take as a percentage of estimated population could rise significantly. Alternatives of overall annual take limits, a limited entry aquarium fishery program, and restrictions including full moratoria on the take of herbivores, species of special concern, and species evidencing severe population declines have not been proposed or analyzed.	Comment noted. The Preferred Alternative in the DEIS includes limited issuance of permits, with the number of permits requested being set at 20 permits per year for the five-year analysis period. In addition, a bag limit for Flame Wrasse is also proposed. Section 3.5 of the EIS addresses alternatives considered but dismissed from further consideration, including a full moratorium, creation of species-specific bag limits, moratorium on herbivores, moratorium on SGCN, and moratorium on species experiencing population declines.
The FEA asserts that certain types of fish such as Flame Wrasse, Psychedelic Wrasse, and Fisher's Angelfish inhabit waters deeper than the CREP monitoring studied, resulting in populations being underestimated and thus the annual take as a percentage of estimated population being overestimated.	Comment noted. Collection of Psychedelic Wrasse and Fisher's Angelfish would be below 0.8% of the island-wide population estimates under any of the alternatives under consideration, which is below the lower end of the 5% to 25% sustainable threshold (Ochavillo and Hodgson 2006). Likely, the populations are even larger than used in our analysis, and thus the impact is even lower. Collection of Flame Wrasse is still below 25% under the Preferred Alternative, yet, as stated in Section 4.4.4.6 of the EIS, the density of Flame Wrasse at 98-132 feet (30-40 meters) on Hawai'i is over 1,000 times greater than the density reported from the CREP surveys on O'ahu (0.002293712 Flame Wrasse per 100 m2). Additionally, the density of Flame Wrasse at 132-164 feet (40-50 meters) is over 900 times greater, and the density below 164 feet (50 meters) is over 100 times greater. Therefore, in all likelihood, the actual population of Flame Wrasse on O'ahu is substantially greater than that reported by the CREP data. Therefore, as concluded in the EIS, the actual collection of Flame Wrasse is likely less than 1% of the population.

Responses to comments received from the DLNR's Notice of Determination (NOD) on the Final EA
NOD dated July 26, 2018

Comment	Response
In addition, we note the proposed alternatives for reduction in bag limits for Flame Wrasse, but do not see a scientific basis for concluding that the proposed reduction would be sufficient to sustain the population.	Comment noted. Section 5.2.1.3 explains why a 60% reduction is expected from implementation of the bag limit for Flame Wrasse. Specifically, since 2012, a total of 15,743 Flame Wrasse have been collected on O'ahu during 625 trips (for the purposes of the EIS, it was assumed that one trip is equal to one day fished under a single permit). This results in an average of 25.2 Flame Wrasse per trip. The 10 individual Flame Wrasse bag limit is an estimated 60% reduction in the number of Flame Wrasse taken by the commercial aquarium fishery on O'ahu. As explained in Section 4.4.4.6 of the EIS, the density of Flame Wrasse at 98-132 feet (30-40 meters) on Hawai'i is over 1,000 times greater than the density reported from the CREP surveys on O'ahu (0.002293712 Flame Wrasse per 100 m2). Additionally, the density of Flame Wrasse at 132-164 feet (40-50 meters) is over 900 times greater, and the density below 164 feet (50 meters) is over 100 times greater. Therefore, in all likelihood, the actual population of Flame Wrasse on O'ahu is substantially greater than that reported by the CREP data. Therefore, collection under any of the alternatives under consideration is likely less than 1% of the island-wide population, and therefore below the lower end of the 5% to 25% sustainable threshold (Ochavillo and Hodgson 2006).
We note the proposed alternative for an expansion of the WaikikI Marine Life Conservation District, but do not see a scientific review of the beneficial impact of Fishery Replenishment Areas on restoring populations, such as has been demonstrated in West Hawai'i, nor an analysis of the optimal placement of Fishery Replenishment Areas on O'ahu to protect and restore populations of aquarium fish.	Comment noted. Section 5.4.1.3 of the EIS includes the following information on direct benefits of the expanded Waikiki MLCD: Friedlander et al. (2007) found that biomass within the existing Waikiki MLCD was 2.5 times higher than adjacent control sites. While the expanded area of the Waikiki MLCD would only be closed to commercial aquarium collection, similar areas in West Hawai'i have shown that fish from protected Fish Replenishment Areas (where only commercial and recreational fishing is banned, and other forms of fishing can continue) will seed unprotected areas (Christie et al. 2010). The use of areas closed to aquarium collection in West Hawai'i was implemented in 1999, and the DAR has determined that it has been "very successful" at driving increased in Yellow Tang populations (the most heavily targeted aquarium fish in West Hawai'i; DAR 2019a). It is assumed that the expanded Waikiki MLCD would have similar benefits as the Fish Replenishment Areas on Hawai'i Island.

Responses to comments received from the DLNR's Notice of Determination (NOD) on the Final EA
NOD dated July 26, 2018

Comment	Response
Cultural impacts of aquarium fishing need significantly more analysis than provided in the FEA. The OEQC guidelines should be followed for assessing cultural impacts, including consulting with traditional cultural practitioners and other knowledgeable informants and sources about cultural resources, cultural practices, and the proposed action's potential impacts. Traditional Hawaiian practices and subsistence uses, local place-based and life-cycle knowledge, and traditional Hawaiian cultural significance of each type of aquarium fish taken should be reviewed. The indirect impact of modem technologies for highly efficient catch methods on traditional harvest capabilities should be included in the analysis.	Comment noted. Cultural impacts are analyzed in depth in the Cultural Impact Assessment (Appendix A of the DEIS) and the DEIS addresses cultural impacts in Section 5.3.
Enforcement and compliance needs and challenges are key factors in the effectiveness of fisheries management, and should be analyzed as part of the environmental analysis.	Comment noted. Information on enforcement and compliance has been included in Section 1.2.5 of the EIS. In addition, a discussion on underreporting and poaching has been added to Section 5.4.3.6 of the FEIS.
We appreciate that as an applicant action, the applicant can propose but not ensure regulations aimed at protecting and restoring populations of aquarium fish. We are interested in proposals for self-regulation by aquarium permit holders which could be incorporated into permit conditions even in the absence of or prior to establishing other regulations to accomplish the same purposes.	Comment noted. As stated by the DLNR, the Applicant cannot ensure enforcement. The Applicant is proposing a limited issuance of permits, creation of a bag limit for the Flame Wrasse, and expansion of the existing Waikiki MLCD. The Applicant can only propose but not ensure regulations; therefore, it is up to the DLNR to make these binding (e.g., changing the law/regulation or including a condition of the permit). Any permit issued would require the permit holder to abide by all conditions of the permit.

Responses to comments received from the DLNR's Notice of Determination (NOD) on the Final EA
NOD dated July 26, 2018

Comment	Response
Overall, we appreciate that certain alternatives have been proposed, but believe they are more appropriately proposed as mitigation measures in an environmental impact statement to mitigate potential environmental impacts, rather than as alternatives in an environmental assessment which, if implemented, might result in a finding of no significant impact. The Department of Land and Natural Resources is obligated to ensure full analysis under HRS Chapter 343 of potential environmental impacts of its actions in issuing aquarium permits. We believe this is most appropriate in an environmental impact statement.	Comment noted. A DEIS has been prepared. Mitigation is discussed in Sections 5.2.4, 5.3.3, and 5.4.4. As noted in Section 5.6, no significant adverse effects would occur as a result of the Preferred Alternative. Therefore, mitigation for impacts is not warranted and no mitigation measures would be implemented. Nevertheless, the Preferred Alternative includes mitigative measures (see Section 5.0) such as a reduction in the number of aquarium permits that would be issued, expanding the existing Waikiki MLCD, and creating a bag limit for the Flame Wrasse, all of which would minimize impacts to biological resources.
Based on the significance criteria outlined in Title 11, Chapter 200, Hawai'i Administrative Rules, we have determined that the preparation of an Environmental Impact Statement is required.	Comment noted. A DEIS has been prepared.

October 16, 2019

Terry VanDeWalle
Stantec Consulting Services Inc.
2300 Swan Lake Boulevard Suite 202
Independence IA 50644-9708

VIA Email: Terry.Vandewall@Stantec.com

RE: Pending Proposed DEIS for the Oahu Aquarium Trade

Mr. VanDeWalle,

As we wrote in our August 30, 2019 letter to you regarding the pending proposed Draft Environmental Impact Statement (DEIS) for the West Hawaii aquarium trade, preliminarily, we must note Stantec's failure to comply with the Hawaii Environmental Policy Act (HEPA) process, including contacting us at the outset of the environmental assessment phase (*see* Haw. Admin. R. § 11-200-9(b), and as formally requested Consulted Parties in this environmental impact study phase (*see* Haw. Admin. R. § 11-200-15(a)). In this case, Stantec contacted us only after we heard through happenstance from the cultural consultant on the West Hawaii Cultural Assessment that Stantec was conducting a DEIS. We learned that the proposed DEIS for Oahu has been ongoing since July, however, it was not until September 16 that you reached out to us for input, but excluded critical details of the proposed DEIS, such as the scope and number of applicants. It was only upon our subsequent explicit request for additional information that we learned Stantec/Pet Industry Joint Advisory Council are now representing 21 Oahu applicants who are seeking aquarium permits. Therefore, by not contacting us early in the process, as required, we were deprived of the opportunity to meaningfully participate in the consultation and decision-making process early on, which is a critical and imperative part of the HEPA process. We expected the Applicant to endeavor to develop a fully acceptable DEIS prior to the time the DEIS is filed with the Hawaii Office of Environmental Quality Control (OEQC) through a full and complete consultation process, rather than relying solely upon environmental review documents to expose environmental concerns. For examples of some of our expectations regarding the consultation process, see page two of our Sept. 7, 2018 comments on the Final Environmental Assessment-Environmental Impact Statement Preparation Notice, as well as the 2012 Guide to the Implementation and Practice of the Hawaii Environmental Policy Act (HEPA Guide), published by the OEQC. Despite our objections, we submit these comments and questions to inform and improve the forthcoming DEIS.

You will see that many of our questions are similar to those we submitted on the pending DEIS for West Hawaii.

The below questions were prompted after recently being made aware of the geographic scope of the forthcoming Oahu DEIS, the preferred alternative referenced in the earlier FEA, to include *"expanding the Waikiki Marine Life Conservation District northward to the southern tip of DAR's Honolulu Harbor Kapalama Canal Fish Management Area. (The current Waikiki MLCD covers approximately 77.3 acres (31.3 hectares). The area proposed in the Preferred Alternative expands this MLCD by 740 acres (299.5 hectares) to 817.3 acres, more than 10.5 times the size of the current Waikiki MLCD. In addition, the current Waikiki MLCD is bordered to its south by the Waikiki-Diamond Head Shoreline Fisheries Management Area (WDHSFMA) covering approximately 239 acres (96.7 hectares),* as well as the DEIS's intent to provide exclusive aquarium collection privileges to 21 individuals, which was not specified in the earlier Draft Environmental Assessments (DEA). Again, some of the Consulted Parties learned of the scope of the proposed DEIS only recently, from other Consulted Parties. Stantec's failure to provide this crucial information to all Consulted Parties limited some of the Consulted Parties' ability to meaningfully comment, and undermines HEPA's notice requirements.

We also continue to await your response to our earlier questions and comments on the proposed DEIS for the West Hawaii aquarium trade and those submitted on the DEA in May 2018 and on the FEA-EISPN in September of 2018 – which are attached in the email and incorporated herein by reference.

Your thorough response to these new and earlier outstanding questions is necessary to inform our response to the pending DEIS, and to ensure that you are thoroughly evaluating the environmental impacts of this proposed action pursuant to HEPA.

Despite our continuing objections, we submit these comments and questions to inform and improve the forthcoming DEIS for the Oahu Aquarium Trade.

> 1. What are the **environmental benefits** of removing tens to hundreds of thousands of animals annually from Oahu's coral reefs for the aquarium trade?
>
> 2. a) Specifically, why is the proposed DEIS limited to Oahu? The Hawaii Dept. of Land and Natural Resources (DLNR) issuance of aquarium collection permits under HRS 188-31.5 applies to collection statewide (including West Hawaii where an additional permit is needed), b) Do the 21 collectors propose to collect only on Oahu? c) How would this be regulated given the existing permitting scheme has no geographic limits?
>
> 3. Recent research into two species of small bodied surgeonfishes, including *kole* which is heavily targeted by the aquarium trade, has determined that populations of these fishes are genetically distinct on each of the main Hawaiian Islands. This means that, for at least these two species, there is little genetic mixing between islands, and once species are depleted on any given island, there is no other source for population replenishment. Further, connectivity and dispersal studies on the island scale for certain species have identified important spawning source areas that are essential for maintaining populations

on other reefs across the island. A summary of this research is attached in the email and incorporated herein by reference.

The currents and conditions that control larval connectivity and dispersal processes are complex. The larvae of some species are able to travel between islands, while others do so to a lesser extent. Regardless of whether larval connectivity exists mainly intra-island or extends inter-island, a depletion of species in important source areas impacts that species in other areas as well. Specifically, what are your plans for ascertaining key spawning source areas for all of the species the applicants intend to take?

4. The Proposed DEIS would provide exclusive take and related privileges to 21 individuals that no other person would otherwise have access to. Given these 21 applicants are requesting special permission to take constitutionally protected public trust resources, the below information is needed to explain how and why these 21 applicants should be granted this exclusive privilege, that would otherwise be denied to others.

a) Please identify the 21 applicants by name and business or trade name (i.e. "Doing Business As").

b) How many reef animals have been taken by the 21 applicants in the past decade (list per year, per species and method of collection) and in what area, and how many are the applicants proposing to take each year for the next decade (list per species and method)?

c) What are the GPS coordinates for the exact sites the 21 applicants propose to operate on?

d) Have any of the applicants been charged with any offense related to the aquarium trade or occurring during the course of aquarium trade activities, or county or state natural resource related offenses? If so, include date, offense and outcome of each offense.

e) What steps will be taken by the 21 applicants to reduce the impacts of climate change, specifically, coral bleaching and ocean temperature rise, which is predicted to occur more frequently and more severely over the next decade, given they will be removing thousands of herbivorous species?

The environmental review must fully disclose the changing baseline from climate change and the effects of the proposed activities on the reef in light of climate change. The Fourth National Climate Assessment, released in late 2018, projects that by 2040 Hawaii's coral reefs will bleach annually which will result in the loss of 71% of the state's current coral reef cover by mid-century, and 99% by 2100. The executive summary of the assessment's chapter related to Hawaii is attached in the email and incorporated herein by reference.

Unprecedented coral bleaching across Hawaii has already occurred: back-to-back years of increased sea temperatures in 2014 and 2015 caused 32% of Oahu's corals to bleach.

5. On August 23, 2019, the DLNR warned of possible severe and widespread coral bleaching across the state within the next two months as the result of sea temperatures that are currently 3 degrees above normal. Real-time reports from across the state indicate that widespread bleaching is occurring. Elevated temperatures are projected to continue at least through the end of October, and the National Oceanic and Atmospheric Administration (NOAA) bleaching alert remains at the highest level, indicating likely coral mortality. This bleaching event will likely be even worse than the one that damaged so many of Hawaii's reefs 4 – 5 years ago. DLNR and NOAA have asked the public to take actions to minimize any additional stress to Hawaii's reefs. Notably, among the actions to be avoided are many that are widespread and/or inherent to the aquarium trade, referenced below.

a) How will the 21 applicants specifically comply with the following recommended actions:

- Reduce or stop taking herbivorous fishes such as surgeonfish which are needed to keep algae growth under control so as not to smother and kill corals stressed from bleaching
- Avoid touching, standing in corals
- Keep vessel anchors and chains off corals

b) Given the extremely limited enforcement resources and capabilities of DLNR, how do they propose to show compliance with the above recommended actions?

6. How do the 21 applicants propose to prevent population reductions of reef species when, outside of the current court order, there are no limits on:

- the issuance of State aquarium collection permits
- the issuance of Commercial Marine Licenses
- caps on the issuance of the above permits or a limited entry program
- the use of certain types of gear that may be detrimental to the environment
- overall take (Total Allowable Catch)
- area/geographical limitations outside of areas already designated as "no take" areas, such as Marine Life Conservation Districts
- collection of species (despite HAR 13-77 Oahu Aquarium Life Management, which in effect, imposes no limits on species or numbers taken to those not in possession of a small mesh net).

7. The DLNR, specifically the Division of Aquatic Resources and their enforcement arm, the Division of Conservation and Resource Enforcement (DOCARE) has severely restricted resources, such as inadequate staff and funding for enforcement, and there are current statutory restrictions on searches of certain containers carrying marine life and certain vessels.

a) How do the 21 applicants propose that enforcement will be achieved on any proposed limits to their activities, including verifiable compliance with current administrative rules, and state and federal laws, including those listed below.

b) How are the 21 applicants currently complying with the following?

- Federal Lacey Act requirements USC Title 16
- Hawaii Misdemeanor Cruelty to Animals statute HRS 711-1109

8. The commercial aquarium trade has long operated with fewer regulations, oversight and compliance-verification mechanisms than those that commercial food fisheries must adhere to. Further, while the issuance of aquarium collection permits is discretionary, and subjects the permit holder to certain legal obligations, including inspection of facilities holding marine life, many of these regulations have not been actively enforced. For clarification, do the 21 applicants cooperate and comply with the following:

- provide open and immediate access to coolers, containers, vessels and other aquarium related gear, equipment and holding facilities upon request of a DLNR DOCARE Officer, as per the conditions of their permits?
- allow observers on their vessels with/without notice?

9. The earlier DEAs for the aquarium trade failed to include data and records which are not readily accessible to the public and other interested parties. Please provide the necessary data and response to the following to address our outstanding concerns with enforceability of the above-referenced laws specifically as it relates to animal health, welfare and mortality rates:

Hundreds of thousands of fish and invertebrates have been taken by the aquarium trade from Oahu reefs since the Supreme Court opinion and subsequent District Court orders were issued in September and October of 2017 which prohibited the use of fine mesh nets (nets with a mesh less than 2 inches). Ninety plus percent of fish catch prior to the court ruling involved the use of fine mesh nets.

a) Please explain in detail the gear and method(s) of collection currently (October 2017 to present) used by each of the 21 applicants and for what species. If the 21 collectors did NOT collect during this period please provide that information as well.

b) For the 21 applicants please provide:
- the numbers of fish/animals that were shipped out of Hawaii by each applicant per month since October 2017 to the present; and
- specifically, where these fish/animals were shipped to (e.g., interstate or international); and
- the mortality rates for each shipment (a) upon arrival and (b) at 14 days post-shipment; and

- what percentage of animals remain in Hawaii (for resale) versus those who are shipped 1) to the US mainland and 2) international;

c) For each of the 21 applicants please note whether the collector is also a dealer. If the collector is not a dealer, provide who the collector sells their catch to;

d) For each of the 21 applicants, please note which collectors engage in the following practices in contradiction to HRS 711-1109:

- withholding of food (starvation) and for what period of time;
- fizzing or puncturing of the swim bladder;
- cutting of spines or dorsal fins;
- body compression (squeezing animal to force out ejection of fecal matter).

10. Lastly, we echo the following issues raised by DLNR in the Oahu FEA that still await your response:

a) "It is necessary to analyze the potential impacts under the no action alternative resulting from non-issuance of aquarium permits, including the increased take of larger, reproductively mature aquarium fish using legal mesh nets."

- We add the need to also analyze the continued take of large numbers of small juvenile fish

b) "The FEA identifies the scope of analysis as one year and states that an EA with updated data and analysis would need to be completed on an annual basis. This improperly segments the analysis which must include the long-term and cumulative impacts over time of aquarium collection."

- We add that the scope of analysis, limited here to Oahu and separately to West Hawaii, also improperly segments the analysis to permits that are currently issued on a statewide basis (e.g. there is nothing stopping any of the 21 permittees from also operating on reefs on any/all of the other islands).

c) "There is no statistical analysis of population growth compared to the life span of each fish and the number of years to and size of first reproduction against which this annual proposed take can be measured for purposes of estimating sustainable take."

d) "With regard to proposed levels of sustainable catch, using "5% to 25%" annual take of estimated populations as proposed in several research papers, we note that 5% to 25% is a wide range, and the precautionary principle calls for applying the lowest estimated percentage of sustainable take in the absence of scientific certainty. We note also that there are no bag limits for most species, and that the fishery as currently regulated does not limit the number of permits, so that the annual take as a percentage of estimated population could rise significantly.”

e) “Alternatives of overall annual take limits, a limited entry aquarium fishery program, and restrictions including full moratoria on the take of herbivores, species of special concern, and species evidencing severe population declines have not been proposed or analyzed.”

f) “The alternatives propose reduction in bag limits for flame wrasse, but there is not a scientific basis for concluding that the proposed reduction would be sufficient to sustain the population.”

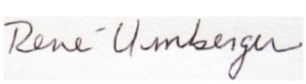
g) “The alternatives propose an expansion of the Waikiki Marine Life Conservation District, but do not include a scientific review of the beneficial impacts of Fishery Replenishment Areas on restoring populations, such as has been demonstrated in West Hawai'i, nor an analysis of the optimal placement of Fishery Replenishment Areas on Oahu to protect and restore populations of aquarium fish.”

h) “As noted earlier, enforcement and compliance needs and challenges are key factors in the effectiveness of fisheries management and should be analyzed as part of the environmental analysis.”

In conclusion, we emphasize that the environmental review must address every phase and aspect of the proposed action to determine the “overall and cumulative effects of an action,” Haw. Admin. R. § 11-200-12(a), which may include “ecological effects (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic effects, [] cultural effects, [and] economic effects . . . whether primary, secondary, or cumulative;” and, which do include animal *communities* per the definition of “environment”. Haw. Admin. R. § 11-200-2. It is vitally important that the environmental review provide a comprehensive analysis of the environmental and cultural effects of the proposed action. These effects combined with the cumulative effects should be fully mitigated or the actions should not be approved.

We also reiterate that thorough answers to the questions posed here, as well as thorough responses to our earlier comments specific to the proposed DEIS for West Hawaii, are necessary in order for us to adequately provide consultation on this matter.

Thank you,



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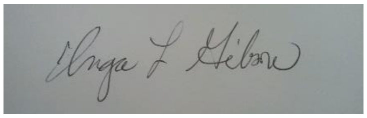

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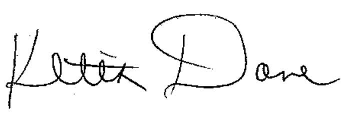

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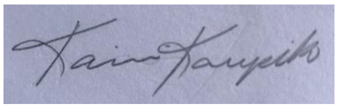

Kaimi Kaupiko
Executive Director
Kalanihale Miloli’i

Wilfred Kaupiko
Milolii Village

Responses to comments received from For the Fishes/ Pono Advocacy LLC/The Humane Society of the United States/Center for Biological Diversity/Moana Ohana/ Kalanihale Miloli'i/Milolii Village
Comment dated October 16, 2019

Comment	Response
As we wrote in our August 30, 2019 letter to you regarding the pending proposed Draft Environmental Impact Statement (DEIS) for the West Hawaii aquarium trade, preliminarily, we must note Stantec's failure to comply with the Hawaii Environmental Policy Act (HEPA) process, including contacting us at the outset of the environmental assessment phase (see Haw. Admin. R. § 11-200-9(b), and as formally requested Consulted Parties in this environmental impact study phase (see Haw. Admin. R. § 11-200-15(a)). Stantec contacted us only after we heard through happenstance from the cultural consultant on the West Hawaii Cultural Assessment that Stantec was conducting a DEIS. We learned that the proposed DEIS for Oahu has been ongoing since July, however, it was not until September 16 that you reached out to us for input, but excluded critical details of the proposed DEIS, such as the scope and number of applicants. It was only upon our subsequent explicit request for additional information that we learned Stantec/Pet Industry Joint Advisory Council are now representing 21 Oahu applicants who are seeking aquarium permits. Therefore, by not contacting us early in the process, as required, we were deprived of the opportunity to meaningfully participate in the consultation and decision-making process early on, which is a critical and imperative part of the HEPA process. We expected the Applicant to endeavor to develop a fully acceptable EIS prior to the time the DEIS is filed with the Hawaii Office of Environmental Quality Control (OEQC) through a full and complete consultation process, rather than relying solely upon environmental review documents to expose environmental concerns. For examples of some of our expectations regarding the consultation process, see page two of our Sept. 7, 2018 comments on the Final Environmental Assessment-Environmental Impact Statement Preparation Notice, as well as the 2012 Guide to the Implementation and Practice of the Hawaii Environmental Policy Act (HEPA Guide), published by the OEQC. Despite our objections, we submit these comments and questions to inform and improve the forthcoming DEIS. You will see that many of our questions are similar to those we submitted on the pending DEIS for West Hawaii. The below questions were prompted after recently being made aware of the geographic scope of the forthcoming Oahu DEIS, the preferred alternative referenced in the earlier FEA, to include *"expanding the Waikiki Marine Life Conservation District northward to the southern tip of DAR's Honolulu Harbor Kapalama Canal Fish Management Area. (The current Waikiki MLCD covers approximately 77.3 acres (31.3 hectares). The area proposed in the Preferred Alternative expands this MLCD by 740 acres (299.5 hectares) to 817.3 acres, more than 10.5 times the size of the current Waikiki MLCD. In addition, the current Waikiki MLCD is bordered to its south by the Waikiki-Diamond Head Shoreline Fisheries Management Area (WDHSFMA) covering approximately 239 acres (96.7 hectares),* as well as the DEIS's intent to provide exclusive aquarium collection privileges to 21 individuals, which was not specified in the earlier Draft Environmental Assessments (DEA). Again, some of the Consulted Parties learned of the scope of the proposed DEIS only recently, from other Consulted Parties. Stantec's failure to provide this crucial information to all Consulted Parties	Comment noted. The commenters were included in the consultation process for the DEIS, as described in Section 6.0.

Responses to comments received from For the Fishes/ Pono Advocacy LLC/The Humane Society of the United States/Center for Biological Diversity/Moana Ohana/ Kalanihale Miloli'i/Milolii Village
Comment dated October 16, 2019

Comment	Response
limited some of the Consulted Parties' ability to meaningfully comment, and undermines HEPA's notice requirements.	
We also continue to await your response to our earlier questions and comments on the proposed DEIS for the West Hawaii aquarium trade and those submitted on the DEA in May 2018 and on the FEA-EISPN in September of 2018 – which are attached in the email and incorporated herein by reference. Your thorough response to these new and earlier outstanding questions is necessary to inform our response to the pending DEIS, and to ensure that you are thoroughly evaluating the environmental impacts of this proposed action pursuant to HEPA.	Comment noted. The responses to comments on the West Hawai'i comment period were included in that DEIS, and responses to comments on the DEIS were published in the FEIS. The Hawai'i DEIS can be found online here: http://oeqc2.doh.hawaii.gov/EA_EIS_Library/2019-11-23-HA-DEIS-Hawaii-Island-Commercial-Aquarium-Permits.pdf And the FEIS can be found online here: http://oeqc2.doh.hawaii.gov/_layouts/15/start.aspx#/The_Environmental_Notice/Forms/AllItems.aspx The responses to the comments on the O'ahu DEA were included in the publication of the FEA and are not repeated here. They can be found online here: http://oeqc2.doh.hawaii.gov/EA_EIS_Library/2018-08-08-HA-FEA-EISPN-Hawaii-Island-Commercial-Aquarium-Permits.pdf The comments and responses on the O'ahu FEA are included in this Appendix.
What are the environmental benefits of removing tens to hundreds of thousands of animals annually from Oahu's coral reefs for the aquarium trade?	Comment noted. The environmental impacts of commercial aquarium collection in Oahu are evaluated in the DEIS in Section 5.0.
Why is the proposed DEIS limited to Oahu? The Hawaii Dept. of Land and Natural Resources (DLNR) issuance of aquarium collection permits under HRS 188-31.5 applies to collection statewide (including West Hawaii where an additional permit is needed), b) Do the 21 collectors propose to collect only on Oahu? c) How would this be regulated given the existing permitting scheme has no geographic limits?	Comment noted. As stated in Section 3.0, it is assumed for all alternatives that a permit condition would be added to each permit limiting the geographic area covered by the permit to the island of O'ahu.
Recent research into two species of small bodied surgeonfishes, including *kole* which is heavily targeted by the aquarium trade, has determined that populations of these fishes are genetically distinct on each of the main Hawaiian Islands. This means that, for at least these two species, there is little genetic mixing between islands, and once species are depleted on any given island, there is no other source for population replenishment. Further, connectivity and dispersal studies on the island scale for certain species have identified important spawning source areas that are essential for maintaining populations on other reefs across the island. A summary of this research is attached in the email and incorporated herein by reference. The currents and conditions that control larval connectivity and dispersal processes are complex. The larvae of some species are able to travel between islands, while others do so to a lesser extent. Regardless of whether larval connectivity exists mainly intra-island or extends inter-island, a depletion of species in important source areas impacts that species in other areas as well. Specifically, what are your plans for ascertaining key spawning source areas for all of the species the applicants intend to take?	Comment noted. For this reason, the EIS analyzes impacts at the island level (based on island-wide population estimates).

Responses to comments received from For the Fishes/ Pono Advocacy LLC/The Humane Society of the United States/Center for Biological Diversity/Moana Ohana/ Kalanihale Miloli'i/Milolii Village
Comment dated October 16, 2019

Comment	**Response**
Please identify the 21 applicants by name and business or trade name (i.e. "Doing Business As").	Comment noted. The Applicant is thePet Industry Joint Advisory Council (PIJAC).
How many reef animals have been taken by the 21 applicants in the past decade (list per year, per species and method of collection) and in what area, and how many are the applicants proposing to take each year for the next decade (list per species and method)?	Comment noted. The average and maximum collection by species of the 20 fishers is included in Table 5-4 and in Section 5-4 for the four species not included in the table. It should be noted that these fishers waived their right to confidentiality, and as such, this includes all their collected numbers from 2000 through 2017 (no data are excluded due to Hawai'i confidentiality laws). The collection numbers are limited to O'ahu for the analysis. It is assumed for the environmental consequences that the collection rates seen over the past 18 years will remain relatively the same over the 5-year analysis period, though the maximum collection is also included in the analysis. Collection would occur via fine mesh nets or other legal methods.
What are the GPS coordinates for the exact sites the 21 applicants propose to operate on?	Comment noted. The collection areas are shown on Figure 1, and the expanded Waikiki MLCD (where no collection would occur under the Preferred Alternative) is shown on Figure 2.
Have any of the applicants been charged with any offense related to the aquarium trade or occurring during the course of aquarium trade activities, or county or state natural resource related offenses? If so, include date, offense and outcome of each offense.	Comment noted. We do not possess this information. Enforcement and information concerning it is within the purview of the State of Hawaii. A section on enforcement and compliance is included in Section 1.2.5.

Responses to comments received from For the Fishes/ Pono Advocacy LLC/The Humane Society of the United States/Center for Biological Diversity/Moana Ohana/ Kalanihale Miloli'i/Milolii Village
Comment dated October 16, 2019

Comment	**Response**
What steps will be taken by the 21 applicants to reduce the impacts of climate change, specifically, coral bleaching and ocean temperature rise, which is predicted to occur more frequently and more severely over the next decade, given they will be removing thousands of herbivorous species? The environmental review must fully disclose the changing baseline from climate change and the effects of the proposed activities on the reef in light of climate change. The Fourth National Climate Assessment, released in late 2018, projects that by 2040 Hawaii's coral reefs will bleach annually which will result in the loss of 71% of the state's current coral reef cover by mid-century, and 99% by 2100. The executive summary of the assessment's chapter related to Hawaii is attached in the email and incorporated herein by reference. Unprecedented coral bleaching across Hawaii has already occurred: back-to-back years of increased sea temperatures in 2014 and 2015 caused 32% of Oahu's corals to bleach. On August 23, 2019, the DLNR warned of possible severe and widespread coral bleaching across the state within the next two months as the result of sea temperatures that are currently 3 degrees above normal. Real-time reports from across the state indicate that widespread bleaching is occurring. Elevated temperatures are projected to continue at least through the end of October, and the National Oceanic and Atmospheric Administration (NOAA) bleaching alert remains at the highest level, indicating likely coral mortality. This bleaching event will likely be even worse than the one that damaged so many of Hawaii's reefs 4 – 5 years ago. DLNR and NOAA have asked the public to take actions to minimize any additional stress to Hawaii's reefs. Notably, among the actions to be avoided are many that are widespread and/or inherent to the aquarium trade, referenced below.	Comment noted. There is no evidence that suggests that commercial aquarium collection is a major contributor to climate change, including coral bleaching or ocean temperature rise, though these impacts are included in the cumulative impacts analysis in the DEIS. As stated in Section 5.4, no impacts on populations of herbivores are anticipated. Tissot and Hallacher (2003) concluded that there were no significant differences in damaged coral between control and collected sites (i.e., sites where aquarium collection occurs) to indicate the presence of destructive fishing practices. In addition, they found no increases in the abundance of macroalgae where the abundance of herbivores was reduced by aquarium collecting. The DAR (2019) concluded that commercial aquarium collecting is not having any measurable negative impact on percent coral cover or change in coral cover over time.
How will the 21 applicants specifically comply with the following recommended actions: Reduce or stop taking herbivorous fishes such as surgeonfish which are needed to keep algae growth under control so as not to smother and kill corals stressed from bleaching; avoid touching, standing in corals; keep vessel anchors and chains off corals	Comment noted. Section 5.4 of the DEIS evaluates the impacts of the alternatives on herbivores and coral reefs. As stated in Section 5.4, no impacts on populations of herbivores are anticipated. Tissot and Hallacher (2003) concluded that there were no significant differences in damaged coral between control and collected sites (i.e., sites where aquarium collection occurs) to indicate the presence of destructive fishing practices. In addition, they found no increases in the abundance of macroalgae where the abundance of herbivores was reduced by aquarium collecting. The DAR (2019) concluded that commercial aquarium collecting is not having any measurable negative impact on percent coral cover or change in coral cover over time.
Given the extremely limited enforcement resources and capabilities of DLNR, how do they propose to show compliance with the above recommended actions?	Comment noted. Section 1.2.5 of the EIS includes information on enforcement and compliance.

Responses to comments received from For the Fishes/ Pono Advocacy LLC/The Humane Society of the United States/Center for Biological Diversity/Moana Ohana/ Kalanihale Miloli'i/Milolii Village
Comment dated October 16, 2019

Comment	Response
How do the 21 applicants propose to prevent population reductions of reef species when, outside of the current court order, there are no limits on: the issuance of State aquarium collection permits; the issuance of Commercial Marine Licenses; caps on the issuance of the above permits or a limited entry program; the use of certain types of gear that may be detrimental to the environment; overall take (Total Allowable Catch); area/geographical limitations outside of areas already designated as "no take" areas, such as Marine Life Conservation Districts; collection of species (despite HAR 13-77 Oahu Aquarium Life Management, which in effect, imposes no limits on species or numbers taken to those not in possession of a small mesh net).	Comment noted. The Preferred Alternative in the DEIS limits the issuance of commercial aquarium permits to 20 fishers, and limits the permits geographically to O'ahu, eliminating some of the uncertainty inherent with an unlimited issuance of permits (as was previously done and analyzed in the DEIS). Existing bag limits would remain in effect, and the Preferred Alternative includes an additional bag limit for the Flame Wrasse and an expansion of the Waikiki MLCD. As evaluated in Section 5.0 of the DEIS, based on the low percentage of the overall populations collected annually by commercial aquarium fishers, which is spread throughout the year and across multiple areas, as well as the targeted collection of smaller, less fecund individuals, commercial aquarium collection would have a less than significant direct impact on reef fish populations.
The DLNR, specifically the Division of Aquatic Resources DAR and their enforcement arm, the Division of Conservation and Resource Enforcement (DOCARE) has severely restricted resources, such as inadequate staff and funding for enforcement, and there are current statutory restrictions on searches of certain containers carrying marine life and certain vessels. How do the 21 applicants propose that enforcement will be achieved on any proposed limits to their activities, including verifiable compliance with current administrative rules, and state and federal laws, including those listed below. How are the 14 applicants currently complying with the following? Federal Lacey Act requirements USC Title 16; Hawaii Misdemeanor Cruelty to Animals statute HRS 711-1109	Comment noted. Enforcement is within the purview of the State of Hawaii. Section 1.2.5 of the EIS includes information on enforcement and compliance.
The commercial aquarium trade has long operated with fewer regulations, oversight and compliance-verification mechanisms than those that commercial food fisheries must adhere to. Further, while the issuance of aquarium collection permits is discretionary, and subjects the permit holder to certain legal obligations, including inspection of facilities holding marine life, many of these regulations have not been actively enforced. For clarification, do the 21 applicants cooperate and comply with the following: provide open and immediate access to coolers, containers, vessels and other aquarium related gear, equipment and holding facilities upon request of a DLNR DOCARE Officer, as per the conditions of their permits?; allow observers on their vessels with/without notice?	Comment noted. Permit holders must comply with law. Enforcement is within the purview of the State of Hawaii. Section 1.2.5 of the EIS includes information on enforcement and compliance.

Responses to comments received from For the Fishes/ Pono Advocacy LLC/The Humane Society of the United States/Center for Biological Diversity/Moana Ohana/ Kalanihale Miloli'i/Milolii Village
Comment dated October 16, 2019

Comment	Response
The earlier DEAs for the aquarium trade failed to include data and records which are not readily accessible to the public and other interested parties. Please provide the necessary data and response to the following to address our outstanding concerns with enforceability of the above-referenced laws specifically as it relates to animal health, welfare and mortality rates: Hundreds of thousands of fish and invertecrates have been taken by the aquarium trade from Oahu reefs since the Supreme Court opinion and subsequent District Court orders were issued in September and October of 2017 which prohibited the use of fine mesh nets (nets with a mesh less than 2 inch). Ninety plus percent of catch prior to the court ruling involved the use of fine mesh nets. Please explain in detail the gear and method(s) of collection currently (October 2017 to present) used by each of the 21 applicants and for what species. If the 21 collectors did NOT collect during this period please provide that information as well.	Comment noted. Data on collection numbers is available via the DAR. Per the DAR, in lieu of fine mesh nets, other gear types that were previously allowed are still legal to use outside the WHRFMA. See the following for more details: https://dlnr.hawaii.gov/dar/files/2017/11/aquarium_permit_faq_rev4.pdf Therefore, collection has continued to occur without fine mesh nets, and the 2018 collection numbers are presented in Table 5-2 of the DEIS.
For the 21 applicants please provide: the numbers of fish/animals that were shipped out of Hawaii by each applicant per month since October 2017 to the present and; specifically where these fish/animals were shipped to (e.g., interstate or international) and; the mortality rates for each shipment (a) upon arrival and (b) at 14 days post-shipment; what percentage of animals remain in Hawaii (for resale) versus those who are shipped 1) to the US mainland and 2) international;	Comment noted. Available collection data is provided in the DEIS from 2018 (when collection was conducted without the use of fine mesh nets).
For each of the 21 applicants please note whether the collector is also a dealer. If the collector is not a dealer, provide who the collector sells their catch to;	Comment noted. This information is not available. Available information is presented in the DEIS.
For each of the 21 applicants, please note which collectors engage in the following practices in contradiction to HRS 711-1109: withholding of food (starvation) and for what period of time; fizzing or puncturing of the swim bladder; cutting of spines or dorsal fins; body compression (squeezing animal to force out ejection of fecal matter).	Comment noted. Permit holders must comply with law. Enforcement is within the purview of the State of Hawaii. Section 1.2.5 of the EIS includes information on enforcement and compliance.

Responses to comments received from For the Fishes/ Pono Advocacy LLC/The Humane Society of the United States/Center for Biological Diversity/Moana Ohana/ Kalanihale Miloli'i/Milolii Village
Comment dated October 16, 2019

Comment	**Response**
Lastly, we echo the following issues raised by DLNR in the Oahu FEA that still await your response: "It is necessary to analyze the potential impacts under the no action alternative resulting from non-issuance of aquarium permits, including the increased take of larger, reproductively mature aquarium fish using legal mesh nets." We add the need to also analyze the continued take of large numbers of small juvenile fish	Comment noted. The impacts of the No Action Alternative in the DEIS include an analysis of data on aquarium fish collection since the October 2017 ban on the use of fine mesh nets. The size class of fish collected cannot be analyzed, as, with only a few exceptions for certain species where fishers classify fish as "small", "medium" or "large", the size of fish collected under CMLs is not required to be reported to the DAR, and thus these data are not available. This language has been included in Section 5.4.2.1 of the EIS.
"The FEA identifies the scope of analysis as one year and states that an EA with updated data and analysis would need to be completed on an annual basis. This improperly segments the analysis which must include the long-term and cumulative impacts over time of aquarium collection." We add that the scope of analysis, limited here to Oahu and separately to West Hawaii, also improperly segments the analysis to permits that are currently issued on a statewide basis (e.g. there is nothing stopping any of the 21 permittees from also operating on reefs on any/all of the other islands).	Comment noted. The analysis period for the DEIS is five years, and cumulative impacts of commercial aquarium collection are also included in Section 5.4.3. The EIS includes the assumption that a permit condition would be added to all permits issued (under any alternative) limiting their geographic scope to the island of O'ahu. Therefore, analyzing O'ahu and West Hawai'i separately is not improperly segmenting the analysis. In addition, there is evidence provided in the EIS for barriers to dispersal between islands, and genetic breaks that restrict gene flow between islands. This fact was also noted by the commenter earlier in this comment.
"There is no statistical analysis of population growth compared to the life span of each fish and the number of years to and size of first reproduction against which this annual proposed take can be measured for purposes of estimating sustainable take."	Comment noted. The ecology of each of the 23 species analyzed in the EIS is briefly described in Section 4.4, including information on size and fecundity where available. To the Applicant's knowledge, this information is not known for all 23 species analyzed. Section 5.4.1.1, under the "Impact of Collection on Overall Fish Populations and Recruitment", discusses the general fecundity information of Hawaiian reef fishes, and why Ochavillo and Hodgson (2006) represents the best available science for establishing a sustainable threshold.
"With regard to proposed levels of sustainable catch, using "5% to 25%" annual take of estimated populations as proposed in several research papers, we note that 5% to 25% is a wide range, and the precautionary principle calls for applying the lowest estimated percentage of sustainable take in the absence of scientific certainty. We note also that there are no bag limits for most species, and that the fishery as currently regulated does not limit the number of permits, so that the annual take as a percentage of estimated population could rise significantly."	Comment noted. As summarized in Section 5.5.1, under the Preferred Alternative, collection of 20 of the 22 species with population estimates available would be less than 2.5% of the island-wide populations. For the 2 remaining species with population estimates available (Yellow Tang and Flame Wrasse), collection is below 25%. However, collection of both these species may potentially be even lower due to uncertainty in the population estimates and is anticipated to be less than 1% of the Flame Wrasse population. While collection of the Yellow Tang may be above 5% of the population, this species displays high fecundity, and collection under the Preferred Alternative is a lower impact compared to the No Action Alternative. In addition, the Preferred Alternative has additional benefits over the No Action Alternative, including size limits on the Yellow Tang and bag limits on both the Yellow Tang and Flame Wrasse, as well as other species.

Responses to comments received from For the Fishes/ Pono Advocacy LLC/The Humane Society of the United States/Center for Biological Diversity/Moana Ohana/ Kalanihale Miloli'i/Milolii Village
Comment dated October 16, 2019

Comment	Response
"Alternatives of overall annual take limits, a limited entry aquarium fishery program, and restrictions including full moratoria on the take of herbivores, species of special concern, and species evidencing severe population declines have not been proposed or analyzed."	Comment noted. The Preferred Alternative in the DEIS includes limited issuance of permits, with the number of permits requested being set at 20 permits per year for the five-year analysis period. In addition, a bag limit for Flame Wrasse is also proposed. Section 3.5 of the EIS addresses alternatives considered but dismissed from further consideration, including a full moratorium, creation of species-specific bag limits, moratorium on herbivores, moratorium on SGCN, and moratorium on species experiencing population declines.
"The alternatives propose reduction in bag limits for flame wrasse, but there is not a scientific basis for concluding that the proposed reduction would be sufficient to sustain the population."	Comment noted. Section 5.2.1.3 explains why a 60% reduction is expected from implementation of the bag limit for Flame Wrasse. Specifically, since 2012, a total of 15,743 Flame Wrasse have been collected on O'ahu during 625 trips (for the purposes of the EIS, it was assumed that one trip is equal to one day fished under a single permit). This results in an average of 25.2 Flame Wrasse per trip. The 10 individual Flame Wrasse bag limit is an estimated 60% reduction in the number of Flame Wrasse taken by the commercial aquarium fishery on O'ahu. As explained in Section 4.4.4.6 of the EIS, the density of Flame Wrasse at 98-132 feet (30-40 meters) on Hawai'i is over 1,000 times greater than the density reported from the CREP surveys on O'ahu (0.002293712 Flame Wrasse per 100 m2). Additionally, the density of Flame Wrasse at 132-164 feet (40-50 meters) is over 900 times greater, and the density below 164 feet (50 meters) is over 100 times greater. Therefore, in all likelihood, the actual population of Flame Wrasse on O'ahu is substantially greater than that reported by the CREP data. Therefore, collection under any of the alternatives under consideration is likely less than 1% of the island-wide population, and therefore below the lower end of the 5% to 25% sustainable threshold (Ochavillo and Hodgson 2006).
"The alternatives propose an expansion of the Waikiki Marine Life Conservation District, but do not include a scientific review of the beneficial impacts of Fishery Replenishment Areas on restoring populations, such as has been demonstrated in West Hawai'i, nor an analysis of the optimal placement of Fishery Replenishment Areas on Oahu to protect and restore populations of aquarium fish."	Comment noted. Section 5.4.1.3 of the EIS includes the following information on direct benefits of the expanded Waikiki MLCD: Friedlander et al. (2007) found that biomass within the existing Waikiki MLCD was 2.5 times higher than adjacent control sites. While the expanded area of the Waikiki MLCD would only be closed to commercial aquarium collection, similar areas in West Hawai'i have shown that fish from protected Fish Replenishment Areas (where only commercial and recreational fishing is banned, and other forms of fishing can continue) will seed unprotected areas (Christie et al. 2010). The use of areas closed to aquarium collection in West Hawai'i was implemented in 1999, and the DAR has determined that it has been "very successful" at driving increased in Yellow Tang populations (the most heavily targeted aquarium fish in West Hawai'i; DAR 2019a).
"As noted earlier, enforcement and compliance needs and challenges are key factors in the effectiveness of fisheries management and should be analyzed as part of the environmental analysis."	Comment noted. Information on enforcement and compliance has been included in Section 1.2.5 of the EIS. In addition, a discussion on underreporting and poaching has been added to Section 5.4.3.6 of the FEIS.

Responses to comments received from For the Fishes/ Pono Advocacy LLC/The Humane Society of the United States/Center for Biological Diversity/Moana Ohana/ Kalanihale Miloli'i/Milolii Village
Comment dated October 16, 2019

Comment	**Response**
In conclusion, we emphasize that the environmental review must address every phase and aspect of the proposed action to determine the "overall and cumulative effects of an action," Haw. Admin. R. § 11-200-12(a), which may include "ecological effects (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic effects, [] cultural effects, [and] economic effects . . . whether primary, secondary, or cumulative;" and, which do include animal *communities* per the definition of "environment". Haw. Admin. R. § 11-200-2. It is vitally important that the environmental review provide a comprehensive analysis of the environmental and cultural effects of the proposed action. These effects combined with the cumulative effects should be fully mitigated or the actions should not be approved. We also reiterate that thorough answers to the questions posed here, as well as thorough responses to our earlier comments specific to the proposed DEIS for West Hawaii, are necessary in order for us to adequately provide consultation on this matter.	Comment noted. The direct, indirect, and cumulative impacts of the Proposed Action are analyzed in the DEIS in Section 5.0. Responses to all comments are provided in Appendix B of the DEIS. Responses to comments on the West Hawai'i documents can be found online at http://oeqc2.doh.hawaii.gov/EA_EIS_Library/2019-11-23-HA-DEIS-Hawaii-Island-Commercial-Aquarium-Permits.pdf And: http://oeqc2.doh.hawaii.gov/_layouts/15/start.aspx#/The_Environmental_Notice/Forms/AllItems.aspx

Additional Comments Received on the FEA EISPN

MS. JOJO TANIMOTO
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SEPTEMBER 1, 2018

RE: OPPOSITION TO THE AQUARIUM COMMERCIAL FISHING PERMIT-ENVIRONMENTAL ASSESSMENT (EA).

Dear Sirs:

I am a member of the Hawaii Island Aha Moku Council. I would like to offer my views and perceptions.

In 2012, the Hawaii State Legislature approved ACT 288, which created the Aha Moku Advisory Council (AMAC). This division is located within the Dept. Of Land and Natural Resources (DLNR). The AMAC is support by an island Council; the Hawaii Island Aha Moku Council (AMIC) has members from six traditional District boundaries (Moku)-Kohala, Kona, Ka‘u, Puna, Hilo, ad Hamakua. The EA does not recognize the efforts of the AMAC nor the AMIC; which reflect incorrectly the sentiments of those ahupua‘a communities.

Hawaii Constitution recognizes two languages: English and Hawaiian. This document heavily relies on the “White List” of fish species. However, this document provides only the scientific and common names of these fishes. The communities and fishing enthusiasts recognize the Hawaiian names of these fishes. This action dis-enfranchises many who are interested parties from participating in this process.

The National Park Service has provided much assistance to the communities by protecting, preserving and restoring the Ala Kahakai Trail system. These historic trails provided important access to the shoreline to engage in fishing activities. Restoration of these trails in current terms once again provide access to the shoreline. This data and the Trail system are missing.

Much is written about the West Hawaii Regional Fishing Management Areas (WHRFMA) and the on-going works of the West Hawaii Fishery Council (WHFC) with regard to sanctuary areas. A) DLNR has yet to research the impacts to neighboring communities in terms of the fishing communities who moved to new grounds to collect fish. This new data is essential in calculating whether fish population can sustain collection for aquarium uses. B) This new data should d determine whether more Kapu regulations are needed, and in what locations.

DLNR also needs to review some of the Policies in place, to recognize the change in methodology for catching fish species. There is little change in protecting and preserving fish habitats from lack of buoys. However, comments to protecting and preserving historic sites (fish koʻa and fish spawning areas) are also lacking in this document.

There is a need for added enforcement personnel for the increased volume of Permits and fish takes. This document offers no address to the issue.

The Aha Moku recognizes that land pollution is a major problem in keeping the fish population in ancestral locations. Rain storms create erosion, cesspools in Naʻalehu and Puako are recognized by the County Environmental Divisions. There are non-descript address to this added conflict of travelling vessels vs shoreline collection, in this document.

Thank you for the opportunity to provide comment. I and the Aha Moku await your reply.

Mahalo

Ms. Jojo Tanimoto
Aha Moku Island Council, Vice-Chairperson

Responses to comments received from Jojo Tanimoto, Aha Moku Island Council
Comment dated September 1, 2018

Comment	**Response**
In 2012, the Hawaii State Legislature approved ACT 288, which created the Aha Moku Advisory Council (AMAC). This division is located within the Dept. Of Land and Natural Resources (DLNR). The AMAC is support by an island Council; the Hawaii Island Aha Moku Council (AMIC) has members from six traditional District boundaries (Moku)-Kohala, Kona, Kaʻu, Puna, Hilo, ad Hamakua. The EA does not recognize the efforts of the AMAC nor the AMIC; which reflect incorrectly the sentiments of those ahupuaʻa communities.	Comment noted. A member of this group (Rocky Kaluhiwa, the O'ahu committee member) was contacted as part of the Cultural Impact Assessment, though no response was received (Appendix A of the DEIS).
Hawaii Constitution recognizes two languages: English and Hawaiian. This document heavily relies on the "White List" of fish species. However, this document provides only the scientific and common names of these fishes. The communities and fishing enthusiasts recognize the Hawaiian names of these fishes. This action dis-enfranchises many who are interested parties from participating in this process.	Comment noted. While the O'ahu document does not use the White List since that list is specific to the WHRFMA on Hawai'i Island, hawaiian names of fish species (where applicable) have been added to the DEIS. A Cultural Impact Assessment has also been conducted (Appendix A of the DEIS).
The National Park Service has provided much assistance to the communities by protecting, preserving and restoring the Ala Kahakai Trail system. These historic trails provided important access to the shoreline to engage in fishing activities. Restoration of these trails in current terms once again provide access to the shoreline. This data and the Trail system are missing.	Comment noted. See response to this comment in the Hawai'i DEIS, as the Ala Kahakai Trail is on the island of Hawai'i. This analysis area for this DEIS is limited to O'ahu. The impact of commercial aquarium collection on tourism and cultural resources is discussed in Section 5.0 of the DEIS.
Much is written about the West Hawaii Regional Fishing Management Areas (WHRFMA) and the on-going works of the West Hawaii Fishery Council (WHFC) with regard to sanctuary areas. A) DLNR has yet to research the impacts to neighboring communities in terms of the fishing communities who moved to new grounds to collect fish. This new data is essential in calculating whether fish population can sustain collection for aquarium uses. B) This new data should determine whether more Kapu regulations are needed, and in what locations.	Comment noted. See the Hawaii DEIS and FEIS for discussions on the WHRFMA and the WHFC.
DLNR also needs to review some of the Policies in place, to recognize the change in methodology for catching fish species. There is little change in protecting and preserving fish habitats from lack of buoys. However, comments to protecting and preserving historic sites (fish koʻa and fish spawning areas) are also lacking in this document.	Comment noted. The Cultural Impact Assessment (Appendix A of the DEIS) addresses cultural and historic resources.
There is a need for added enforcement personnel for the increased volume of Permits and fish takes. This document offers no address to the issue.	Comment noted. The Preferred Alternative in the DEIS includes a limited number of permits issued. Enforcement is within the purview of the State of Hawaii. A section on enforcement and compliance is included in Section 1.2.5 of the EIS.
The Aha Moku recognizes that land pollution is a major problem in keeping the fish population in ancestral locations. Rain storms create erosion, cesspools in Naʻalehu and Puako are recognized by the County Environmental Divisions. There are non-descript address to this added conflict of travelling vessels vs shoreline collection, in this document.	Comment noted. Cumulative impacts are addressed in Section 5.0 of the DEIS.

From: Bob Flatt
To: Sakoda, David
Cc: jim.lynch@klgates.com; VanDeWalle, Terry
Subject: Comment on the scope of HI Aquarium Fishing EIS
Date: Monday, August 13, 2018 4:57:03 PM

The EIS needs to address the quality of current management data. The data quality is insufficient to make reliable management estimates of fish populations due to methodological bias, there is no basis for knowing if the harvest of uncounted species is sustainable.

The current methodology estimates the aquarium fish abundance by determining the abundance of a subset of the species harvested. The assumption is that this subset abundance represents the abundance of most or all aquarium species. This assumption might be correct if the harvesting pressure were equal on all aquarium species, but it is not.

Aquarium harvesting is an economic activity, between species the individual fish price varies 100 fold. The most common species have the lowest price, the least common species the highest price. Given a choice, a rational economic actor will choose to harvest the uncommon $50 fish over the common 50¢ fish. As a practical matter the management methodology samples the most common species. The sampled population data is not representative because the harvesting pressure on uncommon species is higher, this is the cause of the bias.

The resulting data are thus unreliable because they do not include the effect of the price bias. Thus any environmental impact estimates are unreliable.

The methodology from a statistical point of view does over-sample the common species. This oversampling does not address the cause of the price bias as it only increases the sample size of lower price fish species.

The issue is addressable. For example, this bias could be removed by only harvesting counted species. There may be other ways to address the issue, but as it stands there is no basis for knowing if the harvest of uncounted species is sustainable. This should be addressed in the EIS.

In summary (with apologies to Dr Seuss):
Money leads us to prefer harvesting fish that are 'blue'.
Managing by counting fish that are 'red' just wont do.

Robert Flatt
Captain Cook, HI

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Responses to comments received from Robert Flatt
Comment dated August 13, 2018

Comment	Response
The EIS needs to address the quality of current management data. The data quality is insufficient to make reliable management estimates of fish populations due to methodological bias, there is no basis for knowing if the harvest of uncounted species is sustainable. The current methodology estimates the aquarium fish abundance by determining the abundance of a subset of the species harvested. The assumption is that this subset abundance represents the abundance of most or all aquarium species. This assumption might be correct if the harvesting pressure were equal on all aquarium species, but it is not.	Comment noted. Descriptions of fish population survey methods, including limitations, are discussed in Section 4.4.3.1. Confidence intervals are provided for CREP data, . This information is all included in Section 5.0 of the DEIS, including population estimates for 22 of the 23 species analyzed in the EIS. As noted in the DEIS, Bandit Angelfish do not have a CREP population estimate, but collection has averaged 209 individuals per year for the island of O'ahu between 2000 and 2017.
Aquarium harvesting is an economic activity, between species the individual fish price varies 100 fold. The most common species have the lowest price, the least common species the highest price. Given a choice, a rational economic actor will choose to harvest the uncommon $50 fish over the common 50¢ fish. As a practical matter the management methodology samples the most common species. The sampled population data is not representative because the harvesting pressure on uncommon species is higher, this is the cause of the bias. The resulting data are thus unreliable because they do not include the effect of the price bias. Thus any environmental impact estimates are unreliable. The methodology from a statistical point of view does over-sample the common species. This oversampling does not address the cause of the price bias as it only increases the sample size of lower price fish species. The issue is addressable. For example, this bias could be removed by only harvesting counted species. There may be other ways to address the issue, but as it stands there is no basis for knowing if the harvest of uncounted species is sustainable. This should be addressed in the EIS.	Comment noted. The DEIS uses the best available data for population estimates. Descriptions of fish population survey methods, including limitations, are discussed in Section 4.4.3.1.

September 7, 2018

David Sakoda
Hawai'i Department of Land and Natural Resources
Division of Aquatic Resources
1151 Punchbowl Street, Room 330
Honolulu, HI 96813-30813

Submitted via e-mail: david.sakoda@hawaii.gov

Re: Final Environmental Assessments – Environmental Impact Study Preparation Notices: Issuance of Commercial Aquarium Permits for the Islands of Hawai'i and O'ahu; Request for Consulted Party Status and Participation in Scoping Process

Dear Mr. Sakoda:

For the Fishes, the Humane Society of the United States, Center for Biological Diversity, Conservation Council for Hawai'i, and the other undersigned individuals and organizations (collectively, "Commenters"), are conservation and animal protection organizations and individuals with strong interests in preserving the State of Hawai'i's natural resources and protecting its delicate coral reefs. Commenters submit these comments on the Pet Industry Joint Advisory Council's (PIJAC's, or "Applicant's") Final Environmental Assessments (FEAs) purporting to analyze the environmental impacts of commercial aquarium fish collection on both the islands of Hawai'i and O'ahu and the Environmental Impact Statement Preparation Notice (EISPN) submitted by the Department of Land and Natural Resources (DLNR).[1]

We, the undersigned Commenters, request to be Consulted Parties on any Draft Environmental Impact Statements prepared to fulfill the requirements of the EISPN as a result of the determinations by the DLNR that environmental impact statements are required.

[1] Office of Environmental Quality and Control, The Environmental Notice at 3, 4 (Aug. 8, 2018), http://oeqc2.doh.hawaii.gov/The_Environmental_Notice/2018-08-08-TEN.pdf ; PIJAC, Final Environmental Assessment: Issuance of Commercial Aquarium Permits for the Island of Hawai'i (2018), http://oeqc2.doh.hawaii.gov/EA_EIS_Library/2018-08-08-HA-FEA-EISPN-Hawaii-Island-Commercial-Aquarium-Permits.pdf ("Hawai'i FEA"); PIJAC, Final Environmental Assessment: Issuance of Commercial Aquarium Permits for the Island of O'ahu (2018), http://oeqc2.doh.hawaii.gov/EA_EIS_Library/2018-08-08-OA-FEA-EISPN-Oahu-Commercial-Aquarium-Permits.pdf ("O'ahu FEA").

We concur with DLNR's findings that the significance criteria in HAR § 11-200-12 have been met, and that the preparation of EISs is required to fully analyze the environmental impacts of commercial aquarium collection on both the islands of Hawai'i and O'ahu. The proposed actions have a significant impact on the environment including, but not limited to:

- Involving an irrevocable commitment to loss or destruction of any natural or cultural resource;
- Curtailing the range of beneficial uses of the environment;
- Conflicting with the state's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders;
- Substantially affecting the economic or social welfare of the community or State;
- Involving a substantial degradation of environmental quality;
- Cumulatively has considerable effect upon the environment or involves a commitment for larger actions;
- Substantially affects a rare, threatened, or endangered species, or its habitat;
- Affects or is likely to suffer damage by the activity/activities being located in an environmentally sensitive area such as a beach, erosion-prone area or coastal waters.

To this end, we expect the Applicant endeavor to develop fully acceptable EISs prior to the time the EISs is filed with the office, through a full and complete consultation process, and that the Applicant shall not rely solely upon the review process to expose environmental concerns.

We are also requesting to be parties to any public scoping meeting(s) convened to receive comments on the FEA-EISPNs and setting forth the scope of the draft EISs. [2]

Further, we expect our substantive comments on the FEAs, discussed below, to be responded to in writing and incorporated into the draft EIS by the Applicant prior to the filing of the draft EISs with DLNR. We also expect that the responses shall not be merely self-serving recitations of benefits and/or rationalizations of the proposed actions.

In addition, we expect the EIS's to disclose any and all adverse effects on cultural resources and traditional cultural practices, which are set forth in HAR § 11-200-10 and discussed in more detail below.

Finally we also expect the Draft EIS to include discussion and disclosure of climate change impacts, as envisioned by the proposed HAR § 11-200.1-13 Significance Criteria, Criterion 11 (based on the December 2017 Climate Change Mitigation and Adaptation Commission report) to address concerns related to climate change adaptation, such as impacts from increased hurricane frequency and/or intensity, potential endangered species migration, impacts on areas likely to experience wave inundation, increased exposure to hurricanes, or flooding, and further impacts discussed below.

[2] HAR §11-200-15 Consultation Prior to Filing a Draft Environmental Impact Statement.

I. Introduction

DLNR has the authority to issue permits for the taking of fish and other aquatic life for aquarium purposes.[3] While these permits are limited in duration to one year, DLNR has not put a limit on the number of animals that can be captured per commercial permit, nor on the number of permits the Agency issues.[4] In fact, in reality, DLNR automatically grants *every* commercial aquarium permit application, and allows the collection of *unlimited* numbers of animals under those permits.[5] DLNR also automatically grants every recreational permit application, and although recreational permits are limited to nearly 2,000 fish per year per permit, the automatic approval of every permit application effectively creates a system of unlimited recreational collection, as well.[6] Furthermore, while commercial collectors are required to report their collections (in practice, inaccurately), there is no similar requirement for recreational permits,[7] and therefore there is no definitive data on how many of each type of fish or other aquatic animal is taken from the State's delicate coral reef ecosystem each year—nor what level of take would be sustainable.

As earlier noted, the FEAs continue to be entirely inadequate under the Hawai'i Environmental Policy Act (HEPA, Haw. Rev. Chapter 343) and its implementing regulations. The environmental impact statements now required by DLNR must adequately address these and other notable flaws remaining in the FEAs:

- The FEAs fail to analyze the impacts of collection beyond one year;
- The FEAs fail to analyze the cumulative impacts of unlimited collection of aquatic life;
- The FEAs fail to analyze the cumulative impacts of commercial collection on the islands of Hawai'i and O'ahu along with collection in other parts of the State;
- The FEAs fail to analyze the cumulative impacts of commercial collection along with recreational collection;
- The FEAs fail to analyze impacts on cultural resources;
- The FEAs fail to analyze reasonable alternatives;
- The FEAs fail to analyze the impacts of harmful collection practices;
- The FEAs rely on inaccurate, misleading, and incomplete data;
- The FEAs fail to analyze mitigation measures; and
- The FEAs fail to incorporate input of Native Hawai'ian groups, experts, and affected citizens.

[3] Haw. Rev. Stat. § 188-31(a).

[4] Haw. Rev. Stat. § 188-31(a); Haw. Code R. § 13-75-14(4).

[5] *See Umberger v. Dep't of Land and Nat. Resources*, 403 P.3d 225, 300, 304 (Haw. 2017).

[6] Haw. Code R. § 13-75-14(4); *Umberger*, 403 P.3d at 300, 304.

[7] *See* Haw. Rev. Stat. § 189-3; *Umberger*, 403 P.3d at 283, 295.

The Applicant's Preferred Alternatives do not ensure that commercial aquarium fish collection is lawful, responsible, and sustainable for any fish species from nearshore habitats on the Islands of Hawai'i and O'ahu or elsewhere in the state where collection is allowed. The FEAs' continued conclusions that the aquarium fisheries on the Islands of Hawai'i and O'ahu have "no significant impact" on targeted reef fish species, coral reefs, and the human communities that rely on them is unsupportable. EISs are required in order to evaluate the true cumulative effects (both primary and secondary, and both short- and long-term) of the Preferred Alternatives and proper mitigation must be proposed.

II. <u>Cumulative and Long-Term Impacts Inadequately Analyzed</u>

Perhaps the most glaring inadequacy that both FEAs display is their failure to consider cumulative impacts, both short- and long-term. HEPA requires that "agencies shall consider the sum of effects on the quality of the environment and shall evaluate the overall and cumulative effects of an action."[8] Furthermore, the Agency must consider "both primary and secondary" consequences, "and the cumulative as well as short-term and long-term effects of an action."[9] Notably, "cumulative impact" is defined as the impact resulting from "the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions," and "[c]umulative impacts can result from individually minor but collectively significant actions taking place over a period of time."[10]

A. <u>Failure to Analyze Long-Term Impacts</u>

The Applicant unlawfully limited its analyses to the time period of a single year.[11] PIJAC's reasoning for this is that each permit only lasts one year, and therefore a new EA would need to be completed on an annual basis.[12] However, while Commenters agree that it is critical for the Agency to continue to monitor the impacts that aquarium collection is having over time, the relatively short time period of the activity itself does not nullify HEPA's clear requirement for considering the long-term effects of that activity.[13] For example, a large excavation project could destroy habitat in an area of an island that takes decades to regrow—and even if the excavation itself was only for a year, HEPA would clearly require consideration of the impacts to the environment during the decades of regrowth. Similarly, the use of a pesticide could have known impacts on a species where serious or lethal effects are felt far beyond the time frame of the actual application of the pesticides—yet HEPA would clearly require consideration of those expected impacts. Thus, PIJAC's logic simply does not hold up. Additionally, stating that the Agency can simply reevaluate the consequences of a year-long permit *after* that year is up entirely contradicts HEPA's mandate to evaluate the potential consequences of an action *before* the Agency authorizes the action.

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[8] Haw. Code R. § 11-200-12.

[9] Haw. Code R. § 11-200-12.

[10] Haw. Code R. § 11-200-2.

[11] *See* Hawai'i FEA at 14; O'ahu FEA at 10.

[12] Hawai'i FEA at 14; O'ahu FEA at 10.

[13] *See* Haw. Code R. § 11-200-12.

Additionally, a 12-month timeframe that analyzes impacts is inadequate because the impact of fish removal will accumulate over time. Studies show that catch numbers from the commercial aquarium fishery in Hawai'i have significantly increased over the last few decades and are likely to increase even more.

The number of commercial aquarium permits issued per year has significantly increased over the last 18 years for the Island of Hawai'i (at ~35% per year, p=0.01) and for O'ahu (at ~29% per year, p=0.02) (see Fig. 1, see Appendix 1 for linear model results). In fact, these trends have been observed since the early 1980s.[14] It is likely that the number of commercial aquarium permits issued on the Islands of Hawai'i and O'ahu will continue to increase in the coming years due to the high demand for aquarium reef fish and their increasing market value.[15]

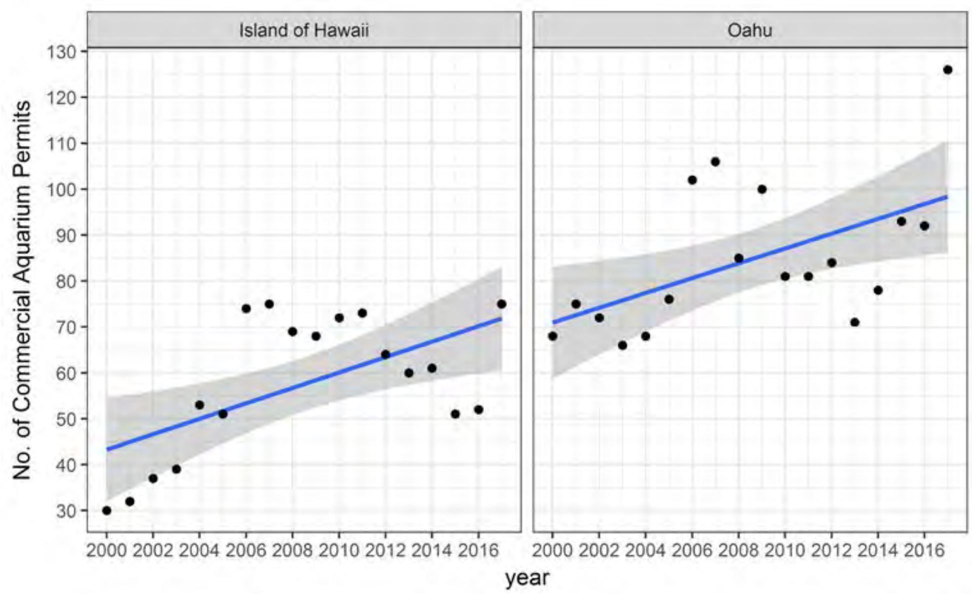

Fig. 1. Number of commercial aquarium permits issued annually for the Islands of Hawai'i (WHRFMA and East Hawai'i combined) and O'ahu from 2000 to 2017. Data from the O'ahu FEA (Table 2, p18) and Hawai'i FEA (Table 3, p21).

In response to this comment, the Applicant claims that the number of permits issued is "[not] necessarily indicative of the number of fish collected," however DLNR data shows a strong correlation between the number of permits issued and the level of catch (Fig. 2). Furthermore, the Hawai'i Supreme Court has made clear that the proper inquiry under HEPA is "the outer limits of what the permits allow . . . ."[16]

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[14] Walsh et al. (2004); Friedlander et al. (2008); Walsh et al. (2014).

[15] Friedlander et al. (2008); Stevenson et al. (2011).

[16] *Umberger*, 403 P.3d at 294.

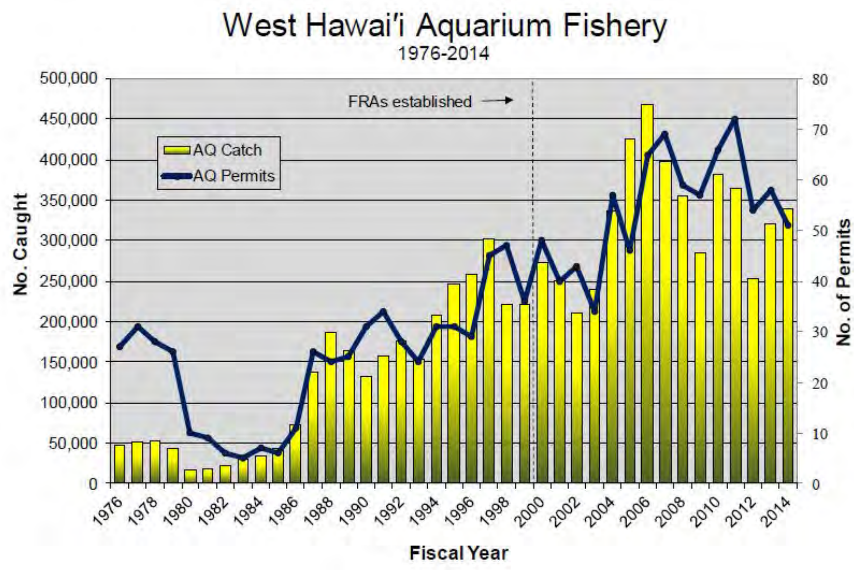

Fig. 2. Number of aquarium animals collected and number of commercial aquarium permits in West Hawai'i for Fiscal years 1976-2014.[17]

The relationship between the number of participants in a fishery and impacts to fish populations is well-established in the literature. The importance of restricting access to fisheries has been acknowledged and used for thousands of years to conserve and help sustain fish populations.[18]

The FEAs failed to take into account how increasing demand and increasing market value will affect already depleted targeted reef fish species in the coming years, thus result in significant environmental impact. For example, the market value of tropical reef fish (e.g., Yellow Tang) has increased and thus collection/fishing pressure is likely to increase in the near future. The commercial aquarium fishery in Hawai'i reports annual landings of over 579,000 organisms (fish and invertebrates combined).[19] The number of aquarium fish caught on the island of Hawai'i since 1976 has substantially increased by 645%.[20] Similarly, the adjusted value of the Hawai'i Island aquarium fishery increased by over 280% between 1976 and 2003.[21] This relationship must be analyzed in the EISs and permitting must be adjusted accordingly to account for populations declines. The FEAs' claim that the high fecundity and long lifespans of reef fishes combined with the limited targeting of adult brood-stock by the trade removes the certainty that the losses will accumulate over time is false. Studies show that populations of heavily targeted species, such as Yellow Tangs, are neither annually replenished, nor restored over time to their natural levels of abundance. On the contrary, they have been severely depleted over time, especially in the areas where they are collected. While the Hawai'i FEA noted that for Yellow Tang and *kole*, which represent two of the top three collected species, population trends are stable or increasing, it failed

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[17] DLNR (2014).
[18] Dewees and Weber (2001).
[19] DLNR Catch Reports.
[20] Walsh et al. (2004); Friedlander et al. (2008).
[21] Walsh et al. (2004).

to acknowledge that the increase in fish abundance is due to an anomalous recruitment pulse that coincided with warming waters in 2014.[22] Typical recruitment pulses, such as those that occurred in 2002 and 2009, have resulted in short-lived increases in fish populations that were followed by prolonged or short and steep population declines. [23]

The FEAs' failure to discuss the effects of the aquarium fishing industry beyond a one-year period is not only a legal flaw but also one of the main reasons that the FEAs do not find a significant impact of the aquarium fishing industry on targeted species and their habitat. By limiting the timeframe of their analysis to a single year, the FEAs have entirely failed to consider the impacts of one-year collection permits cumulatively with other "past, present, and reasonably foreseeable actions" "over a period of time." [24]

B. Failure to Analyze Cumulative Impacts

The FEAs also fail to consider other cumulative impacts. The Hawai'i FEA states that it only analyzes impacts that the aquarium permits issued for the island of Hawai'i will have; similarly, the O'ahu FEA states that it only analyzes the impacts that aquarium permits issued for O'ahu will have.[25] Neither FEA considers the cumulative impacts that permits issued for either island will have cumulatively with permits issued for the *other* island with a FEA—let alone cumulatively with permits issued for islands for which PIJAC conducted *no* FEA (e.g., Kauai and the islands that make up the County of Maui).

Coral reefs in Hawai'i are connected by ocean currents. Carried within these currents are the larvae of Hawai'i's reef fishes which typically settle downstream of the reefs where they originated. Most fishes on Hawai'i's reefs are the result of other fishes upstream of that reef.[26] Fish removed from a reef can re-populate as long as the capacity of the upstream larval reservoir isn't exceeded.[27] For example, the prevailing currents in Hawai'i mean that Hawai'i Island reefs "seed" the islands to the northwest—marine life spreads from the Hawai'i Island to the islands of Maui County and beyond. Reduced populations of reef fishes on Hawai'i Island can seriously impact reef fish abundance in the entire state.

Additionally, the FEAs still fail to even properly address the true nature of what the Applicant is requesting in its Preferred Alternatives. Under the Preferred Alternatives for both FEAs, "DLNR would issue Aquarium Permits for the island of Hawai'i under existing regulation set forth in HRS 188-31," and "DLNR would issue Aquarium Permits for the island of O'ahu under existing regulation set forth in HRS 188-31."[28] In other words, PIJAC's Preferred Alternative is collection of an *unlimited* number of fish and other coral reef inhabitants—the limits of what regulation allows. Additional bag limits, proposed only for Achilles Tangs in the Hawai'i FEA and Flame Wrasses in the

[22] Gove et al. (2016).
[23] Hawai'i FEA Fig. 5.
[24] Haw. Code R. § 11-200-2.
[25] Hawai'i DEA at 14; O'ahu EA at 10.
[26] Noland (1978); Christie et al. (2010).
[27] Noland (1978).
[28] Hawai'i FEA at 34; O'ahu FEA at 30.

O'ahu FEA, fail to limit total catch because these daily catch limits apply to a limitless number of people. Yet, the FEAs still consider only very *limited* collection. HEPA requires that an EA assess the potential cumulative impacts of what State regulations allow, not just what some permittees may claim they *intend* to do with their permits. As the Hawai'i Supreme Court clearly stated, "the properly defined activity for the purposes of the HEPA analysis must encompass the outer limits of what the permits allow and not only the most restrictive hypothetical manner in which the permits may be used."[29] The EISs must address this.

Likewise, although the FEAs purport to analyze impacts cumulatively with those of recreational collection permits, the FEAs still do not account for the fact that the Agency issues a permit for *every* application that is submitted, and therefore the take under recreational permits is potentially unlimited as well.[30] And the FEAs admit that, as there is no required reporting for recreational permits, it is currently impossible to know how many of each species are taken under those permits, and therefore, the impact of collection under these permits on species collected under these permits cannot be quantified.[31] This lack of data must be addressed in the EISs.

The analysis of cumulative impacts must include the impact of the commercial aquarium fishery, regardless of the gear used to capture the marine life, combined with non-aquarium commercial and recreational fisheries and other activities that impact population abundance. Commercial and recreational fishing combined with the aquarium fishery have a substantial impact on targeted species. The EISs must determine cumulative impact of all fishing on target species. In addition, the EISs must analyze indirect impacts from collection such as vessel traffic and accumulated reef damage due to vessel anchoring and collection practices.

As noted earlier, the EISs must also evaluate the potential of cumulative impacts of climate change (warming, coral bleaching, and ocean acidification) on targeted fish species such as decline of coral coverage which have been demonstrated to influence reef fish species diversity and abundance.[32] The FEAs recognize that climate change poses serious threats to Hawai'i's coral reefs and the species targeted by the Applicant, yet ironically claim that climate change impacts coupled with the impacts of implementing the three proposed alternatives are expected to be less than significant. These statements completely deny the research and data that demonstrate what is stated, that climate change impacts, specifically ocean warming, acidification and coral bleaching events will continue, thus further analysis of impacts and exacerbation of impacts due to climate change is required.[33]

It is clear from an analysis of cumulative impacts that many of HEPA's "significance criteria" apply.[34] Most directly, the proposed actions will likely have a significant effect on the environment due to at least: the loss or destruction of natural and cultural resources; curtailing the range of beneficial uses of the environment; substantial degradation of environmental quality; cumulative

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[29] *Umberger*, 403 P.3d at 294.
[30] Hawai'i DEA at 88; O'ahu DEA at 60.
[31] Hawai'i FEA at 98; O'ahu FEA at 73.
[32] Jones et al. (2004); Friedlander et al. (2018).
[33] Hawai'i FEA at 104; O'ahu FEA at 77.
[34] Haw. Rev. Stat. § 11-200-12(b).

effects on the environment; and potentially substantially affecting rare, threatened or endangered species, or its habitat.[35] The scope of the EISs must address these effects. The scope must include a temporal baseline that captures the impacts of collection pressure over time, before the natural populations of targeted species were depleted by this activity. Proper examination of the magnitude of the effect of aquarium collecting on natural populations and the coral reef ecosystem over time requires a look-back period that in the very least begins in 1953 when the aquarium permits were authorized by the state.

III. Statewide Impacts Inadequately Analyzed

Environmental impacts from aquarium trade activities have been documented for over forty years. Under the Preferred Alternatives, every fish and marine creature, other than corals and those associated with live rock, could be removed from one, or all, of the State of Hawai'i's reefs—with catastrophic effects. This is not speculation: there is currently no law, regulation or enforcement capability that would prevent this from occurring. The potential for unlimited collection is a fact that encompasses the outer limits of what the aquarium permits allow, as was explained earlier.

Collecting individual species in high numbers poses a significant threat to coral reef health. As explained herein, herbivorous species, such as Yellow Tangs and Goldring Surgeonfishes, are the most heavily targeted.[36] Herbivorous fish are essential to avoid algal overgrowth of corals and concomitant degradation of the reef.

Hermit crabs are also collected in large numbers despite being essential to ecosystem health. Other important functional groups include: planktivores (e.g. Hawai'ian Dascyllus), corallivores (e.g. Fourspot Butterflyfish, Multiband Butterflyfish), fish predators (e.g. Hawkfishes, Hawai'ian Lionfish) and cleaner fishes (e.g. Hawai'ian Cleaner Wrasse). The collection of large numbers of invertebrates including hermit crabs and shrimps that are grazers, scavengers, or cleaners, could potentially have serious ecosystem impacts including reduced resiliency to other threats.

The reduction of natural populations of species taken by the aquarium trade in any area (e.g. specific site, zone, coastline, island or statewide), and by any amount, whether one or one hundred percent, indicates an irrevocable commitment and loss of a natural and cultural resource.[37] This very loss curtails the range of beneficial uses that would otherwise be provided by the natural abundance of these populations.[38]

As has been long recognized,

> The impact of commercial aquarium fish collecting is a complicated issue. The fish community members are highly dependent on one another. There is a constant interaction between predators and competitors, as well as other members of the food web. There is a lot of variability in the system, even when it is not disturbed by man.

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[35] Haw. Rev. Stat. § 11-200-12(b)(1), (2), (7), (8), (9).

[36] DLNR Catch Reports.

[37] Haw. Rev. Stat. § 11-200-12(b)(1).

[38] Haw. Rev. Stat. § 11-200-12(b)(2).

Reefs seem to undergo natural cycles. At times they may be very abundant. There is also natural variation in the fish community at different locations.[39]

The EISs and any discussion of "sustainable" must include the high aesthetic value of this beautiful marine life as well as impacts to the complex relationships inherent in coral reef ecosystems and impacts to overall coral reef health. "Animal communities" are included in the rule definition for "environment," however the FEAs still exclude any mention of the impact to fish and invertebrate communities.

The Hawai'i State Wildlife Action Plan (SWAP) states that "Excessive extractive use constitutes a threat to wildlife. Certain reef fishes are harvested for sale in the aquarium trade . . . These activities are not sustainable on a large scale and impact native wildlife."[40]

A. General Impacts on Targeted Species

The list of species of greatest conservation need includes at least 18 native fish species that are threatened by the aquarium trade and in need of conservation actions to reduce the risk of extinction (depicted in Fig. 3).

Fig. 3. Native fish species threatened by the aquarium trade.[41]

Butterflyfishes are among the most beautiful of coral reef fishes (see Fig. 4). Their bright yellow, white and black markings are especially striking against pale corals and deep blue waters. When encountered by snorkelers/divers the beauty of these species is often breath-taking. They are

[39] Noland (1978).
[40] DLNR, SWAP (2018).
[41] DLNR, SWAP (2018).

heavily targeted by the aquarium trade in Hawai'i. In 1976 five of the top ten most collected species were butterflyfish (see Fig. 5).[42]

Fig. 4. Most heavily targeted butterflyfishes on Hawai'i reefs, statewide: Fourspot Butterflyfish, Longnose Butterflyfish, Teardrop Butterflyfish, Forcepsfish, Multiband/Copperband Butterflyfish.[43]

TOP TEN MARINE AQUARIUM FISHES COLLECTED IN HAWAII
(Fiscal Year 1976)

	Species	Number	% of Total Catch	Estimated Value	% of Total Value	Estimated Value Per Fish
1.	*Zebra flavescens* (Yellow manini)	35,006	22	$ 43,235	18	$1.24
2.	*Forcipiger longirostris* (Long-nosed butterfly)	10,022	6	18,718	8	1.87
3.	*Centropyge potteri* (Potter's angel)	9,299	6	17,919	7	1.93
4.	*Acanthurus achilles* (Naenae)	9,233	6	18,920	8	2.05
5.	*Naso lituratus* (Kala)	6,478	4	14,536	6	2.24
6.	*Chaetodon quandrimaculatus* (Fourspot butterfly)	4,925	3	6,997	3	1.42
7.	*Zanclus canescens* (Kihikihi)	4,520	3	8,763	4	1.94
8.	*Chaetodon unimaculatus* (Teardrop butterfly)	4,496	3	6,502	3	1.45
9.	*Forcipiger flavissimus* (Long-nosed butterfly)	4,259	3	6,914	3	1.62
10.	*Chaetodon multicinctus* (Copperband butterfly)	3,623	2	3,343	1	.95
	TOTAL: top ten	91,861	58%	$145,938	61%	$1.67 (avg.)

Fig. 5. Five butterflyfish species were among the top ten marine aquarium fishes collected in 1976, statewide.[44]

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42 Katekaru (1978).

43 Katekaru (1978).

44 Katekaru (1978).

Reported aquarium harvest of those same five species has since plummeted (see Fig. 6). The same is true for other heavily targeted butterflyfish species that have been among the top twenty aquarium fishes collected by the trade since 1976.[45]

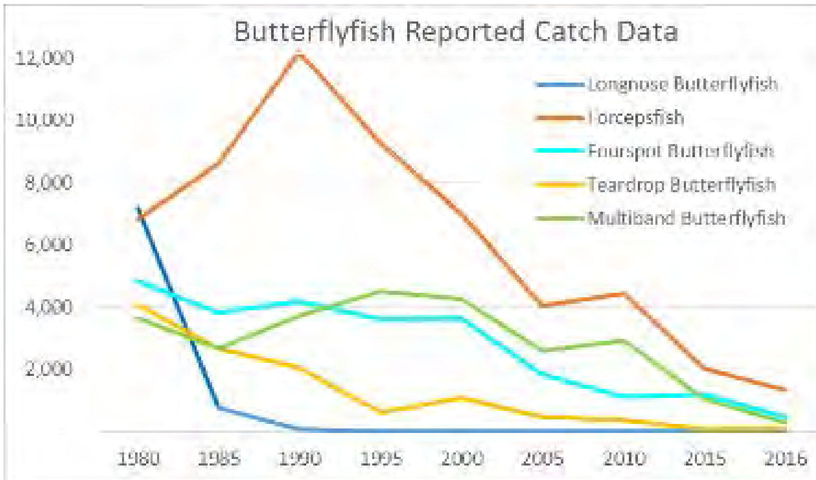

Fig. 6. DLNR reported harvests of the five most heavily targeted butterflyfish species since 1976. Data represents statewide annual average catch over five-year periods.[46]

This sharp decline in reported catch is not an indicator that these species are no longer in demand. Continuing demand is confirmed by several examples:

- These species' inclusion in the West Hawai'i White List.
- Their exclusion from the O'ahu rules.
    - The O'ahu aquarium rule prohibits take of three butterflyfishes, citing their "coral diets" as the need for the restriction.[47] Since 1999 total reported take of those three species was 50 fish.[48]
    - Zero restrictions were provided for three additional coral eating butterflyfishes, with total reported take of over 51,000 individuals since 1999.[49]
- The Fourspot Butterflyfish catch increase that followed the 2014/2015 warming event and unprecedented fish bloom.[50] Subsequently, catch of the Fourspot Butterflyfish declined to an all-time low.[51]

[45] DLNR Aquarium Catch Reports.
[46] DLNR Aquarium Catch Reports.
[47] DLNR (2012).
[48] DLNR Aquarium Catch Reports.
[49] DLNR Aquarium Catch Reports.
[50] Talbot (2014).
[51] DLNR Aquarium Catch Reports.

The scope of the EISs must include a temporal baseline that captures the impacts of the heavy collection pressure on these species over time, before their natural populations were depleted by this activity.

B. Damage to Reef Habitat

In nearly every encounter with commercial aquarium collectors on West Hawai'i reefs, snorkelers and divers have witnessed and documented destructive practices that harm corals, with the most damage coming from vessel anchors and chains. Sticks, buckets, nets, underwater propulsion devices (scooters) are laid in the corals and the fins, knees and legs of collectors often come in contact with the reef—in fact, they are typically described as "crawling across" or "standing" on the corals. The results of these actions include abrasion and coral breakage. Both FEAs refer to a study that determined there was no evidence to indicate the presence of destructive fishing practices (e.g. breaking apart corals to capture hiding fishes).[52] However, the abundance of photographic evidence documenting coral breakage from vessel anchoring and fish capture activities, these impacts cannot be dismissed and must be evaluated in the EISs. Photographs of these practices and their effects can be found at Appendix 2.

Abundant coral reefs—put at risk by the Preferred Alternatives—have a range of beneficial uses. The EISs must adequately address the curtailment of "the range of beneficial uses of the environment."[53]

1. Aesthetic Value

In addition to the impacts to biodiversity, ecosystem function, and other fisheries, aesthetic and other social values are also heavily impacted.[54] Species experiencing the heaviest collection pressure, with a corresponding reduction in natural abundance, are Hawai'i's most beautiful, charismatic and iconic fishes. The diminished aesthetic value from the cumulative and substantial reductions in species such as Yellow Tangs, butterflyfishes and Moorish Idols, which are dominated by vibrant yellows and oranges and striking white and black patterns, cannot be overestimated (see Fig. 7).

[52] Hawai'i FEA at 89; O'ahu FEA at 68.
[53] Haw. Rev. Stat. § 11-200-12(b)(2).
[54] Walsh, Background on Proposed Hawai'i Administrative Rule 13-60.4 (2013).

Fig. 7. Reefs lacking yellow and orange fishes are greatly diminished in beauty.

These colors are more than aesthetically pleasing, as our eyes are physiologically attuned to them. The frequencies and wavelengths of yellows, oranges and reds allow them to strike our eyes much faster than the other colors.[55]

By removing the species with prominent yellow, orange, red or white coloration and markings, the palette and very essence of what makes a coral reef beautiful to the human eye is diminished and degraded. It is impossible to decrease populations of a coral reef's beautiful wildlife without greatly decreasing the natural beauty of the place. Divers who have frequented these coral reefs, such as some of the Commenters, have noticed decreased abundance of colorful fish in recent years. The EISs must acknowledge and address these cumulative losses and propose proper mitigation measures.

2. Property/Amenity Value

The EISs must acknowledge and address the effects of the trade on the amenity/property values and propose proper mitigation measures. Houses that are within a block or 100 meters of beautiful, clean and healthy coastlines, beaches and coral reefs are more valuable and sell for significantly higher prices than comparable properties elsewhere. The same is true for condos and hotels/hotel rooms which generally command higher room and occupancy rates. Healthy coral reefs are also more likely to prevent beach erosion and, therefore, add value as a form of coastal protection. One and a half percent of the sale price of these properties is attributable to the marine ecosystem. Hawai'i's reef-related property value in 2001 was calculated at $40 million.[56]

3. Recreational Value

The EISs must acknowledge and address the effects of the trade on the recreational value of this marine life and their coral reef homes and propose proper mitigation measures. The annual estimated expenditures related to marine life viewing (i.e. snorkeling and scuba) in Hawai'i is $551

55 Slembrouck (2011).
56 Cesar et al. (2002).

million. Reef-adjacent marine tourism expenditures (including hotel rooms) within 30 km of the coastline are an annual $680 million.[57]

These amounts exclude the lost value from declining fish abundance which is captured in willingness to pay surveys and summarized below:

- Healthier reefs lead to substantial economic gains.
    - Recreational users are willing to pay higher rates for a healthier marine environment. [58]
    - Snorkel/dive businesses benefit when there are more fish for their clients to see.[59] One recent study showed divers were willing to pay $93 to $110 more to dive with abundant fish life. [60]
- Without new regulations the potential for increasing losses is real.
    - Inability to stem declining reef fish numbers could cause significant losses to dive tourism industry (i.e. reductions in willingness to pay).[61]
    - These consumer surplus losses could range from $1.2 million to $12.2 million annually.[62]
    - Areas with degraded reefs and low fish populations could also see significant losses from a decrease in their share of the global dive market.[63]
    - Anecdotal reports from long-time residents and visitors point to revenue loss already occurring from reduced abundance of beautiful fishes on Hawai'i reefs.

4. Passive Use Value

The EISs must acknowledge and address the effects of the trade on the substantial non-use values of this marine life and their coral reef homes and propose proper mitigation measures. Intrinsic and social values associated with coral reefs are diminished by reduced fish populations. Concern for the marine environment has increased in recent years and people now place tremendous value on coral reef ecosystems. Many people value beautiful and healthy coral reef ecosystems as part of their legacy and responsibility to ensure future generations are able to experience them. A 2011 report for the National Oceanic and Atmospheric Administration (NOAA) estimated the passive use annual value of Hawai'i's coral reef ecosystems through a willingness to pay survey of U.S.

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[57] Spalding (2017).
[58] Davidson et al. (eds.) (2003); FORCE Management Brief #4 for Caribbean Reef Management (P7/2007-2013).
[59] Davidson et al. (eds.) (2003).
[60] FORCE Management Brief #4 for Caribbean Reef Management (P7/2007-2013).
[61] FORCE Management Brief #4 for Caribbean Reef Management (P7/2007-2013).
[62] FORCE Management Brief #4 for Caribbean Reef Management (P7/2007-2013).
[63] FORCE Management Brief #4 for Caribbean Reef Management (P7/2007-2013).

households. The survey included a visual representation of an overfished and an abundant coral reef (see Fig. 8).

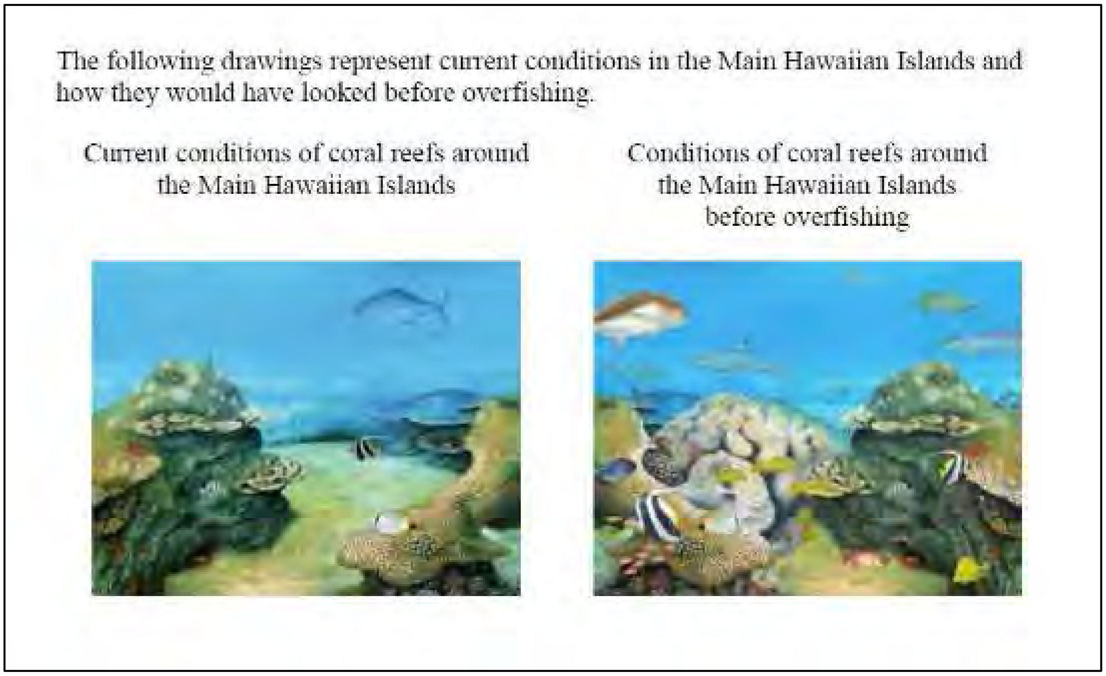

Fig. 8. Survey excerpt: NOAA Economic Value for Protecting and Restoring Hawai'ian Coral Reef Ecosystems.[64]

The project determined that increased protections and restoration of degraded coral reefs in Hawai'i is worth about $288 to the average U.S. household which aggregated over all U.S. households amounts to a $34 billion annual passive use value for Hawai'i's coral reefs.[65] This and other socio-economic values described here provide meaningful insights into the public's concerns and should be addressed in a comprehensive EIS.

C. Impacts to Cultural Resources

As noted earlier and as set forth in HAR §§ 11-200-10 and -16 through -18, a complete analysis and discussion of impacts to cultural resources is required.[66] The EISs must acknowledge and address the direct, indirect, and cumulative impacts on cultural resources. The loss and harm caused by the irrevocable commitment of natural resources equally applies to impacts to cultural resources, as well. The EISs must also acknowledge and address the effects of the trade on Native Hawai'ians traditional reliance on species targeted by the trade for subsistence, such as *pākuʻikuʻi* (Achilles Tang) and *kole* (Gold Ring Surgeonfish), and propose proper mitigation measures.

[64] Bishop et al. (2011).

[65] Bishop et al. (2011).

[66] *See also* Office of Environmental Quality and Control, Guidelines for Assessing Cultural Impacts (1997), http://oeqc2.doh.hawaii.gov/OEQC_Guidance/1997-Cultural-Impacts-Guidance.pdf.

The EISs must also acknowledge and address the Native Hawai'ian cultural and spiritual connections to the reef. Examples include consideration of the reef ecosystem and its associated gods and goddesses and their many *kinolau* (divine bodily forms). These gods and goddesses include, but are not limited to, the Goddess *Hina* and her form as *Hina 'Opu Hala Ko'a* who is the goddess of the coral and who gives birth to the reef itself; or, in her moon form which relates to coral spawning events. The Native Hawai'ian ceremonial practices associated with these types of cultural and religious beliefs must be included in the scope of the EISs.

Likewise, many of the particular fish species favored by the aquarium trade also happen to be '*aumakua* (family guardians). The taking of these species obviously adversely impacts Native Hawai'ian cultural and religious beliefs and practices. These aspects must be addressed in the EISs.

"Malama aina involves asking permission prior to fishing, taking only what you need, sharing your catch with your extended '*ohana* or community and having respect for the sacredness of the process. Clearly, harvesting live fish for economic gain and shipping them in a bag for a long, convoluted odyssey, potentially resulting in mortality and waste, violates the very core of these traditional values."[67]

The aforementioned examples were not adequately addressed in the FEAs and serve to highlight that where cultural impacts are concerned, the need for significant analysis remains.

D. Premature Mortality in Captivity and Humaneness Concerns

A major factor that drives the rates of collection is premature mortality rates in captivity. According to a long-time industry insider, most Yellow Tangs die with the first month in a hobbyist tank and fewer than 1% of those captured survive one year in captivity.[68] A 2012 study determined that mistreatment in capture, handling, transport, and holding plays a larger factor in these premature deaths than hobbyist inexperience.[69] Hawai'i's Yellow Tang ranks among the top ten fish sold in the marine aquarium trade.[70] As such, it was prominently featured in the study, in both the consumer survey, as one of the nine fish species featured, and in the supply chain analysis, as one of the eighty-five species analyzed which included eleven other species that are captured both in Hawai'i and elsewhere in the Indo-Pacific.[71] The researchers also determined that each step in the supply chain significantly profits from customer purchases to replace fish that die prematurely, and that profits from replacement fish sales are so high, stores have no incentive to take action to reduce deaths.[72]

A number of practices frequently utilized as cost saving measures by the aquarium trade in Hawai'i are inhumane and significantly contribute to the stressors that accumulate and ultimately lead to premature deaths of captive marine life. They include rapid surfacing and subsequent use of a technique known as "fizzing" to mitigate the resulting barotrauma injury to swim bladders; starving

[67] Tissot (2005).
[68] Fenner, FAQs About Yellow Tangs 4; Fenner. Marine Life Use in the Aquarium Hobby.
[69] Cartwright et al. (2012).
[70] DLNR Aquarium Catch Reports; Rhyne et al. (2015).
[71] Cartwright et al. (2012).
[72] Cartwright et al. (2012).

fish for 2 – 10 days prior to transport and spine cutting. Alternatives to these practices include slow surfacing, transport in larger volumes of water to dilute any waste produced by fishes during transport, and transport in hard plastic containers that cannot be punctured by fish spines.

Every fish that dies early puts extra pressure on natural resources because of the take of replacements. There is a general consensus in many countries that it is not ethical to trade in live animals, unless their health and welfare are ensured. These unnecessary and early deaths have given the trade a poor image. A $20 million, multi-stakeholder reform effort failed, in part, because of trade reluctance to address, and take steps to reduce, mortality rates.

Fifty percent of species among Hawai'i's historical top 20 fish list are either not guaranteed to arrive alive or stay alive longer than 7 – 14 days when purchased from online or "brick and mortar" retailers. Examples are found in Appendix 3.

IV. <u>Area-Specific Impacts Inadequately Analyzed</u>

A. <u>Island of Hawai'i</u>

As mentioned above, reduced populations of reef fishes on Hawai'i Island can seriously impact reef fish abundance in the entire state, as the prevailing currents in Hawai'i mean that Hawai'i Island reefs "seed" the islands to the northwest. There have also been documented impacts of the aquarium trade on the Island of Hawai'i itself.

1. Examples of Impacts Documented in Various Hawai'i Island Regions

Baseline fish population data from the 1970's at Honaunau in West Hawai'i were compared to data gathered in surveys conducted 1998 – 2001. The results indicated that nearly all small bodied surgeonfish, butterflyfish and angelfish (i.e. species targeted by the aquarium trade) declined in abundance. Commercial aquarium collecting was implicated in the decline (see Fig. 9).[73] Similar results were found at Ke'ei where the site had been intermittently surveyed since 1979.[74]

[73] Williams & Walsh (2007).
[74] Williams & Walsh (2007).

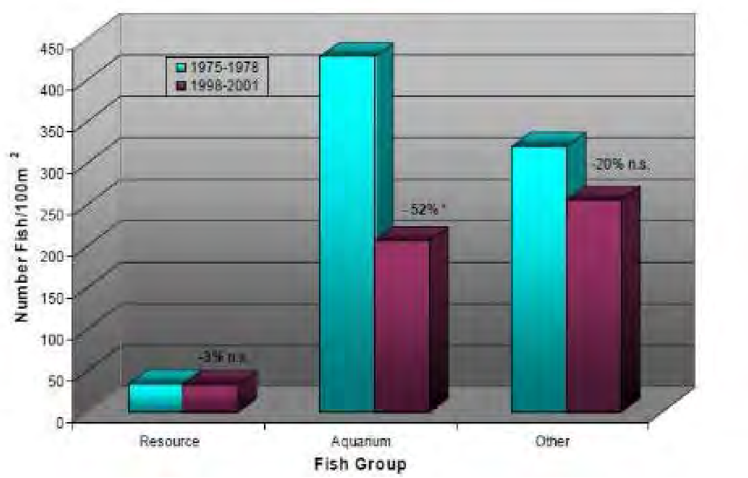

Fig. 9. Comparison of various fish functional groups at Honaunau over two survey periods. *=p<0.05,t-test. [75]

"Of the 20 most collected aquarium species, 18 declined in abundance with the species facing the heaviest fishing pressure typically showing the greatest declines."[76]

In addition to documenting the impact of aquarium collecting in these areas, these studies also document baselines for abundance levels of aquarium targeted and other impacted species. Examinations of reported catch, as documented by DLNR, serve to further highlight the impacts of the trade. [77] The documentation shows that the initial surveys were conducted during a time when the aquarium trade reported taking fewer than 50,000 fish annually from West Hawai'i reefs. In subsequent years, from 1987 to the final surveys in 2001, reported aquarium fish catch in West Hawai'i ranged between 150,000 and 300,000 individuals taken. Since then the annual West Hawai'i aquarium fish catch has ranged between 250,00 and >450,000 fish. Additionally, with the closure of approximately 32% of the reefs in West Hawai'i with the implementation of the FRAs in 2000, this increased fishing pressure was focused in smaller areas with likely intensified results.

Another long-term study looked at reefs in South Kohala and determined that reef fish abundance was in "drastic decline" and reefs were in "dire straits".[78] Populations of all of the top five most abundant fish families had declined since the original surveys conducted in 1979-1981 (see Fig. 10). Thirty-one of the thirty-five most abundant fish species had declined, including 19 species targeted by the aquarium trade. Most of the aquarium targeted species had declined by more than 50% and many were down by more than 80%.[79] The extent to which the massive increase in reported take has contributed to this decline must be studied.

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[75] Williams & Walsh (2007).

[76] Williams & Walsh (2007).

[77] DLNR (2014).

[78] Walsh (2013).

[79] Walsh, unpublished data used as background in South Kohala Reefs in Walsh (2013).

As the Applicant noted in the FEAs' responses to this comment, the "Dire Straits" report concluded that "the widespread declines in families of fish not typically targeted either for food use or for the aquarium fishery suggest that other, more widespread factors are *additionally* contributing to the overall long-term declines in fish abundance."[80][emphasis added] Rather than rebutting the argument that further analysis is needed, this statement only serves to highlight why the EISs must *also* evaluate the potential of cumulative impacts of other factors (e.g. pollution, and sedimentation) on targeted fish species, such as decline of coral coverage, which have been demonstrated to influence reef fish species diversity and abundance.[81]

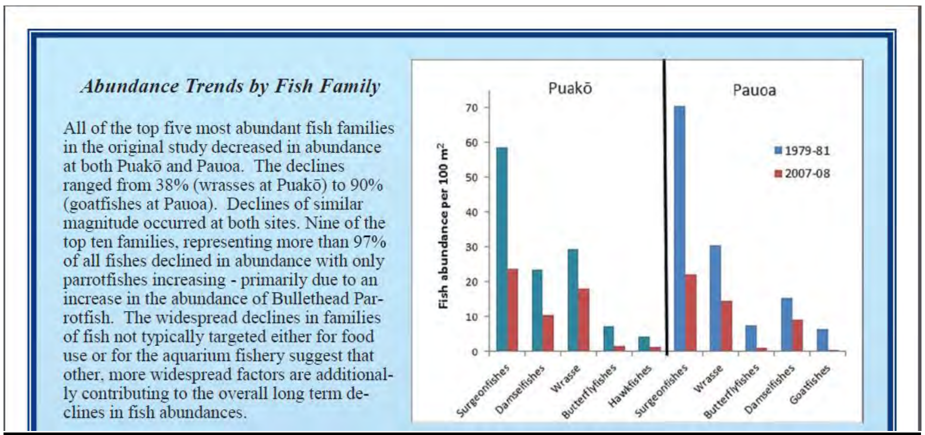

Fig. 10. Drastic declines of the most abundant fish families at two South Kohala Reefs.[82]

The areas south of these reefs are subject to some of the most intense aquarium collecting pressure in the state. Aquarium take between Keahole Point and these reefs in South Kohala, in one year alone, exceeds the aquarium take from the entire Great Barrier Reef in Australia, which has a reef area that is 300 times larger than Hawai'i's. For example, in 2014 aquarium collectors reported taking 191,083 fish from this Hawai'i zone. [83] By comparison, 2014 reported aquarium take from the Great Barrier Reef was 112,000.[84]

Abundant populations of herbivorous fishes are critically important to coral reefs. They keep algae from overgrowing corals or preventing new corals from starting. Important families of herbivorous fishes in Hawai'i include surgeonfishes, damselfishes and parrotfishes. The vast majority of fishes taken by the aquarium trade are surgeonfishes. Yellow Tangs are the dominant herbivore in West Hawaii.[85] They are also the most heavily collected species. The Dire Straits study documented a 90% decline in herbivorous surgeonfish and damselfish populations, while parrotfish populations had actually increased over time.[86]

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[80] Hawai'i FEA at Comment No. 833-24

[81] Jones et al. (2004); Friedlander et al. (2018).

[82] Walsh (2013).

[83] DLNR Aquarium Catch Reports.

[84] Queensland Summary Fishery Reports.

[85] Toonen (2011).

[86] Walsh (2013).

This aforementioned 90% decline in herbivores contributed to a 35% reduction in coral cover, a 64% reduction in coral building coralline algae, a 38% increase in algae at one site and a staggering 322% increase in algae at another. DLNR claims that parrotfishes are more important herbivores than surgeonfishes when it comes to keeping algae in check on coral reefs. [87] On these South Kohala reefs, the increased parrotfish populations were not enough to offset the loss of surgeonfishes and damselfishes, and the algae still outcompeted the corals. The notion that surgeonfishes taken by the aquarium trade are not an important component to coral reef health is challenged by this study.

The FEAs attempt to downplay the importance of surgeonfishes and other herbivorous fishes taken by the trade by citing a 2003 study by Tissot and Hallacher (described more in the next section) that found no evidence of increased algal growth in areas of collection versus areas without collection, despite reduced fish abundance in the collected areas.[88] However, the authors concluded that the study may not be a good test of that hypothesis for several reasons and that further investigation is warranted.[89]

Further, a more recent assessment of ecosystem trends in West Hawai'i includes, among other data, the differences in herbivore biomass and coral cover between reefs on the northern portion of the West Hawai'i coast (which encompasses the South Kohala area described above and extends from Keahole Point, northward) and reefs on the southern portion (from Keahole Point, southward).[90] The data shows that herbivore biomass in the north is significantly lower than that found on the south.[91] Additionally, while the northern reefs are now dominated by algae, and coral cover has declined by ~30%, the same not true for the southern reefs.[92] Notably, though the northern area is ~33% smaller than the area to the south, catch reports do not indicate a corresponding reduction in take. In fact, in 2014 take was higher in the north than in the south.[93] The extent to which heavy collection pressure in the north has contributed to this shift must be thoroughly addressed in the Hawai'i EIS.

The FEAs also attempt to downplay the importance of herbivores taken by the trade by claiming that they target the smaller fish which are "the least effective sizes for cropping algae."[94] A comparison of adult Yellow Tang densities in the West Hawai'i long-term protected areas (i.e. MPAs) vs. the Open Areas, shows that collection pressure on small, juvenile, Yellow Tangs has reduced the natural abundance of adults, which are 2 – 4 times larger than juveniles, by an average of 60%.[95]

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[87] DLNR (2015); KHON TV (2015).

[88] Hawai'i FEA at 89; O'ahu FEA at 68

[89] Tissot and Hallacher (2003).

[90] Gove et al. (2016).

[91] Gove et al. (2016).

[92] Gove et al. (2016).

[93] DLNR Catch Reports

[94] Hawai'i FEA at 89; O'ahu FEA at 68

[95] Hawai'i FEA at 77 (Table 9).

The fact remains that algae now dominates many West Hawaii reefs, making it essential that the EISs thoroughly evaluate and mitigate any Applicant impacts that occur as a result of reduced herbivory.

2. Examples of Impacts to Species

Two peer reviewed studies documented the magnitude of the effect of aquarium collecting on natural populations of heavily targeted species by the aquarium trade. One, published in 2003 by Tissot and Hallacher, was conducted the two years prior to the establishment of the West Hawai'i Fish Replenishment Areas (i.e. aquarium no-take zones).[96] The next study, by Tissot, et al., was conducted in 2000-2002, three years after those area closures.[97] The results of each study showed that aquarium collectors have a significant effect on the abundance of targeted aquarium fishes (see Fig. 11).

Taxa	This Study	Tissot and Hallacher (2003)
Acanthurus achilles	−56*	−58*
Centropyge potteri	−42*	−46*
Chaetodon multicinctus	−4	−38*
Chaetodon ornatissimus	−7	−39*
Chaetodon quadrimaculatus	−97*	−42*
Ctenochaetus strigosus	−14*	−15
Forcipiger spp.	−55*	−54*
Zanclus cornutus	−49*	−46*
Zebrasoma flavescens	−43*	−47*
Overall	−26*	

Note: Statistical differences in density between reference and FRA sites were tested using a two-sample *t*-test (* = significant at $P < 0.05$). Mean estimates are compared with the study of Tissot and Hallacher (2003), which estimated the effects of aquarium collectors on these species in a previous study in West Hawai'i.

Fig. 11. Effects of aquarium collecting on nine heavily collected aquarium species. Significant declines, ranging from 14% - 97%, were seen in 7 of 9 species.[98]

The U.S. Coral Reef Task Force described these results as follows: "Severe overfishing for aquarium trade occurs even in the United States: Aquarium fishes outside of reserves [in West Hawai'i] experience significant declines – from 14% to 97%."[99]

In a 2010 grant report to NOAA, DLNR documented that "a number of aquarium-targeted species have not responded to the increase in protected areas and have actually decreased in West Hawai'i

[96] Tissot & Hallacher (2003).
[97] Tissot et al. (2004).
[98] Tissot et al. (2004).
[99] U.S. Coral Reef Task Force, Trade Subgroup Report (2005).

since 1999" (see Fig. 12).[100] Per DLNR aquarium catch reports, these species are also among the top 20 most harvested fishes. Nonetheless, all but two species, the Moorish Idol and the Hawai'ian Cleaner Wrasse, were included in the West Hawai'i 40 Species White List adopted in 2014. DLNR therefore calls for the continued harvesting of these species, despite knowing that their populations are in decline.

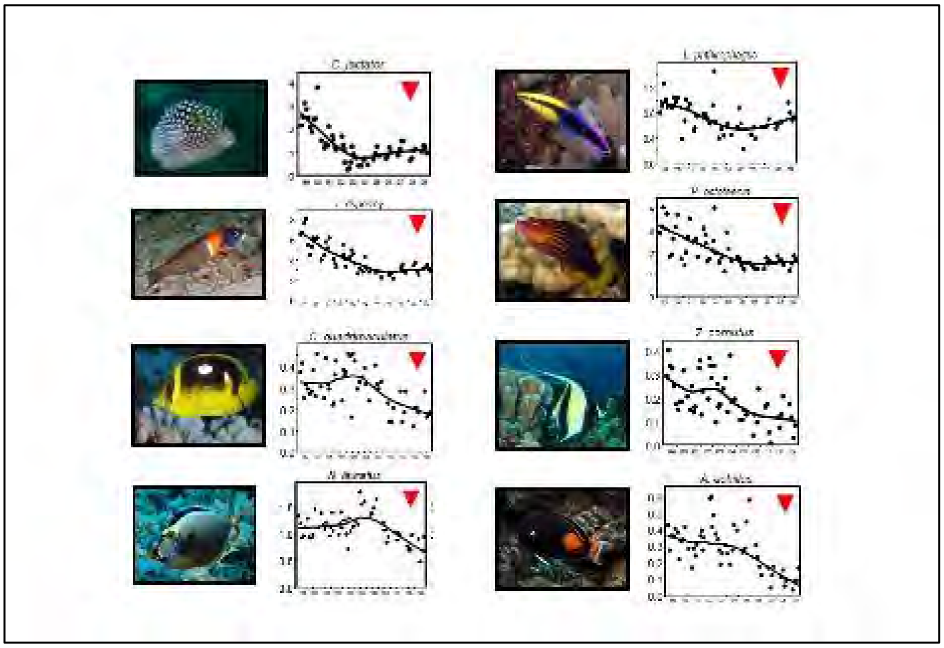

Fig. 12. Example of some targeted aquarium species that failed to respond to FRA's and had decreased along the West Hawai'i coastline from 1999 - 2010 (x-axis = year; y-axis = # 100 sq. meters).[101]

Three species identified in the SWAP, the Bandit Angelfish, Bluestripe Butterflyfish, and Hawai'ian Turkeyfish Figure 4 (in gold outline) were included in a DLNR presentation on West Hawai'i Species of Special Concern (Fig. 3) where two were described as routinely seen in the 1970's and now very rare, and one was described as down by 99% in two different areas.[102]

In West Hawai'i the decline of butterflyfishes has been well-documented in both population surveys and aquarium catch data. A 2008 presentation on West Hawai'i aquarium species of special concern reported declines in butterflyfish abundance and diversity.[103] Two species were particularly hard hit: the Bluestripe Butterflyfish and the Teardrop Butterflyfish, experienced population declines ranging from 89% - 100% in two West Hawai'i areas (see Fig. 13).

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[100] Walsh et al. (2013).

[101] Walsh et al. (2013).

[102] Williams & Walsh (2008).

[103] Williams & Walsh (2008).

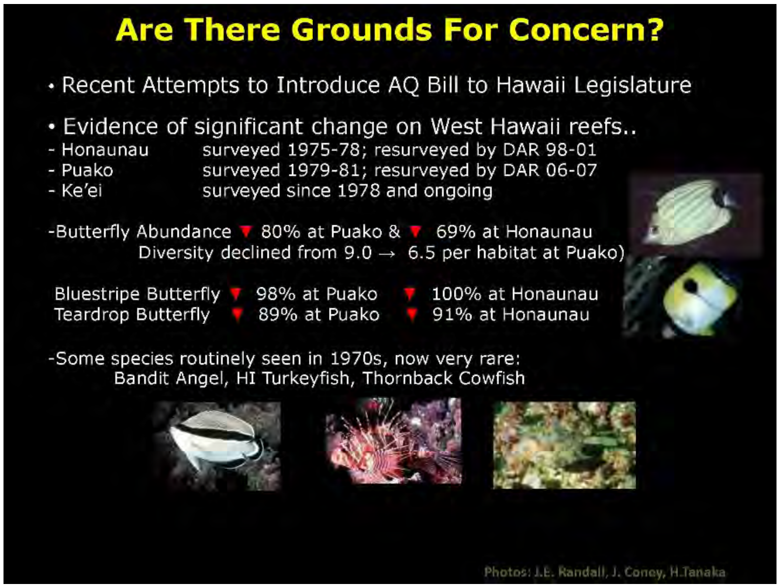

Fig. 13. Aquarium trade impacts to heavily targeted butterflyfishes and other species in West Hawai'i.

The Bluestripe Butterflyfish is a highly unique, endemic Hawai'ian species that, having no sister species elsewhere in the Indo-Pacific, is also known as a relic (see Fig. 14).[104] Until 1980, this species was among the top twenty fishes collected in West Hawai'i, with an annual average harvest of 347.[105] By 2012, the last year this species appeared on West Hawai'i catch reports, reported harvest had dropped to a total of nine.[106] This species was excluded from the West Hawai'i forty species White List which went into effect in 2014.[107]

Fig. 14. Relic species, Bluestripe Butterflyfish (Photo courtesy of Lynn Allen).

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104 Randall (1996).

105 DLNR Aquarium Catch Reports 1976 – 2005.

106 DLNR Aquarium Catch Report for 2012.

107 *See* Haw. Code R. § 13-60.4-7.

The 2015 Hawai'i SWAP lists the Bluestripe Butterflyfish among the species of greatest conservation need. Threatened by the aquarium trade, conservation actions include to "protect current populations, but also to establish further populations to reduce the risk of extinction."[108]

According to DLNR reef surveys and catch data, the Teardrop Butterflyfish has also experienced drastic declines on West Hawai'i reefs (see Fig. 13). This beautiful species is named for the striking upside-down black teardrop located mid-body (see Fig. 4).

Until 1980, the Teardrop Butterflyfish was among the top ten fishes collected in West Hawai'i with an average annual harvest of 1,454 individuals (see Fig. 15).[109] During the following five years, the harvest rate dropped, but it was still among the top twenty species collected (see Fig. 15).[110] Though collection continued until at least 2013, by the late 1990's DLNR considered Teardrop Butterflyfish as no longer targeted by the aquarium trade and excluded them a list of aquarium targeted species provided to researchers, Brian Tissot and Leon Hallacher, who were embarking on a project to document the magnitude of the effect of aquarium collecting on natural populations.[111] They were, however, included in the surveys to test assumptions since they were similar to targeted species.[112] The researchers encountered just one individual Teardrop Butterflyfish during the entire study and so they were excluded from further analysis.[113]

Taxa	1980	1985	1990	1995	2000	2005
Bluestripe Butterflyfish	347	85	269	77	58	12
Teardrop Butterflyfish	1,454	185	508	158	204	185

Fig. 15. Adapted from DLNR Hawai'i Island reported catch data for top 20 aquarium species. Data represents statewide annual average catch over five-year periods.

In 2011 a group of divers encountered an aquarium collector at a popular North Kohala dive site. They watched in horror as the collector scooped up the first Teardrop Butterflyfish they had seen in that area in years along with a number of Yellow Tangs and other fishes (Fig. 16).[114] In 2013, the last year Teardrop Butterflyfish appeared on aquarium catch reports, reported take had dropped to

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[108] DLNR, Species of Greatest Conservation Need (2018).

[109] DLNR Aquarium Catch Reports 1976 – 2005.

[110] DLNR Aquarium Catch Reports 1976 – 2005.

[111] Brian Tissot 2010. Email communication with Rene Umberger

[112] Tissot & Hallacher (2003).

[113] Tissot & Hallacher (2003).

[114] Brooke Everett 2011. Pers. Communication with Rene Umberger

a total of ninety, reflecting a 99% drop in annual catch since 1980.[115] This species was excluded from the West Hawai'i forty species White List which went into effect in 2014.

Fig. 16. Teardrop Butterflyfish captured by an aquarium collector on a North Kohala Reef (photo courtesy of Brooke Everett).

The exclusion of any formerly collected species from the White List, such as the Bandit Angelfish, Bluestripe Butterflyfish, Hawai'ian Turkeyfish, Teardrop Butterflyfish, or Thornback Cowfish, is not an exemption for a thorough analysis of their current status within the West Hawai'i Regional Fishery Management Area (WHRFMA) and elsewhere on Hawai'i Island, compared to the baseline (i.e. historic natural abundance), nor does it exempt the need for thorough analysis of impacts from collection efforts elsewhere in the state.

The aquarium fishery in West Hawai'i takes 1.8X more reef fish than recreational and other commercial fishing combined. Most of these fish are Yellow Tangs.[116]

"Overall Yellow Tang abundance in 30'-60' hardbottom habitat in West Hawai'i increased by 355,758 individuals from 1999/2000 to 2010-2012 even though Yellow Tang abundance in the Open areas decreased by 21%. <u>This decrease is attributable largely to an increase in the number of aquarium collectors and collected animals</u> relative to the period when the FRAs were established."[117]

Over sixty percent of West Hawai'i reefs are open to the aquarium trade. On the reefs in those areas, the impact of the aquarium trade on natural populations of Yellow Tangs has been a significant reduction in the abundance.[118] For example, natural populations were reduced by over 75% in

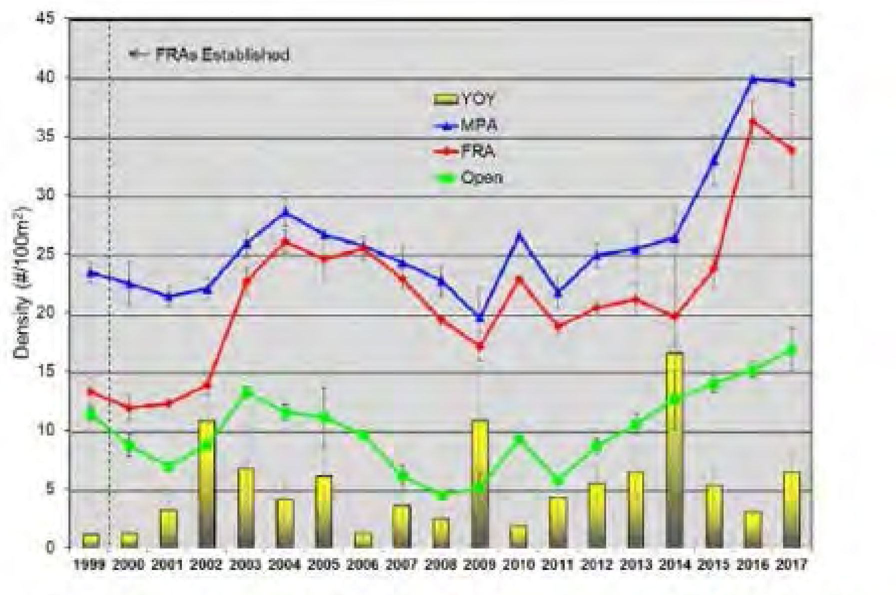
[115] DLNR Aquarium Catch Report for 2013.

[116] DLNR (2014).

[117] Walsh et al. (2013).

[118] Tissot & Hallacher (2003); Tissot et al. (2004); DLNR (2014).

2007-2009 and in recent years, by 60% (see Fig. 17). The increase in FRA Yellow Tang abundance that began in 2002, three years after establishment of these protected areas, is a clear example of the impact of the trade on natural populations: when collection pressure is removed, given enough time, populations may be able to rebound. As noted earlier, the overall increase in Yellow Tang abundance that has occurred since 2014 is due to an anomalous recruitment pulse that coincided with warming waters in 2014.[119] Typical recruitment pulses, such as those that occurred in 2002 and 2009, have resulted in short-lived increases in fish populations that were followed by prolonged or short and steep population declines (see Fig. 17).



Overall changes in Yellow Tang density (Mean ± SE) in FRAs, MPAs, and Open Areas, 1999-2017. Yellow vertical bars indicate mean density (MAY-NOV) of Yellow Tang YOY. YOY are not included in trend line data (DAR 2018b).

Fig. 17. Overall changes in Yellow Tang abundance 1999-2017. As shown by the large gap between the green line (areas open to the aquarium trade) and blue line (long term protected areas which serve as a proxy for natural abundance), millions of Yellow Tangs are missing from West Hawai'i reefs.[120]

3. Achilles Tang Conservation Proposed Alternative

We agree with DLNR that the Achilles Tang Conservation Alternative does not provide a scientific basis for concluding that the proposed reduction would be sufficient to sustain the population. Further, in 2014 a bag limit of 10 Achilles Tang per day was imposed on the aquarium trade in an attempt to address declining populations in West Hawai'i. Since 2014, the price has increased, populations have decreased. The FEA proposes to reduce the daily bag limit to 5 per day for commercial aquarium purposes and create a 5 per day bag limit for all consumptive purposes, as well. As with other heavily targeted aquarium species, the natural abundance of Achilles Tangs, as

[119] Gove et al. (2016).

[120] Hawai'i FEA at 79.

indicated by population densities in long-term protected areas such as MPAs, is substantially diminished by aquarium trade collection pressure.[121]

Most importantly, a serious flaw in the DLNR data used by the Applicant to show Achilles Tang catch as a percentage of the Open Area population substantially underestimates the impact of collection pressure. DLNR compared Achilles Tang average reported catch over FY 2013 – 2014 to their CY 2012 – 2013 Achilles Tang Open Area population estimate and determined that catch as a percentage of Open Area population was 32.7%.[122] An examination of catch report data reveals that had they used reported catch from the same time period as the population estimate (i.e. CY 2012 – 2013), Achilles Tang catch as a percentage of Open Area population was substantially higher (see Fig. 18).[123]

Time Period	Achilles Tang Reported Catch	30' – 60' Open Area Population 2012 - 2013	Catch as % of 30' – 60' Open Area Population
FY 2013 - 2014	7,073*	21,627	32.7%
CY 2012	28,649	21,627	132.4%
CY 2013	9,623	21,627	44.5%
CY 2012 - 2013	19,136*	21,627	88.5%

* Averaged

Fig.18. West Hawai'i Open Area population estimate of Achilles Tang based on WHAP and DLNR data and percent of the population taken annually by the aquarium trade at the 30' – 60' depth over CY 2012 – 2013 (adapted from Table 6 in Hawai'i FEA).

This exemplifies the potential for extreme over-collection by the trade; the need for a thorough review of annual reported catch numbers and their relationships to the populations of aquarium targeted species in the areas from which they taken; and, the need for mechanisms for real-time assessments and adjustments to protect these vulnerable species.

B. Island of O'ahu

1. Examples of Impacts Documented in Various O'ahu Regions

Unlike West Hawai'i, no aquarium fish population data was gathered during the early years of aquarium trade operations on O'ahu reefs. More recent data has been gathered in a yet to be published study by Dr. Gail Grabowsky of Chaminade University and is summarized below. Dr. Grabowsky reached the same conclusions reached by Williams and Walsh in a 2007 report documenting declines in populations of certain fishes on two Hawai'i Island reef areas: commercial

[121] Hawai'i FEA at 77 (Table 9).

[122] Hawai'i FEA at 58; DLNR (2014).

[123] Hawai'i FEA at 74, 98, 104; DLNR (2014); DLNR Aquarium Catch Reports.

aquarium collecting is implicated in the declines; and, the greatest declines are seen in the species that have faced the heaviest fishing pressure.[124]

- Using the same methods described in earlier research on Hawai'i Island documenting the magnitude of the effect of aquarium collecting on natural populations of heavily targeted species, Dr. Grabowski and her team quantified the abundance of aquarium collected fish at over 20 sites around O'ahu from 2008- 2010.[125]

- Surveyed species included Yellow Tangs, Forcepsfish, the Hawai'ian "Domino" Damselfish, as well as additional butterflyfishes, surgeonfishes, and other fishes targeted by the aquarium trade.

- The fish population surveys showed that species targeted by the aquarium trade are ten times more abundant at Hanauma Bay, Hawai'i's first marine life conservation district, protected since 1967, than they are on other O'ahu survey sites.[126] As with the Hawai'i Island studies conducted by Tissot and others, uncollected sites were selected as controls and served as a proxy for estimating natural abundance.[127] [128]

- The data also showed that aquarium fish are rare at Pupukea and Coconut Island in Kaneohe Bay, both of which are protected similarly to Hanauma Bay, but unlike Hanauma Bay, are easily accessed by poachers.

- There were no juvenile fish smaller than a silver dollar at Hanauma Bay, which led Dr. Grabowsky to surmise that it may be "that the fish are so depleted on O'ahu that those we see are the "living dead" who cannot effectively maintain a population due to their rarity. This is called the Allee effect and has been documented in other rare species."[129]

In addition to population surveys, catch data can provide an important view into the status of populations of targeted fishes. As explained elsewhere in these comments, using catch data to estimate the proportion of fishing mortality to total population is highly problematic since catch reports are unverified and both underreporting and non-reporting are highly likely. However, where baseline population data are absent, and where consumer demand exists for a particular species or family group, it is highly likely that substantial declines of reported catch reflect reduced abundance of the target sizes—juveniles in most cases—of those species or families Hawai'i's reefs.[130] In fact, historical catch reports have been used to document the collapse of the aquarium fishery on southwest O'ahu reefs after hurricane Iwa hit Hawai'i in 1982 and damaged many

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[124] Williams & Walsh (2007); Grabowsky (2011); Grabowsky (2014).

[125] Grabowsky (2011).

[126] Grabowsky (2014).

[127] Tissot & Hallacher (2003).

[128] Tissot et al. (2004).

[129] Grabowsky (2011).

[130] Walsh et al. (2004).

reefs.[131] Per anecdotal reports from a number of aquarium collectors, the storm destroyed important habitat for Yellow Tangs and other targeted species. This resulted in the migration of many fishes to undamaged coral reef areas. Aquarium collectors then concentrated their efforts on these sites and within a few short years, populations of species targeted by the trade completely collapsed.[132] Referring to these data, researchers noted that since Yellow Tangs are in high demand, these declines reflect the situation on these reefs (i.e. reduced abundance of the small Yellow Tangs targeted by the trade) (Walsh et al. 2004). Catch reports from 2016 confirm that Yellow Tang populations have yet to recover (see Fig. 19, 20).[133]

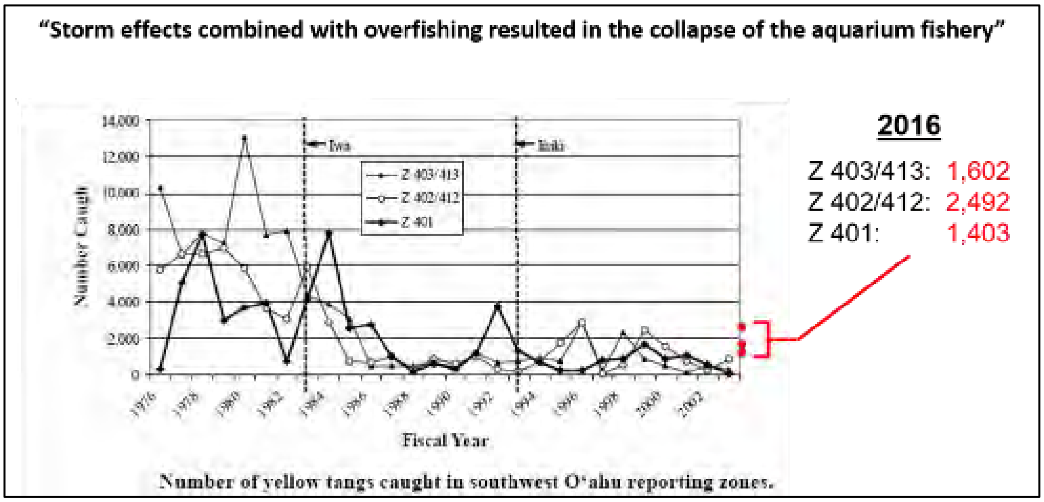

Fig. 19. Catch reports document the collapse of Yellow Tang populations along O'ahu's SW coastline.[134]

[131] Walsh et al. (2004).

[132] Walsh et al. (2004).

[133] DLNR Aquarium Catch Reports 2017.

[134] Walsh et al. (2004).

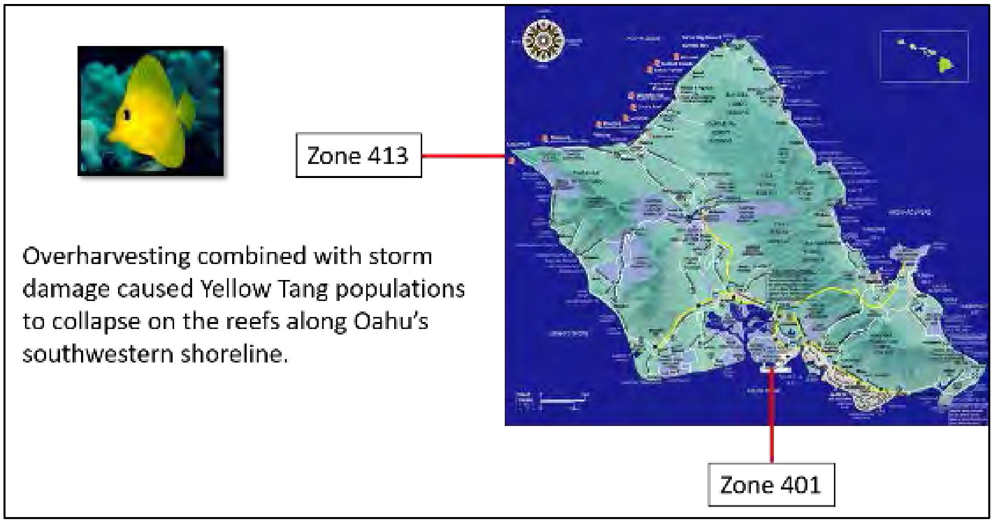

Fig. 20. Map of area encompassed within aquarium catch reporting zones 401 - 413.[135]

2. Examples of Impacts to Species

As previously mentioned, the decline of butterflyfishes on O'ahu has also been documented in the aquarium fish population surveys conducted by Dr. Gail Grabowsky which showed a 90% decline in natural populations of butterflyfishes and other fish species heavily targeted by the aquarium trade.[136]

The Bluestripe Butterflyfish (see Fig. 14) was among the top fifteen aquarium fishes captured on O'ahu through the five-year period that ended in 1995.[137] As of the five-year period that ended in 2015, reported catch had declined by 79% from the five-year period that ended in 1980. In 2016, reported catch dropped an additional 15% (see Fig. 21).[138] As previously noted, the Bluestripe Butterflyfish is listed among the species of greatest conservation need in the 2015 Hawai'i SWAP. Despite this listing and the alarming decline in reported catch, no take limits were placed on this species in the O'ahu Aquarium Rule.

Reported catch of the Teardrop Butterflyfish has also experienced drastic declines on O'ahu reefs (see Fig. 19). During the ten-year period 1976-1985, the Teardrop Butterflyfish was among the top ten fishes collected on O'ahu with an average annual harvest of 2,558 individuals (see Fig. 21).[139] During the following five years, the harvest rate dropped, but it was still among the top twenty species collected.[140] As of the five-year period that ended in 2015, reported catch had declined by

[135] Walsh et al. (2004).

[136] Grabowsky (2014).

[137] DLNR Aquarium Catch Reports.

[138] DLNR Aquarium Catch Reports.

[139] DLNR Aquarium Catch Reports 1976 – 2005.

[140] DLNR Aquarium Catch Reports 1976 – 2005.

94% from the five-year period that ended in 1980. In 2016, reported catch dropped an additional point (see Fig. 21).[141]

The Bandit Angelfish is another beautiful and highly unique, endemic Hawai'ian species with a color pattern unlike that of any other angelfish on Earth (see Fig. 22).[142] The Bandit Angelfish has been among the top twenty aquarium fishes captured on O'ahu on and off since 1976, most recently in 2016.[143] During the five-year period 1976-1980, annual reported catch averaged 1,380 individuals (see Fig. 21). After that, annual reported catch rarely exceeded 600 individuals and from 1996-2005 the average was less than 100.[144] As of the five-year period that ended in 2015, reported catch had declined by 64% from the 1976-1980 high (see Fig. 21).[145]

Average Annual Catch 5 YEAR PERIOD ENDING (except 2016)								
Taxa	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2015**	**2016**
Bluestripe Butterflyfish	2,226	1,886	2,110	1,629	1,079	127	478	124
Teardrop Butterflyfish	2,616	2,499	1,574	485	896	295	160	131
Bandit Angelfish	1,380	541	154	152	77	70	491	559

Fig. 21. O'ahu Reported Aquarium Catch of the Bluestripe and Teardrop Butterflyfish and Bandit Angelfish.[146]

[141] DLNR Aquarium Catch Reports 1976 – 2005.

[142] Hoover (1993).

[143] DLNR Aquarium Catch Reports.

[144] DLNR Aquarium Catch Reports.

[145] DLNR Aquarium Catch Reports.

[146] DLNR Aquarium Catch Reports.

Fig. 22. Bandit Angelfish (By NOAA's National Ocean Service)

Catch reports also indicate increasing consumer demand for this precious species in the landed value data. From 1976-2003 the average landed value for a Bandit Angelfish was $10.[147] By 2004 it had jumped to $54 and in recent years has skyrocketed to $137 each.[148] A similar pattern was noted for Bandit Angelfishes captured in West Hawai'i and prompted University of Hawai'i (UH) and DAR researchers to point out that decreasing catch combined with increasing value signals a real population decline.[149]

Not surprisingly, the Bandit Angelfish is also listed among the species of greatest conservation need in the 2015 Hawai'i SWAP. Threatened by the aquarium trade, conservation actions include to "protect current populations, but also to establish further populations to reduce the risk of extinction."[150]

The O'ahu aquarium rule established a daily bag limit of two Bandit Angelfishes greater than 5.5 inches in length. Commercial data does not capture fish sizes so the impact of this size limit cannot be determined.

3. O'ahu Aquarium Life Management

Rules governing the take of certain aquarium species on O'ahu were adopted in 2014.[151] The development and adoption of these rules was highly controversial because they were not

[147] Walsh et al. (2004).

[148] DLNR Aquarium Catch Reports.

[149] Williams and Walsh (2008).

[150] DLNR, Species of Greatest Conservation Need (2018).

[151] Haw. Code R. §§ 13-7-1 et seq.

scientifically sound and did not address the concerns of stakeholders outside the aquarium trade.[152] Over 4,000 testimonies were received by DAR, and 98% of the comments preferred that aquarium collecting should end altogether or in the very least should include limits on the number of permits issued, and scientific and community-based limits on species and take levels. Many comments noted that the so-called "limits" allowed take that far exceeded the number of animals historically taken by the trade, and in fact, allowed limitless catch because they included no restrictions on input (i.e. permit limits), and no meaningful restrictions on output (species or take limits).[153]

Among those opposed to the rules was coral reef and marine fisheries biologist, Frazer McGilvray, who was the DAR Administrator at the time. Mr. McGilvray opposed the rules because they were neither based on science, nor were they developed under a multi-stakeholder approach. The written and oral testimony Mr. McGilvray presented to the board governing DLNR included the following:

- "All stakeholders should be consulted and everyone's opinion should be taken into account."
- "There appears to be no scientific basis for the proposed bag limits for each species."
- "The proposed take limits were akin to setting a speed limit at 400 MPH."
- "These rules do not address the take of undersize, sexually immature fish."
- "The majority of Yellow Tang allowed to be taken under this rule are immature and have not contributed to the future of the species."
- "These rules, driven by the demands of the trade, are contrary to good natural resource management."
- "The take of juveniles is generally prohibited" in other fisheries, but not by the aquarium trade.
- "The take of adults is allowed, but only where good management practices govern the take" in other fisheries, but not by the aquarium trade.
- "The taking of 100 immature Yellow Tang per person per day is not consistent with good natural resource management when there are more than 50 licensed aquarium collectors on O'ahu."
- "It is my belief that these rules require further work and are not yet ready for adoption." [154]

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[152] Board of Land and Natural Resources, Minutes (2014); Hawai'i Small Business Regulatory Review Board, Proposed O'ahu Regulations Analysis (2012); Hawai'i Small Business Regulatory Review Board, memo to DLNR (2012).

[153] Hawai'i Small Business Regulatory Review Board, memo to DLNR (2012); Board of Land and Natural Resources, Item F-2 Submittal (2014). October 24, 2014. Item F-2 Submittal.

[154] Board of Land and Natural Resources, Minutes (2014); McGilvray (2014).

The DLNR submittal to the board conceded that the proposed limits were not intended to reduce take, but were, instead, based on animal welfare.[155] This statement does not stand up to scrutiny since no animal welfare experts or groups familiar with the aquarium trade were consulted, and in fact, the concerns of several of these groups were dismissed outright.

The 2014 O'ahu rules also imposed bag limits for certain sizes of three species: a minimum and maximum (i.e. slot) limit for Yellow Tangs and maximum size limits for *kole* (bag limits of two of each size) and Bandit Angelfishes (bag limit of two). While there has been some discussion of the poor survival rates of very small Yellow Tangs, no such discussion was documented for the larger sizes. Finally, because aquarium catch reports do not capture fish sizes, it is impossible to determine or even estimate the impact of a size limit in the aquarium fishery."[156] However, catch reports do show that despite the combined catch, size and vessel limits, Yellow Tang catch in 2015 and 2016 exceeded historical reported catch. This was due to an unprecedented warm water event that bleached and killed many corals, but also brought large numbers of young fishes to Hawai'i's reefs during 2014 and 2015.

4. Other O'ahu Regulated Species and Invertebrates

The O'ahu FEA's discussion of other regulated species describes the Achilles Tang, Bandit Angelfish, and Hawai'ian Cleaner Wrasse as "not collected to the level of the top twenty collected species." [157] However, according to both historical and recent catch data, this is inaccurate. These three species have historically, and recently in one case, been among the top twenty collected species on O'ahu as follows:

- Achilles Tang was among the top twenty during the five-year period that ended in 1985.
- Bandit Angelfish was among the top twenty during the five-year period that ended in 1980 and again in 2014, 2015 and 2016.
- Hawai'ian Cleaner Wrasse among the top twenty during the five-year period that ended in 1980.

Bandit Angelfish have been described earlier, and Achilles Tangs are both a culturally important food source and an important herbivore on the reef. The Hawai'ian Cleaner Wrasse plays a particularly critical role in the reef ecosystem by feeding on parasites, dead tissue and mucus of reef and other fishes (see Fig. 23). In 2008 the West Hawai'i aquarium trade included the Hawai'ian Cleaner Wrasse in its list of Species of Special Concern that should not be captured, citing the key role the play in maintaining the "health of the reef population, as the doctors of the sea".[158] Obviously this species plays a similar role on reefs throughout Hawai'i. This is another clear example of how the dictates of the North American aquarium trade are driving extremely poor management decisions. The cumulative impact of long term sustained heavy collecting pressure on

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[155] Aila (2014).

[156] DLNR, Small Business Impacts Analysis (2012).

[157] O'ahu FEA at 41; DLNR catch reports.

[158] Walsh, Background on Proposed Hawai'i Administrative Rule 13-60.4 (2013).

these and other species, and its effects on coral reef ecosystems must be fully evaluated and proper mitigation must be proposed in the EISs.

Fig. 23. A pair of Hawai'ian Cleaner Wrasses cleaning a Hawai'ian Hogfish (photo credit: Victoria Martocci).

In addition to fishes, marine invertebrates such as hermit crabs, Feather Duster Worms, sea stars and snails, are taken in very high numbers by commercial aquarium collectors. These invertebrates play a key role in the coral reef environment, and their overharvesting may have serious ecological consequences.[159] The EISs must address the very large numbers of invertebrates that are taken and proper mitigation measures must be proposed.

Concerns expressed by experts about the very high levels of hermit crab collection include:

- "The removal of available shells, a critical resource for hermit crabs, will doom the hermit crab population in any given area; replenishment of shells of all sizes due to natural causes will not be able to keep up with the artificial removal by collectors; hermit crabs are essential to the ecosystem. Not only are they grazers but even more importantly they are detritus feeders and scavengers keeping the ecosystem 'clean'." [160]
- "Collectors do not merely take the crabs, they take also the shells. This amounts to destroying the available habitat for these animals; hermits regularly outgrow their shells and seek new ones, leaving the smaller shells for smaller hermits. When a hermit dies, it leaves its shell for another hermit; taking all the shells will leave no shells for hermits to live in. The population will crash; taking the shells will eventually make shells so uncommon that there are virtually no hermits." [161]

5. Expanded Waikiki MLCD and Flame Wrasse Conservation (Preferred) Alternative

[159] Livengood & Chapman (2007).

[160] Dr. Ernie Reese, UH Professor Emeritus, Biology, Behavioral ecology of coral reef animals. 2008 email communication with Rene Umberger.

[161] John Hoover, Author of Hawai'i's Sea Creatures: A Guide to Hawai'i's Marine Invertebrates. 2008 email communications with Rene Umberger.

The O'ahu FEA proposes to expand the Waikiki Marine Life Conservation District MLCD by 740 acres, and to prohibit only commercial aquarium collection within that expanded area.[162] We concur with the Agency that this alternative is problematic for a number of reasons, including its lack of proper scientific review of the impacts. While it is expected that once collection pressure is removed, there may be a beneficial impact of increasing populations of targeted species, it is also expected that without concurrent reductions in allowable take, populations in the areas open to collection are likely to experience further declines as a result of increased pressure that result from reduced access elsewhere, as has been demonstrated in West Hawai'i.

In addition, the O'ahu FEA proposes a bag limit of 10 Flame Wrasses per day. We concur with the Agency that this proposal lacks a scientific basis for concluding that a bag limit of 10 per day would be sufficient. Not only would the bag limit apply to a limitless number of people, and as such, would neither limit actual take nor would it help to restore or protect populations from increasing collection pressure, it also fails to address the potential for extirpation of Flame Wrasses on coral reefs shallower than 98 feet where collection pressure is the greatest.

As pointed out in the O'ahu FEA, a recent study found zero Flame Wrasses shallower than 98 feet on West Hawai'i reefs.[163] Rather than an indication that Flame Wrasses spend much of their time in deeper waters, an idea forwarded in both FEAs with no reference, the absence of Flame Wrasses in their natural range is more likely an indicator of severe over-collection by the trade in the shallower depths they once inhabited. Flame Wrasses naturally occur at depths over 50 feet. [164] SCUBA divers, including two of the Commenters, have for decades consistently encountered harems of Flame Wrasses at depths ranging from 50 – 90 feet on multiple dive sites, as long as the sites weren't accessed by the aquarium trade. On sites accessed by the trade, Flame Wrasses at those depths have completely disappeared.[165]

Historical catch records indicate that collection pressure on O'ahu populations of Flame Wrasses has dramatically increased: hundreds were annually captured prior to 2008; since then, annual catch has ranged between 1,000 - >4,000.[166] The potential for Flame Wrasses to disappear from shallower reefs around O'ahu, as they have from West Hawai'i, is very real. This increasing collection pressure must be acknowledged and addressed in the EISs.

V. Reliance on Inadequate Science and Data

A. Flawed Threshold for "Sustainable" Collection

The applicant continues to base both FEAs on the premise that fish collection is considered sustainable if only removes less than 5% to 25% of the entire population (annually), but the reasoning behind this threshold is flawed. The FEAs stated that "research suggests that collection

[162] O'ahu FEA at 13.
[163] O'ahu FEA at 35.
[164] Randall (1996); Hoover (2008).
[165] Observations communicated by Rene Umberger, Mike Nakachi, Lynn Allen, Warren Blum, all SCUBA instructors with tens of thousands of dives between them
[166] DLNR catch reports.

between 5% and 25% of a reef fish population is sustainable for various reef fish species in the Philippines that are similar to those on the White List (e.g., tang, wrasse, butterflyfish, angelfish, and triggerfish)" based on a *Reef Check* report by Ochavillo and Hodgson (2006).[167] However, the EISs should not use these thresholds because:

- These thresholds for sustainable ornamental fish collection are species–specific based on estimated natural mortality rates (M) and fishing mortality at maximum sustainable yield (F_{MSY}) or year-per-recruit analysis. Natural mortality rates for reef fishes are based on growth rates and length and thus are also area-specific. Mortality is based on catch data. Yield-per-recruit analysis should be derived from several annual surveys. Thus, these parameters should be specifically calculated for Hawai'ian reef fish targeted by the aquarium industry as highlighted in Ochavillo & Hodgson (2006).
- The 5%-25% threshold indicates "a good rule-of-thumb of collection limit" for coral reef fishes in the Philippines.[168] This does not mean it is a good rule of thumb for collecting reef fishes in Hawai'i.
- Most ornamental fish species in Ochavillo and Hodgson (2006) are species different from those on the White list. Only a few species share the same genus or species (butterflyfish, a couple of wrasses, one angelfish, a couple of damselfish, one tang and one triggerfish). Thus, it is questionable whether this fairly wide threshold (5%-25%) is representative and applicable to Hawai'ian species.
- Finally, this report is not peer-reviewed research, it is a field manual: Marine Aquarium Trade for Coral Reef Monitoring Protocol with a Data Analysis and Interpretation Manual. This field manual was designed in part to: "provide a scientific basis for recommending sustainable levels of collection."[169]

The FEAs continue to assume that current fish abundance for target species is the baseline, and thus 1% to 5% of individuals removed from the population would be considered sustainable. But this is wrong. The FEAs still do not acknowledge that current population abundance of most of these fish species is already depleted due to in part to heavy exploitation by the aquarium trade since at least the 1970's and habitat degradation. The total allowable collection/catch for each species must be calculated based on information on natural mortality rates and the available and limited information on collection/catch records, specific to the geographic areas and locations where they are taken throughout the state.[170]

B. Unrepresentative Data Used

The Coral Reef Ecosystem Program (CREP) data used in the FEAs for the entire Islands of Hawai'i and O'ahu (based on 2010-2016 surveys) continue to not be representative of regional population

[167] Hawai'i FEA at 95; O'ahu FEA at 70.

[168] Ochavillo & Hodgson (2006), at 12.

[169] Ochavillo & Hodgson (2006).

[170] *See* Ochavillo and Hodgson (2006) for step by step guidance on how to do this analysis.

abundance such as in East Hawai'i and the WHRFMA, and should not be used to estimate regional proportions of fish catch.

Population abundance estimates for fish species for the entire island of Hawai'i[171] are not representative of regional fish abundances such as East Hawai'i and WHRFMA. The CREP data collect fish data from 257 stationary point count locations around Hawai'i between depths of 0-98 feet. In contrast, the West Hawai'i Aquarium Project (WHAP) collected data from 25 transect survey sites from WHRFMA area between depths of 30-60 feet.

It is well established that population abundances of reef fish species in Hawai'i, especially relatively small-size species that are targeted by the aquarium industry, are highly variable in space depending on reef complexity, depth and wave exposure, and in time (within and among years) depending on the season, mortality, recruitment to the population, and environmental factors.[172] The relative proportion abundance of fish species taken annually by the aquarium industry should be based on regional total abundances and regional catch records (e.g., aligned with the aquarium fish trip report zones). Allowable levels of take should be determined in conjunction with the wishes of Hawai'i residents and visitors who strongly desire that fish populations are restored to their naturally occurring (i.e. unfished) levels of abundance on the majority of Hawai'i reefs.

The FEAs continue to assume that current island-wide and regional targeted fish population estimates are healthy and not impacted and this represents a shifting in baselines. Population abundance of most of these fish species has declined over the past decades due to overexploitation and habitat degradation and thus they cannot be considered baselines. Strong scientific evidence shows that coral reefs of the main Hawai'ian Islands, especially near higher human population densities (where exploitation pressure is the highest), have significantly less abundance and biomass of reef fish species than more isolated islands due to overfishing.[173]

The allowable number of individuals that could be collected from aquarium fish populations must be substantially less than those stated by the FEAs because most of these species are already depleted. Fishing effort has substantially increased for aquarium fish species on the Island of Hawai'i as well as for certain species, such as Flame Wrasses, on O'ahu.[174] Prime-targeted species on both islands have significantly declined due to overharvesting.[175] For example, population abundance of one of the most heavily exploited species, Yellow Tang (*Zebrasoma flavescens*), on the west coast of the Big Island of Hawai'i (West Hawai'i) declined 45% due to exploitation in areas open to fishing/collection from 1999 to 2007.[176] Yellow Tang abundance is closely tied to annual levels of recruitment, and after good recruitment levels from 2008 – 2013, Yellow Tang abundance in the Open Areas improved, but was still 4.7% lower than the 1999 – 2000 Open Area baseline.[177]

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[171] CREP (2018).
[172] Friedlander & Parrish (1998a, 1998b).
[173] Friedlander & DeMartini (2002); Williams et al. (2008); Nadon et al. (2015); Nadon (2017); Friedlander et al. (2018).
[174] DLNR Catch Reports.
[175] Williams et al. (2009); Walsh et al. (2004).
[176] Williams et al. (2009).
[177] 2015 Report to the Legislature.

As noted earlier, an anomalous recruitment pulse in 2014 is likely behind the increase in abundance seen since then.[178]

Even when including marine managed areas (MMAs) such as fish replenishment areas (FRA), where collection is prohibited and abundances are five times higher than in open areas, the population abundance of Yellow Tangs on West Hawai'i is substantially less than historical levels.[179] The established networks of MMAs have definitely worked to increase Yellow Tangs and some other fish species in the West Hawai'i FRAs,[180] but not all species have responded positively, and some have actually decreased overall since the FRAs were established. The extent to which collection pressure—whether in the Open Areas or due to poaching—is driving the decline of heavily targeted aquarium species in the areas closed to the trade must be studied. While the FEA attempts to minimize the impacts of collection pressure by proposing that "factors other than aquarium collecting [are] also affecting their populations," it remains highly likely that the main cause is collection pressure [181] An example of the effect of collection pressure on populations in MMA's is found in the significant decline of Yellow Tangs in those areas from 2004-2009 which coincided with Yellow Tang reported catch during that period that was substantially higher (e.g. in 2004 and 2006 it was more than double that reported in 2002).

Given the relative long life-span of Yellow Tangs (>40 yrs.) and increasing fishing intensity, these MMAs are just becoming sources for the aquarium fishing industry. The recovery of this species to past levels is unlikely if fishing/collection intensity continues or increases in the future.

The commercial aquarium fishery in the Island of Hawai'i has grown over the last three decades, particularly after the O'ahu aquarium fishery substantially declined in the early 1990s due to hurricanes and localized overfishing.[182] It is thought that the expansion of the Island of Hawai'i aquarium fishery was due to new collectors and relocation of collectors from O'ahu.[183] Scientific evidence shows that collecting activities substantially affect targeted species in Hawai'i[184] and fishing intensity remains high even when stocks are depleted or recruitment is weak.[185]

Therefore, the current estimates of population abundance of fish species for the entire Island of Hawai'i (from 2010 to 2016)[186] should not be used as regional/local reference abundances (e.g., East Hawai'i, WHRFMA) to estimate minimum and maximum percentage of fish taken per year.[187] This is because these calculations underestimate the proportion of fish collected by region (East and West Hawai'i) and assumes fish populations of the entire Island of Hawai'i are distinct or discrete. A more accurate calculation of allowable catch would be based on regional population

[178] Gove et al. (2016).
[179] Williams et al. (2009).
[180] Tissot et al. (2004); Williams et al. (2009).
[181] Hawai'i FEA at 60, 99, 101.
[182] Walsh et al. (2004); Friedlander et al. (2008).
[183] Friedlander et al. (2008).
[184] Tissot & Hallacher (2003).
[185] Stevenson et al. (2011).
[186] CREP (2018).
[187] Hawai'i FEA, Tables 10, 11, 12, 13, 14, 15.

abundance, using the aquarium trip report zones, and by using the WHAP data estimates obtained from the depth ranges where the fishes are captured, rather than by regions.

Finally, sustainable fishable abundance for target species must take into consideration the fact that most target species are depleted in comparison with historical levels. The EISs must take into account these depletions to determine the number of individuals that could be taken from the populations. The EISs must analyze the impact of collection/fishing on current population abundance and consider that these populations are far below the historical baselines.

C. Catch Is Grossly Underreported

As mentioned above, there is no requirement for recreational aquarium collectors to report catch. For commercial collectors, while reports are required, catch report compliance is substantially low on the Islands of Hawai'i and O'ahu and thus catch records grossly underestimate the real impact of the aquarium fishery.

The number of permits reporting catch in the islands of Hawai'i and O'ahu was approximately half of the number of commercial aquarium permits issued annually from 2000 to 2017. On average, 47% (40 out 85) of commercial aquarium permit holders reported their catch between 2000 and 2017 in O'ahu.[188] Similarly, on average, 56% (33 out 59) of commercial permit holders in the Island of Hawai'i (WFRFMA and East Hawai'i combined) reported their catch during the past 18 years (see Table 3 in the DEA of Island of Hawai'i). Although commercial aquarium fishers are required to report their monthly catch on an aquarium fish catch report, the compliance is clearly significantly low. This is a systemic problem that undermines the evaluation of the real impact that the aquarium fishery has on target species, the coral reef ecosystem, and the people that depend on them in Hawai'i. As such the impact of the aquarium fishing industry is likely larger than is reported, which has been discussed in the scientific literature.[189]

As a former DLNR employee succinctly wrote regarding aquarium catch reports: "The reliability of the data depends upon the sincerity of the permittees."[190] There is no verification system, such as that provided by independent observers, to ensure the accuracy of self-reported data. One additional major impediment to accurate data stems from the lack of a license requirement for marine dealers and/or exporters. Currently there is a requirement for dealers (i.e. those who buy directly from aquarium collectors) to report their purchases. According to DLNR, the effect is that "dealer reporting is essentially on a voluntary basis and a few dealers are not reporting in whole or in part.[191] DLNR cannot know whether a "few" or a dozen dealers are not reporting, but without a requirement for these businesses to have licenses, these businesses operate beneath the radar and serve as a conduit for moving unreported catch out of the state.

[188] *See* O'ahu DEA, Table 2.

[189] Friedlander et al. (2008).

[190] Katekaru (1978).

[191] DLNR (2014).

Establishing a marine dealer/exporter license has long been a priority for those within DLNR concerned about Hawai'i's marine resources, because it would enable the department to verify catch reports, identify unlicensed collectors (and all commercial fishers), identify dealers and helped with generating economic data about the fisheries. Without this information DLNR/DAR has no accurate data on health of fish populations. According to a former DAR Commercial Fisheries manager, Karl Brookins, the process of establishing the license was abandoned due to lack of funding.[192]

In addition, the combined average of total fish and invertebrates collected under aquarium permits from East Hawai'i and the WHRFMA annually from 2000-2017 should not be used as reference for future annual collections. The lack of collection data for East Hawai'i from 2001 to 2004 lowers the calculated average and underestimates the number of fish collected.[193] A more accurate estimation is to use data collected after 2005 when collection data from East Hawai'i resumed. As such the combined average fish and invertebrates collected under Aquarium Permits from East Hawai'i and the WHRFMA annually from 2005-2017 was 392,006 individuals instead of 355,381 (see Fig. 24). This updated estimate, which accounts for 36,625 more individuals, along with a value representing underreporting, should be used as the reference point for the Hawai'i EIS to calculate proportion of the population that is being taken by the fishery island wide. We note that Table 8 in the Hawai'i FEA has *not* "been updated to exclude any years without data in the averaging for East Hawai'i data," as stated in the Applicant's response.[194]

[192] Clark & Gulko (1999); Brookins, K., DAR commercial fisheries manager, personal communication to author R. Umberger (October 7, 2008).

[193] See Hawai'i DEA, Table 8.

[194] Hawai'i FEA at Comment No. 833-49.

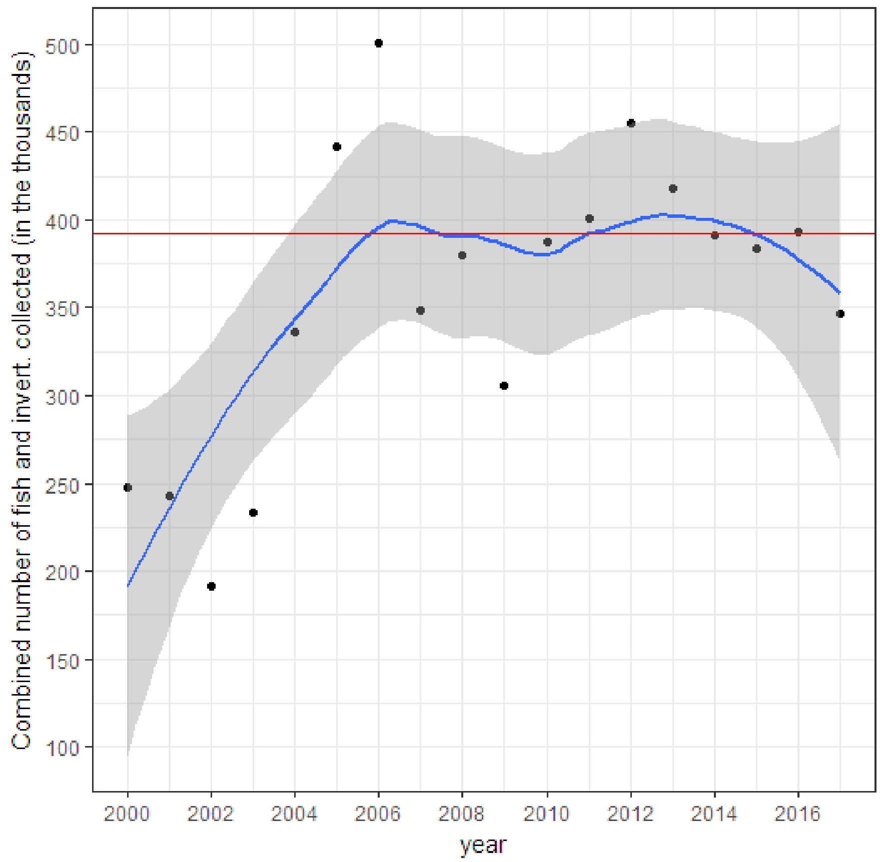

Fig. 24. Combined number of fish and invertebrates collected under Aquarium permits from East Hawai'i and the WHRFMA annually from 2000-2017. Blue line is a loess trend with span of 0.8 and 95% confidence interval (grey area). Red horizontal line is the average between 2005 and 2017. Note that the data before 2005 is missing records from East Hawai'i. Data extracted from Hawai'i FEA, Table 8.

D. Further Data is Needed for an EIS

As discussed above, there is no reliable data on how many fish and other species are actually taken pursuant to aquarium permits in any given year. The FEAs repeatedly referred to a lack of data for numerous species. For example:

- "Because specific species of hermit crabs are not reported on aquarium permits reporting forms, it is not possible to know which species are collected, with the exception of zebra hermit crabs."[195]

- "Due to this underestimation, it is not possible to know the exact proportion of Flame Wrasse population that would be collected. . . ."[196]

[195] Hawai'i FEA at 51.

[196] O'ahu FEA at 70.

- For Psychedelic (Redtail) Wrasse, Tinker's Butterflyfish, Longfin Anthias, Flame Wrasse, Fisher's Angelfish, and Eyestripe Surgeonfish (Palani), open area populations and catch as a percent of the open area populations are not available, because species "occur[] in habitats not adequately surveyed by transects."[197]

This data is necessary in order for the EISs to properly assess impacts. Furthermore, the Agency must conduct stock assessments of species before it is able to determine a sustainable rate of take. Clearly the Agency has not done so, as DLNR personnel have stated that to do so would take over a decade for just 40 fish species, out of the more than 287 fish and invertebrate species the Agency identifies as targeted by the trade (found at Appendix 4).[198] Without such data, the Agency cannot meaningfully assess the environmental impacts of commercial aquarium collection. Such assessments must be completed prior to the issuance of the EISs, and in the face of any uncertainty, the EISs' analyses must err on the side of caution to protect these vulnerable species.

VI. Additional Deficiencies

The FEAs continue to contain additional deficiencies that must be remedied for the Agency to conduct a thorough review of environmental impacts.

A. Lack of Meaningful Alternatives Analyses

Neither FEA considers any alternatives other than the Preferred Alternative, Status Quo Alternative, and a No Action Alternative. HEPA requires EAs to identify and summarize reasonable alternatives.[199] The new Preferred Alternatives ignore the vast majority of comments submitted on the DEAs and instead focus on just two species, Achilles Tangs on Hawai'i Island and Flame Wrasses on O'ahu. They also ignore the many comments naming locations where the impacts of collecting pressure are of concern, and instead arbitrarily name Waikiki as an area where no commercial collection would occur in the future.

The Agency's letter of determination stated that "because the applicant can propose but not ensure regulations aimed at protecting and restoring populations of aquarium fish, [the Agency] is interested in proposals for self-regulation by aquarium permit holders which could be incorporated into permit conditions even in the absence of or prior to establishing other regulations to accomplish the same purposes."[200] We dispute the value of any self-regulation measure. Meaningful change must be binding on the industry, and a meaningful alternatives analysis requires the Applicant to propose binding measures.

A reasonable alternative would require the Agency to first determine:

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[197] Hawai'i FEA at 59, Table 6.

[198] DLNR (2017); Eagle (2017); Aquarium Fishing Trip Report.

[199] *See* Haw. Code R. § 11-200-10(7).

[200] DLNR HRS Chapter 343, Final Environmental Assessment, Notice of Determination for Hawai'i at 3 and for O 'ahu at 3.

1) the life history, spawning grounds and offspring/recruitment patterns for each species to be collected for aquarium purposes (see DLNR list of aquarium species at Appendix 4);[201]
2) natural abundance (i.e. unfished) levels and complete stock assessments, for each island as a whole in addition to each collection zone, for those same species (see DLNR map of aquarium fish zones at Appendix 5);[202]
3) a definition for "sustainable" as it relates to the natural abundance of coral reef species taken for aquarium purposes; and
4) annual total allowable catch, by species, designed to restore and then sustain natural abundance levels, with negligible impacts as defined in the Queensland Ecological Risk Assessment of the Marine Aquarium Fish Fishery, for each species to be taken for aquarium purposes, in each zone.[203]

After making these necessary threshold determinations, the Agency should issue limited numbers of Aquarium Permits, by zone and by species with corresponding total allowable catch limits, per the above parameters. Additionally, the Agency should require Aquarium Collection Permits, for all take for aquarium purposes, regardless of the method of collection.

B. Lack of Mitigation Measures

HEPA also requires an EIS to consider mitigation measures.[204] With minor exceptions, such a discussion is plainly absent from both FEAs. Decades of Applicant actions have directly impacted more than 200 species and indirectly impacted an unknown number of additional vertebrate and invertebrate species found in Hawai'i's coral reefs, one of the most complex ecosystems on Earth, where the fate of each species is determined by the existence, abundance and diverse actions of a multitude of other species that inhabit or otherwise rely upon these unique places. Yet, the FEAs claim there are no significant impacts whatsoever, and therefore, propose no mitigation measures outside of those found in the Preferred Alternatives, related to just two species and one area, which were designed to mitigate potential impacts to cultural resources only.[205] In addition to proposing mitigation measures to address biological and related impacts to the various socio-economic values described herein, the EISs must also propose mitigation for impacts to cultural resources and for the ethical concerns and harm done to the animals, themselves, also described herein.

C. Lack of Early Consultations

PIJAC additionally failed to conduct the required early consultations prior to submitting its DEAs/FEAs. HEPA requires that the application must "at the earliest practicable time, . . . consult with . . . those citizen groups and individuals which the approving agency reasonably believes to be affected."[206] In this case, it is clear from the long history of litigation that Commenters, at the very

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[201] See DLNR Aquarium Fish Trip Report

[202] See DLNR Aquarium Fish Trip Report

[203] *See* Roelofs (2008) for a useful guide for describing the range of impacts to populations of target species in marine aquarium fisheries.

[204] Haw. Code R. § 11-200-10(7).

[205] Hawai'i FEA at 74; O'ahu FEA at 59.

[206] Haw. Code R. § 11-200-9(b)(1).

least, should have been consulted. PIJAC should also have consulted Native Hawai'ian groups and experts such as Gail Grabowsky. As a result of this failure to abide by HEPA's mandate of early consultation, the FEAs fail to analyze all impacts, and are skewed toward a favorable result for industry.

VII. <u>Conclusion</u>

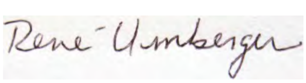
For the reasons explained above, the Hawai'i FEA and O'ahu FEA are patently insufficient to analyze the impacts of commercial aquarium collection permits. Moreover, as numerous significance criteria are met, we concur with the Agency that EISs are required to fully analyze the impacts of issuing these permits prior to issuing any in the future.

A serious overhaul of aquarium fish permitting in Hawai'i is needed.

Because currently there are not restrictions on the number of collection permits or the amount of take per species under a fine mesh net (i.e. aquarium) permit or commercial fishing license, the impact that collection may have on target species must be evaluated before issuing permits. As such, each aquarium collection permit must show the total allowable catch, per species and ideally per zone that permit holders must follow to prevent unsustainable fishing. Catch limits per species and per zone should be calculated in conjunction with input from all stakeholders and based on the stock assessment for each target species in the specific areas where they will be allowed to be taken under a permit.

The legislature has decreed it the "policy of the State" that DNLR and other agencies must "[c]onserve natural resources . . . by preserving or augmenting natural resources, and by safeguarding the State's unique natural environmental characteristics . . . ."[207] The Agency must also "[e]ncourage management practices which conserve . . . all natural resources," and encourage all individuals "to fulfill the responsibility as trustees of the environment for the present and succeeding generations."[208] In enacting HEPA, the State legislature found "that the quality of humanity's environment is critical to humanity's well-being, [and] that humanity's activities have broad and profound effects upon the interrelations of all components of the environment . . . ."[209] The Agency simply cannot meet these mandates by continuing to allow unlimited aquarium collection, in light of the serious environmental consequences of those permits.

Respectfully submitted,



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[207] Haw. Rev. Stat. § 344-3(1).
[208] Haw. Rev. Stat. § 344-4(2)(A), (10)(A).
[209] Haw. Rev. Stat. § 343-1.

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<u>Appendix 1</u>

Linear model results showing a significant increase on the number of commercial aquarium permits issued annually for the Island of Hawai'i (WHRFMA and East Hawai'i combined) and O'ahu. Data from O'ahu DEA (Table 2, p16) and Hawai'i DEA (Table 2, p20).

Island of Hawai'i

```
                          Estimate Std. Error t value Pr(>|t|)
(Intercept) -3316.8903  1157.5586  -2.865   0.0112 *
year           1.6801     0.5763   2.915   0.0101 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 12.69 on 16 degrees of freedom
Multiple R-squared:  0.3469,	Adjusted R-squared:  0.3061
F-statistic: 8.498 on 1 and 16 DF,  p-value: 0.01012
```

O'ahu

```
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -3157.1228  1260.2195  -2.505   0.0234 *
year           1.6140     0.6274   2.572   0.0205 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 13.81 on 16 degrees of freedom
Multiple R-squared:  0.2926,	Adjusted R-squared:  0.2484
F-statistic: 6.617 on 1 and 16 DF,  p-value: 0.02045
```

Appendix 2

All photos courtesy of Paul Cox.

Aquarium Collecting Vessel Anchored off Black Rock Caves, North Kohala 2011

Aquarium Collecting Vessel Anchored off Papa Bay, Milolii, February 2014: prior coral damage apparent in trench adjacent to current anchor location; newly broken coral indicated by bright white pieces.

Aquarium Collecting Vessel Anchored off Papa Bay, Milolii, March 2014 (same vessel as in images for Feb. 2014).

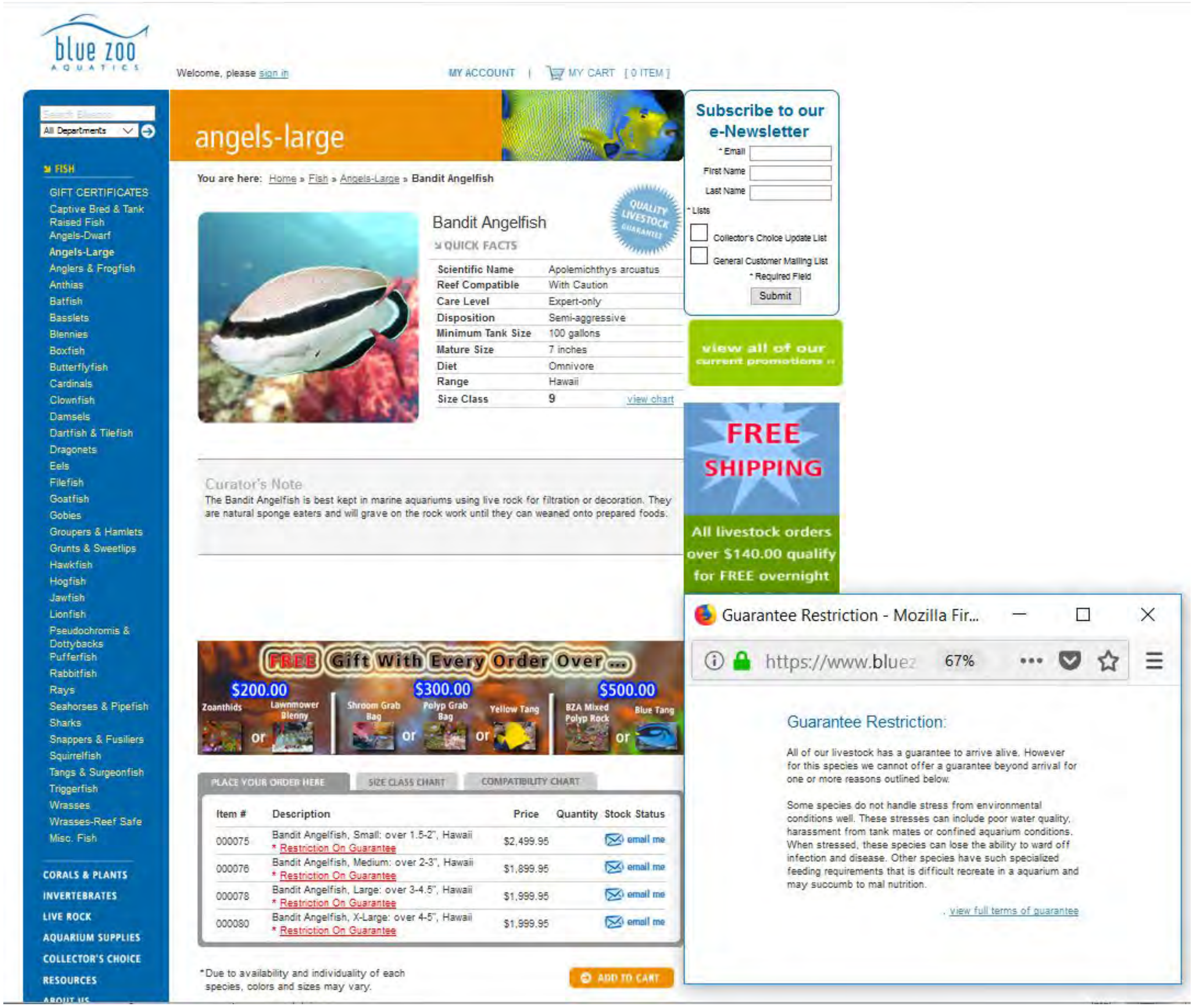
<u>Aquarium Collecting Vessel Anchored off Papa Bay, Milolii, September 2014: (different vessel from Feb/March photos).</u>

Aquarium collectors crawling through coral wearing knee pads. Note: none of these divers are wearing buoyancy control devices—used to maintain neutral buoyancy above the coral—which are standard equipment for recreational scuba divers. Instead they use a backpack designed to contribute to negative buoyancy, along with weight belts.

Fins, sticks, nets, buckets in the coral

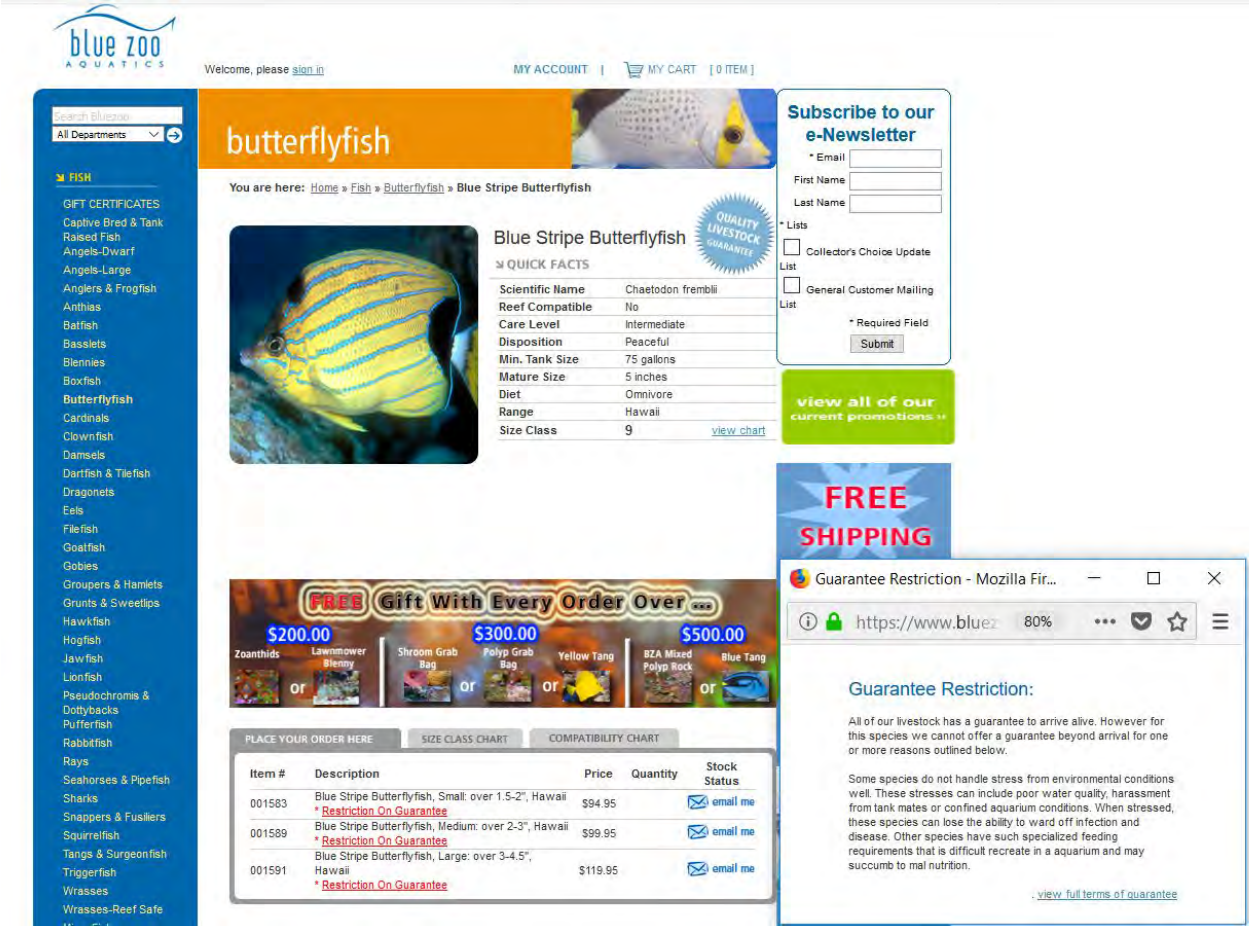
Appendix 3

Live Arrive/Stay Alive Restrictions on Guarantees



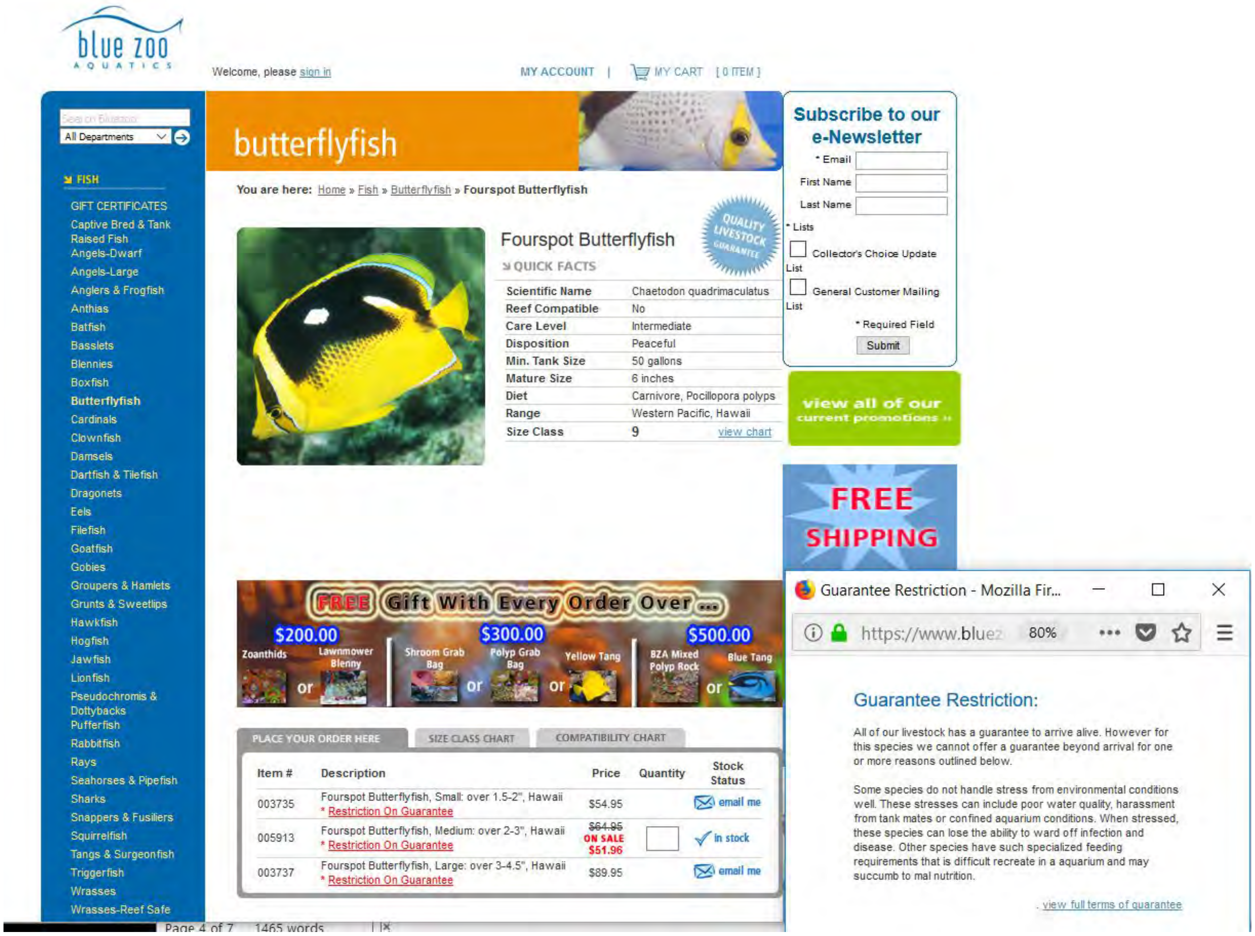
Available at: https://www.bluezooaquatics.com/productdetail.asp?cid=8&pid=145&did=1

Guarantee Restriction: https://www.bluezooaquatics.com/guarantee_restriction.htm



Available at: https://www.bluezooaquatics.com/productdetail.asp?cid=26&pid=558&did=1

Guarantee Restriction: https://www.bluezooaquatics.com/guarantee_restriction.htm



Available at: https://www.bluezooaquatics.com/productdetail.asp?cid=26&pid=617&did=1

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Golden Cleaner Wrasse (Hawaii) - Labroides phthirophagus - Cleaner Royal Cleaner Wrasse

roll over image to magnify

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Aquarium suitability:	
Care level:	Expert Only!!! Not Cover Under Arrive Guaranteed
Behavior:	Peaceful
Minimum tank size:	30 Gallon
Maximum size:	3.9 inches
Reef compatibility:	Yes
Diet:	Carnivore
Origin:	Hawaii
Family:	Labridae
Manufacturer Name:	FreshMarine
Regular Price:	~~$62.99~~
Purchase size:	Small 1" - 2" Medium 3" - 4" Large 5" - 6"
Our Price:	**$50.50**
You Save:	$12.49 (19.83%)
Stock Code :	golden-cleaner-wrasse

Available at: https://www.freshmarine.com/golden-cleaner-wrasse.html

Appendix 4: DLNR Commercial Aquarium Species List (available in DLNR Aquarium Fish Trip Report Booklet)

rev. 9/30/2011

Commercial Aquarium Species List

	Angelfishes	**(Pomacanthidae)**
219	Bandit	*(Desmoholocanthus arcuatus)*
223	Fisher's	*(Centropyge fisheri)*
221	Flame	*(Centropyge loricula)*
225	Masked	*(Genicanthus personatus)*
220	Potter's	*(Centropyge potteri)*
	Anthias & Groupers	**(Serranidae)**
663	Bicolor Anthias	*(Pseudanthias bicolor)*
675	Grammistidae	
650	Groupers, Basslets and Anthias	
661	Hapu'u Grouper	*(Epinephelus quernus)*
664	Hawaiian Longfin Anthias	*(Pseudanthias hawaiiensis)*
667	Redblotch perchlet	*(Plectranthias winniensis)*
660	Roi - Bluespot Grouper	*(Cephalopholus argus)*
600	Soapfishes	
662	Thompson's Anthias	*(Pseudanthias thompsoni)*
665	Yellow Anthias	*(Holanthias fuscipinnis)*
	Blennies	**(Blenniidae)**
440	Blenny	(Blenniidae)
449	Biting	*(Plagiotremus goslinei)*
448	Blue-striped	*(Plagiotremus rhinorhyncus)*
447	Hump-Head	*(Blenniella gibbifrons)*
445	Istiblennius spp.	*(Istiblennius* spp.)
444	Marbled	*(Entomacrodus marmoratus)*
441	Red Sailfin	*(Exallias brevis)*
443	Red Speckled	*(Cirripectes variolosus)*
442	White speckled	*(Cirripectes obscurus)*
446	Zebra Rockskipper	*(Istiblennius zebra)*
	Boxfishes - Trunkfishes	**(Ostraciidae)**
323	Spiny Cowfish	*(Lactoria diaphana)*
320	Spotted Boxfish	*(Ostracion meleagris)*
322	Thornback Cowfish	*(Lactoria fornasini)*
319	Trunkfishes	(Ostraciidae)
321	Whitley's Trunkfish	*(Ostracion whitleyi)*
199	**Butterflyfishes**	**(Chaetodontidae)**
207	Blacklip (Kleini, Coral)	*(Chaetodon kleinii)*
205	Bluestripe	*(Chaetodon fremblii)*
218	Chevron	*(Chaetodon trifascialis)*
214	Fourspot	*(Chaetodon quadrimaculatus)*
228	Golden Banded	*(Prognathodes roa excelsa)*
216	Lemon (Citron)	*(Chaetodon citrinellus)*
222	Lined	*(Chaetodon lineolatus)*
200	Longnose	*(Forcipiger flavissimus)*
217	Milletseed	*(Chaetodon miliaris)*
227	Orange Margin	*(Prognathodes basabe)*
213	Ornate (Clown)	*(Chaetodon ornatissimus)*
212	Oval	*(Chaetodon lunulatus)*
215	Pebbled	*(Chaetodon multicinctus)*
202	Pennantfish	*(Heniochus diphreutes)*
204	Pyramid (Zoster)	*(Hemitaurichthys polylepis)*
211	Raccoon	*(Chaetodon lunula)*
201	Rare Longnose	*(Forcipiger longirostris)*
	Butterflyfishes (cont)	**(Chaetodontidae)**
206	Reticulated	*(Chaetodon reticulatus)*
208	Saddleback	*(Chaetodon ephippium)*
210	Teardrop	*(Chaetodon unimaculatus)*
203	Thompson's	*(Hemitaurichthys thompsoni)*
209	Threadfin (Cross-stripe)	*(Chaetodon auriga)*
224	Tinker's	*(Chaetodon tinkeri)*
390	**Cardinalfishes**	**(Apogonidae)**
394	Bandfin	*(Apogon menesemus)*
395	Bay	*(Foa brachygramma)*
393	Iridescent	*(Apogon kallopterus)*
392	Red	*(Apogon erythrinus)*
391	Spotted	*(Apogon maculiferus)*
195	**Damselfishes**	**(Pomacentridae)**
192	Agile Chromis	*(Chromis agilis)*
187	Backfin Chromis	*(Chromis vanderbilti)*
181	Blackspot Sergeant	*(Abudefduf sordidus)*
185	Blue-eye Damsel	*(Plectroglyphidodon johnstonianus)*
183	Brighteye Damsel	*(Plectroglyphidodon imparipennis)*
191	Chocolate-Dip Chromis	*(Chromis hanui)*
180	Hawaiian Domino	*(Dascyllus albisella)*
182	Hawaiian Sergeant Major	*(Abudefduf abdominalis)*
193	Indo-Pacific Sergeant Major	*(Abudefduf vaigiensis)*
188	Oval Chromis	*(Chromis ovalis)*
184	Rock Damsel	*(Plectroglyphidodon sindonis)*
190	Threespot Chromis	*(Chromis verator)*
189	Whitetail Chromis	*(Chromis leucurus)*
186	Yellow-eye Damsel	*(Stegastes fasciolatus)*
	Eels	**Moray & Others**
423	Brown Moray	*(Gymnothorax steindachneri)*
422	Common Moray	*(Gymnothorax eurostus)*
414	Dark-banded Moray	*(Echidna polyzona)*
417	Dragon Moray	*(Enchelycore pardalis)*
411	Dwarf Moray Eel	*(Gymnothorax melatremus)*
410	Moray	(Muraenidae)
426	Mustache Conger	*(Conger cinereus)*
413	Snowflake Moray	*(Echidna nebulosa)*
429	Tiger Moray	*(Scuticaria tigrina)*
425	Undulated Moray	*(Gymnothorax undulatus)*
416	Uropterygius knighti	*(Uropterygius knightii)*
415	Uropterygius spp.	*(Uropterygius* spp.)
421	Whitemouth Moray	*(Gymnothorax meleagris)*
424	Yellowhead	*(Gymnothorax rueppelliae)*
420	Yellowmargin Moray	*(Gymnothorax flavimarginatus)*
419	Yellowmouth Moray	*(Gymnothorax nudivomer)*
412	Zebra Moray	*(Gymnothorax zebra)*
428	Magnificent Snake Eel	*(Myrichthys magnificus)*
427	Snake Eels and Worm Eels	(Ophichthidae)
310	**Filefishes**	**(Monacanthidae)**
313	Orange-fin	*(Cantherhines dumerilii)*
312	Redtail	*(Pervagor spilosoma)*
311	Scribbled	*(Aluterus scriptus)*

Commercial Aquarium Species List

	Filefishes (cont)	**(Monacanthidae)**
314	Squaretail	(*Cantherhines sandwichiensis*)
315	Yellowtail	(*Pervagor aspricaudus*)
169	**Goatfishes**	**(Mullidae)**
170	Bandtail	(*Upeneus taeniopterus*)
176	Kumu - Whitesaddle*	(*Parupeneus porphyreus*)
175	Moana kali - Blue	(*Parupeneus cyclostomus*)
177	Moano - Manybar*	(*Parupeneus multifasciatus*)
178	Munu - Doublebar	(*Parupeneus bifasciatus*)
172	Red Weke - Yellowfin*	(*Mulloidicthys vanicolensis*)
174	Sidespot	(*Parupeneus pleurostigma*)
171	White Weke - Yellowstripe*	(*Mulloidicthys flavolineatus*)
330	**Hawkfishes**	**(Cirrhitidae)**
331	Arc-eye	(*Paracirrhites arcatus*)
332	Blackside (Freckled, Forster's)	(*Paracirrhites forsteri*)
336	Longnose	(*Oxycirrhites typus*)
335	Redbar	(*Cirrhitops fasciatus*)
333	Stocky	(*Cirrhitus pinnulatus*)
334	Twospot	(*Amblycirrhitus bimacula*)
	Pipefishes	**(Syngnathidae)**
504	Fantail	(*Doryhamphus exisus*)
565	Pipefishes	
505	Redstripe	(*Doryrhamphus baldwini*)
566	Seahorses	
567	Spotted Seahorse	(*Hippocampus kuda*)
349	**Porcupinefishes**	**(Diodontidae)**
350	Porcupinefish	(*Diodon hystrix*)
351	Spiny Balloonfish	(*Diodon holocanthus*)
290	**Pufferfishes**	**(Tetraodontidae)**
293	Amboy Toby	(*Canthigaster amboiensis*)
291	Crown Toby	(*Canthigaster coronata*)
294	Maze Toby	(*Canthigaster rivulata*)
341	Spotted Puffer	(*Arothron meleagris*)
342	Stripebelly Puffer	(*Arothron hispidus*)
292	White-spot Toby	(*Canthigaster jactator*)
295	Yellowtail Toby	(*Canthigaster epilamera*)
400	**Scorpionfishes**	**(Scorpaenidae)**
405	Devil Scorpionfish	(*Scorpaenopsis diabolus*)
403	Green Lionfish	(*Dendrochirus barberi*)
402	Hawaiian Turkeyfish	(*Pterois sphex*)
401	Leaf Scorpion	(*Taenianotus triacanthus*)
407	Speckled Scorpionfish	(*Sebastapistes coniorta*)
406	Titan Scorpionfish	(*Scorpaenopsis cacopsis*)
	Squirrelfishes & Soldierfishes	**(Holocentridae)**
376	Bigscale Soldier	(*Myripristis berndti*)
377	Brick Soldier	(*Myripristis amaena*)
374	Crown Squirrel	(*Sargocentron diadema*)
375	Hawaiian Squirrel	(*Sargocentron xantherythrum*)
378	Shoulder-bar Soldier	(*Myripristis kuntee*)
370	Squirrelfish	(Holocentridae)
373	Whitespot Squirrel	(*Sargocentron punctatissimum*)

	Surgeonfishes	**(Acanthuridae)**
103	Achilles Tang	(*Acanthurus achilles*)
107	Bluelined Surgeon	(*Acanthurus nigroris*)
114	Chevron Tang	(*Ctenochaetus hawaiiensis*)
104	Goldrim Surgeon	(*Acanthurus nigricans*)
113	Kole - Goldring	(*Ctenochaetus strigosus*)
106	Lavender Tang (Forktail)	(*Acanthurus nigrofuscus*)
120	Long bodied Surgeon	(*Naso brevirostris*)
101	Manini - Convict Tang*	(*Acanthurus triostegus*)
118	Naso Tang	(*Naso lituratus*)
109	Orange-shoulder Surgeon	(*Acanthurus olivaceus*)
110	Palani - Eyestripe	(*Acanthurus dussumieri*)
111	Pualu - Yellowfin	(*Acanthurus xanthopterus*)
112	Ringtail Surgeonfish	(*Acanthurus blochii*)
116	Sailfin Tang	(*Acanthurus veliferum*)
119	Sleek Unicorn*	(*Naso hexacanthus*)
102	Spotted Tang	(*Acanthurus guttatus*)
100	Surgeonfishes	(Acanthuridae)
108	Thompson's Surgeon	(*Acanthurus thompsoni*)
121	Unicorn*	(*Naso unicornis*)
117	Unicornfishes	
105	Whitebar Surgeon	(*Acanthurus leucopareius*)
115	Yellow Tang	(*Zebrasoma flavescens*)
122	Moorish Idol	(*Zanclus cornutus*)
307	**Triggerfishes**	**(Balistidae)**
303	Black	(*Melichthys niger*)
300	Blue-throat	(*Xanthichthys auromarginatus*)
299	Crosshatch	(*Xanthichthys mento*)
302	Lagoon	(*Rhinecanthus aculeatus*)
301	Picasso	(*Rhinecanthus rectangulus*)
304	Pinktail	(*Melichthys vidua*)
305	Whiteline, Lei	(*Sufflamen bursa*)
130	**Wrasses**	**(Labridae)**
157	Belted (Orange-bar)	(*Stethojulis balteata*)
151	Bird	(*Gomphosus varius*)
150	Blacktail	(*Thalassoma ballieui*)
146	Christmas	(*Thalassoma trilobatum*)
131	Cigar (Alligator)	(*Cheilio inermis*)
134	Cleaner	(*Labroides phthirophagus*)
144	Dragon	(*Novaculichthys taeniourus*)
139	Eightline	(*Pseudocheilinus octotaenia*)
153	Elegant Coris	(*Coris venusta*)
160	Flag	(*Anampses cuvier*)
162	Flame	(*Cirrhilabrus jordani*)
140	Fourline	(*Pseudocheilinus tetrataenia*)
133	Hogfish	(*Bodianus bilunulatus*)
155	Lined Coris	(*Coris ballieui*)
165	Moon (Lyretail)	(*Thalassoma lunare*)
161	Ornate (Pinkface)	(*Halichoeres ornatissimus*)
143	Peacock Razorfish	(*Xyrichtys pavo*)
156	Pencil	(*Pseudojuloides cerasinus*)
158	Potter's	(*Macropharyngodon geoffroy*)

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Commercial Aquarium Species List

	Wrasses (cont)	**(Labridae)**
145	Razorfish	(*Xyrichtys umbrilatus*)
159	Red-tail (Psychedelic)	(*Anampses chrysocephalus*)
136	Ringtail	(*Oxycheilinus unifasciatus*)
148	Saddle	(*Thalassoma dupperey*)
138	Scarlett	(*Pseudocheilinus evanidus*)
142	Sharp-headed	(*Cymalutes lecluse*)
132	Sunrise Wrasse	(*Bodianus sanguines*)
147	Sunset	(*Thalassoma lutescens*)
149	Surge	(*Thalassoma purpureum*)
137	Twospot	(*Oxycheilinus bimaculatus*)
152	Yellowstriped Coris	(*Coris flavovittata*)
154	Yellowtail Coris	(*Coris gaimard*)
	Other Fish	
280	Aholehole - Hawaiian Flagtail*	(*Kuhlia sandvicensis*)
360	Aweoweo - Bigeyes	(Priacanthidae)
780	Baitfish	
630	Bat fish	(Onocephalidae)
570	Boarfish	(Histioopteridae)
500	Cornetfish	(*Fistularia commersonii*)
465	Dartfish	(Microdesmidae)
680	Dwarf rockfish	(*Canthidermis maculatus*)
610	Frogfish	(Antennnariidae)
460	Gobies	(Gobiidae)
560	Hawaiian Morwong	(*Cheilodactylus vittatus*)
670	Helmet Gurnard	(*Dactyloptena orientalis*)
470	Lefteye Flounders	(Bothidae)
480	Lizardfishes	(Synodontidae)
790	Mollies	(Poecilidae)
530	Moi - Threadfin*	(*Polydactylus sexfilis*)
700	Mu - Bigeye Emperor	(*Monotaxis grandoculis*)
270	Nenue	(*Kyphosus bigibbus*)
250	Papio - Jacks*	(Carangidae)
715	Redspotted Sandperch	(*Parapercis schauinslandii*)
475	Righteye Flounders	(Pleuronectidae)
620	Saltwater cats	(Brotulidae)
690	Sand Tilefish	(*Malacanthus brevirostris*)
240	Scaridae	(Scaridae)
795	Sharks	
522	Sharp-jaw Mullet	(*Neomyxus leuciscus*)
520	Striped Mullet*	(*Mugil cephalus*)
510	Stripey	(*Microcanthus strigatus*)
267	Ta'ape - Blueline Snapper	(*Lutjanus kasmira*)
642	Toau - Blacktail Snapper	(*Lutjanus fulvus*)
490	Trumpetfish	(*Aulostomus chinensis*)
230	Uhu - Parrotfishes*	(Scaridae)
398	Velvetfish	(Caracanthidae)
	Algae (Limu - Seaweed)	
801	Grape Calerpa	(*Caulerpa racemosa*)
804	Halimeda	(*Halimeda* spp.)
802	Letucce Cauerpa	(*Caulerpa* spp.)
970	Other Algae	

	Algae (Limu - Seaweed) (cont)	
803	Red Kelp	(*Halymenia* spp.)
805	Sea Lettuce	(*Ulva* spp.)
	Invertebrates	
926	**Anemones**	
811	Mann's Anemone	(*Cladactella manni*)
812	Seabae Anemone	(*Heteractis malu*)
931	**Crustaceans: Crabs**	
863	Aama	(*Grapsus tenuicrustatus*)
933	Anemone Hermit (Orange-leg)	(*Dardanus gemmatus*)
860	Black Zanthid	
861	Flat Rock (Sally Lightfoot)	(*Percnon planissimum*)
862	Pom-Pom	(Lybia)
932	Yellow Hairy Hermit	(*Aniculus maximus*)
937	Halloween Hermit Crab	(*Calcinus elegans*)
934	Hermits (small & misc.)	(Diogenidae)
938	Zebra Hermit Crab	(*Clibanarius zebra*)
854	Arrow	(Majidae)
865	Strawberry	(Xanthidae)
800	**Crustaceans: Crayfish**	
909	**Crustaceans: Lobsters**	
936	Hawaiian Red Lobster	(Enoplometiopidae)
910	Spiny Lobster*	(Palinuridae)
912	Slipper Lobster*	(Scyllaridae)
949	**Crustaceans: Shrimp**	
945	Cleaner	(*Lysmata amboinensis*)
948	Coral-banded	(*Stenopus hispidus*)
943	Ghost	(*Stenopus pyrsonotus*)
944	Green	(Hippolytidae)
946	Harlequin	(*Hymenocera picta*)
866	Opae ula - Red Pond	(*Halocaridina rubra*)
947	Red-Stripe	(*Saron marmoratus*)
880	**Echinoderms: Brittlestars**	**(Ophiuroidea)**
952	Echinoderms	
953	**Echinoderms: Sea Cucumbers**	**(Holothuroidea)**
876	Black	(*Holothuria atra*)
877	Strawberry or Pink	(*Holothuria edulis*)
878	Stubborn	(*Holothuria pervicax*)
955	**Echinoderms: Seastars**	**(Asteroidea)**
881	Blue Linckia	(*Linckia guildingi*)
882	Common Linckia	(*Linckia multifora*)
954	Crown-of-Thorns	(*Acanthaster planci*)
883	Cushion Star	(*Culcita novaeguinae*)
884	Orange Knob	(*Pentaceraster cumingi*)
957	**Echinoderms: Urchins**	**(Echinodea)**
891	Longspine	(Echinothrix or Diadema spp.)
892	Pincushion	(*Tripneustes gratilla*)
893	Shortspine	(*Echinometra* spp.)
956	Slate urchin	(*Heterocentrotus mammilatus*)
928	**Jellyfishes**	

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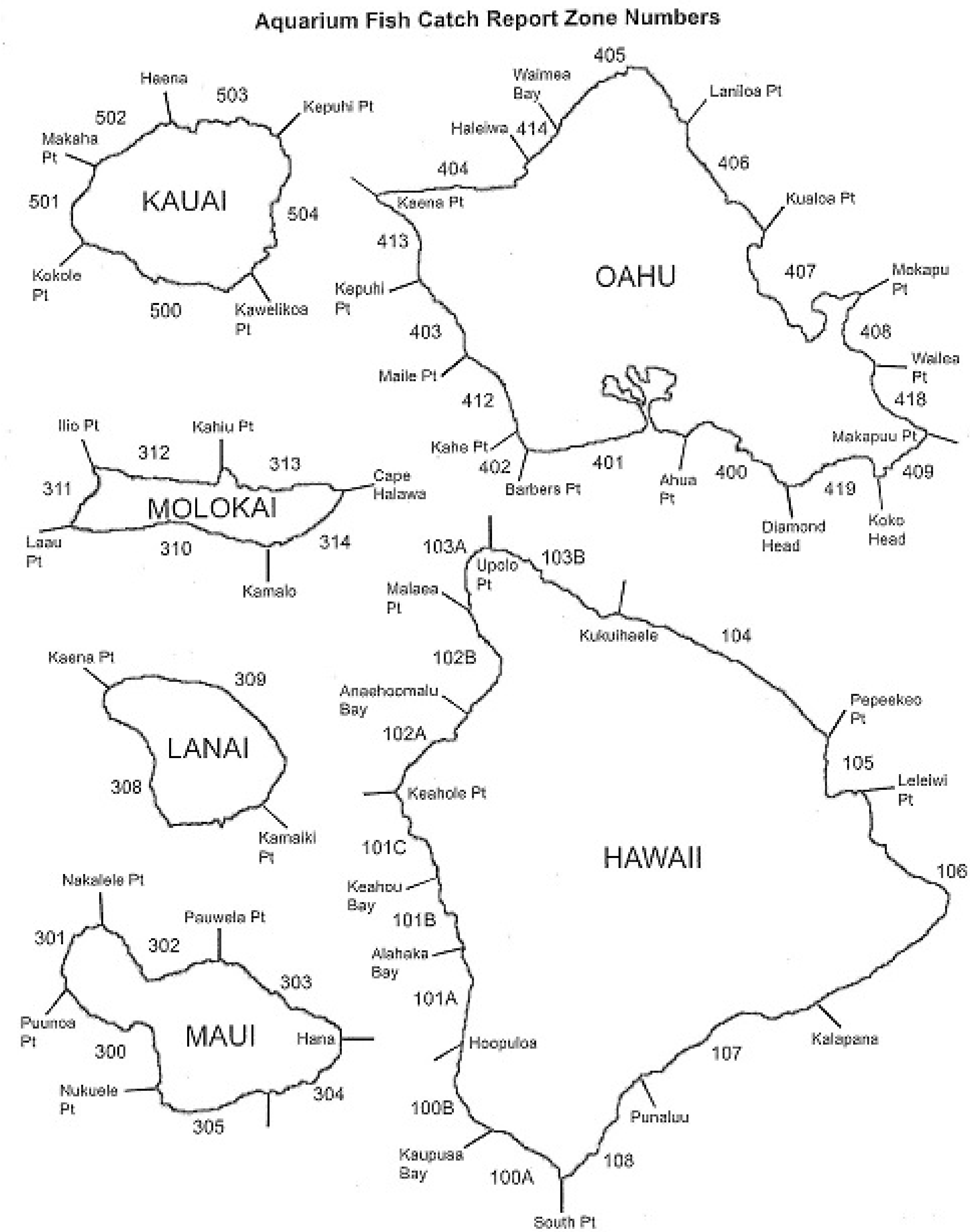
958	**Molluscs**	
858	Bobtail Squid	(*Euprymna scolopes*)
963	Bubble Shells	(order Cephalaspidea)
961	Nudibranchs	(order Nudibranchia)
900	Octopus*	(Octopus spp.)
859	Oval Squid	(*Sepioteuthis lessoniana*)
962	Sea Hares	(order Anaspidea)
964	Spanish Dancer	(*Hexabranchus sanguineus*)
959	Cones	(Conidae)
960	Cowries	(Cypraeidae)
852	Reticulated Cowries	(*Cyrpaea reticulata*)
851	Tiger Cowries	(*Cypraea tigris*)
929	**Soft Corals**	
818	Snowflake Coral	(*Carijoa riisei*)
965	**Sponges**	
922	**Worms**	
921	Featherduster	(*Sabellastarte sanctijosephi*)
923	Medusa Worms	(*Loimia medusa*)
825	**Zoanthids**	

999 Misc. (For any Invert or Fish: please describe specimen)

Appendix 5

DLNR Aquarium Fish Catch Report Zones (available in DLNR Aquarium Fish Trip Report Booklet)



Responses to comments received from For the Fishes/The Humane Society of the United States/Center for Biological Diversity/Kalanihale Mololi'i/Moana Ohana Comment dated September 7, 2018

Comment	**Response**
We concur with DLNR's findings that the significance criteria in HAR § 11-200-12 have been met, and that the preparation of EISs is required to fully analyze the environmental impacts of commercial aquarium collection on both the islands of Hawai'i and O'ahu.	Comment noted. A DEIS has been prepared.
To this end, we expect the Applicant endeavor to develop fully acceptable EISs prior to the time the EISs is filed with the office, through a full and complete consultation process, and that the Applicant shall not rely solely upon the review process to expose environmental concerns. We are also requesting to be parties to any public scoping meeting(s) convened to receive comments on the FEA-EISPNs and setting forth the scope of the draft EISs. Further, we expect our substantive comments on the FEAs, discussed below, to be responded to in writing and incorporated into the draft EIS by the Applicant prior to the filing of the draft EISs with DLNR. We also expect that the responses shall not be merely self-serving recitations of benefits and/or rationalizations of the proposed actions. In addition, we expect the EIS's to disclose any and all adverse effects on cultural resources and traditional cultural practices, which are set forth in HAR § 11-200-10 and discussed in more detail below. Finally we also expect the Draft EIS to include discussion and disclosure of climate change impacts, as envisioned by the proposed HAR § 11-200.1-13 Significance Criteria, Criterion 11 (based on the December 2017 Climate Change Mitigation and Adaptation Commission report) to address concerns related to climate change adaptation, such as impacts from increased hurricane frequency and/or intensity, potential endangered species migration, impacts on areas likely to experience wave inundation, increased exposure to hurricanes, or flooding, and further impacts discussed below.	Comment noted. A DEIS has been prepared, and the commenter was included as a consulted party. No public scoping meeting was held. Cultural impacts are analyzed in depth in the Cultural Impact Assessment (Appendix A of the DEIS). The DEIS includes an analysis of the cumulative impacts of climate change (Section 5.4.3.5 of the DEIS).
The FEAs are entirely inadequate under the HEPA and its implementing regulations. The environmental impact statements now required by DLNR must adequately address these and other notable flaws remaining in the FEAs fail to analyze the impacts of collection beyond one year; fail to analyze the cumulative impacts of unlimited collection of aquatic life; fail to analyze the cumulative impacts of commercial collection on the islands of Hawai'i and O'ahu along with collection in other parts of the State; fail to analyze the cumulative impacts of commercial collection along with recreational collection; fail to analyze impacts on cultural resources; fail to analyze reasonable alternatives; fail to analyze the impacts of harmful collection practices; rely on inaccurate, misleading, and incomplete data; fail to analyze mitigation measure; fail to incorporate input of Native Hawai'ian groups, experts, and affected citizens.	Comment noted. The DEIS expanded the analysis to a 5-year period, and also addresses the cumulative impact of past, present, and foreseeable aquarium collection in future years in Section 5.4.3.3. Cumulative impacts of recreational collection is discussed in Section 5.4.3.1. Impacts to cultural resources are analyzed in Section 5.3, and also included in the Cultural Impact Assessment (Appendix A of the DEIS). One additional alternative has been added in the DEIS that addresses concerns with the number of permits that would be issued. Specifically, one alternative includes issuance of only 20 permits, as well as implementing a Flame Wrasse bag limit and expanding the Waikiki MLCD. The Cultural Impact Assessment (Appendix A of the DEIS) included consultation with Native Hawaiian groups and affected citizens. The best available scientific data has been included in the DEIS.
The Applicant unlawfully limited its analyses to the time period of a single year. PIJAC's reasoning for this is that each permit only lasts one year, and therefore a new EA would need to be completed on an annual basis. However, while Commenters agree that it is critical for the Agency to continue to monitor the impacts that aquarium collection is having over time, the relatively short time period of the activity itself does not nullify HEPA's clear requirement for considering the long-term effects of that activity (example given).	Comment noted. As noted in the DEIS, the analysis period has been expanded to five years. However, under HRS 188-31, the DLNR may issue an Aquarium Permit not longer than one year in duration.

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Additionally, a 12-month timeframe that analyzes impacts is inadequate because the impact of fish removal will accumulate over time. Studies show that catch numbers from the commercial aquarium fishery in Hawai'i have significantly increased over the last few decades and are likely to increase even more	Comment noted. As noted in the DEIS, the analysis period has been expanded to five years. However, under HRS 188-31, the DLNR may issue an Aquarium Permit not longer than one year in duration. While it is correct that individuals are removed from the population annually, it is also true that new individuals are added during that period, and therefore it is not certain losses will accumulate over time. As noted in Section 5.4.1.1 of the DIES, reef fish have high fecundity and are long lived, and as such produce a large number of young each year over many years. In addition, as noted throughout the DEIS, commercial aquarium collection targets juvenile fish leaving behind the adult broodstock. Section 5.4.3.3 of the DEIS addresses the cumulative impacts of multiple years of commercial aquarium collection.
The number of commercial aquarium permits issued per year has significantly increased over the last 18 years for the Island of Hawai'i (at ~35% per year, p=0.01) and for O'ahu (at ~29% per year, p=0.02) (see Fig. 1, see Appendix 1 for linear model results). In fact these trends have been observed since the early 1980s. It is likely that the number of commercial aquarium permits issued on the Islands of Hawai'i and O'ahu will continue to increase in the coming years due to the high demand for aquarium reef fish and their increasing market value. In response to this comment, the Applicant claims that the number of permits issued is "[not] necessarily indicative of the number of fish collected," however DLNR data shows a strong correlation between the number of permits issued and the level of catch (Fig. 2). Furthermore, the Hawai'i Supreme Court has made clear that the proper inquiry under HEPA is "the outer limits of what the permits allow . . . ." The relationship between the number of participants in a fishery and impacts to fish populations is well-established in the literature. The importance of restricting access to fisheries has been acknowledged and used for thousands of years to conserve and help sustain fish populations.	Comment noted. The DEIS has been updated, and the new Preferred Alternative limits the number of permits to be issued to 20 fishers.
The FEAs failed to take into account how increasing demand and increasing market value will affect already depleted targeted reef fish species in the coming years, thus result in significant environmental impact. For example, the market value of tropical reef fish (e.g., yellow tang) has increased and thus collection/fishing pressure is likely to increase in the near future. The commercial aquarium fishery in Hawai'i reports annual landings of over 579,000 organisms (fish and invertebrates combined. The number of aquarium fish caught on the island of Hawai'i since 1976 has substantially increased by 645%. Similarly, the adjusted value of the Hawai'i Island aquarium fishery increased by over 280% between 1976 and 2003. This relationship must be analyzed in the FEAs and permitting must be adjusted accordingly to account for populations declines. The FEAs' claim that the high fecundity and long lifespans of reef fishes combined with the limited targeting of adult brood-stock by the trade removes the certainty that the losses will accumulate over time is false. Studies show that populations of heavily targeted species, such as Yellow Tangs, are neither annually replenished, nor restored over time to their natural levels of abundance. On the contrary, they have been severely depleted over time, especially in the areas where they are collected. While the Hawai'i FEA noted that for Yellow Tang and kole, which represent two of the top three collected species, population trends are stable or increasing, it failed to acknowledge that the increase in fish abundance is due to an anomalous recruitment pulse that coincided with warming waters in 2014. Typical recruitment pulses, such as those that occurred in 2002 and 2009, have resulted in short-lived increases in fish populations that were followed by prolonged or short and steep population declines	Comment noted. As discussed in the DEIS, collection of fish from O'ahu has not grown between 2000 and 2017, with 66,896 fish collected in 2000 compared to a collection of 66,059 fish in 2017. However, the Preferred Alternative further limits commercial aquarium collection by limiting the number of permits to 20. The analysis looks at both average and maximum collection rates from recent years (2000-2017) to estimate collection over the 5-year analysis period.

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The FEAs also fail to consider other cumulative impacts. The Hawai'i FEA states that it only analyzes impacts that the aquarium permits issued for the island of Hawai'i will have; similarly, the O'ahu FEA states that it only analyzes the impacts that aquarium permits issued for O'ahu will have. Neither FEA considers the cumulative impacts that permits issued for either island will have cumulatively with permits issued for the other island with a FEA—let alone cumulatively with permits issued for islands for which PIJAC conducted no FEA (e.g., Kauai and the islands that make up the County of Maui). Coral reefs in Hawai'i are connected by ocean currents. Carried within these currents are the larvae of Hawai'i's reef fishes which typically settle downstream of the reefs where they originated. Most fishes on Hawai'i's reefs are the result of other fishes upstream of that reef. Fish removed from a reef can re-populate as long as the capacity of the upstream larval reservoir isn't exceeded. For example, the prevailing currents in Hawai'i mean that Hawai'i Island reefs "seed" the islands to the northwest—marine life spreads from the Hawai'i Island to the islands of Maui County and beyond. Reduced populations of reef fishes on Hawai'i Island can seriously impact reef fish abundance in the entire state.	Comment noted. As noted in Section 4.4 of the DEIS, Toonen et al. (2011) conclude that the Hawaiian Archipelago is not a single, well-mixed marine community, but rather there are at least four significant multi-species barriers to dispersal along the length of the island chain, and that species that appear capable of extensive dispersal, such as Yellow Tang and Kole, show significant population differentiation within the Hawaiian Archipelago. In addition, there are significant consensus genetic breaks that restrict gene flow between islands, including a barrier between the island of Hawai'i and the rest of the Main Hawaiian Islands (MHI).
Additionally, the FEAs fail to even properly address the true nature of what the Applicant is requesting in its Preferred Alternative. Under the Preferred Alternatives for both EAs, "DLNR would issue Aquarium Permits for the island of Hawai'i under existing regulation set forth in HRS 188-31," and "DLNR would issue Aquarium Permits for the island of O'ahu under existing regulation set forth in HRS 188-31." In other words, PIJAC's Preferred Alternative is collection of an unlimited number of fish and other coral reef inhabitants—the limits of what regulation allows. Additional bag limits, proposed only for Achille Tangs in the Hawai'i FEA and Flame Wrasses in the O'ahu FEA, fail to limit total catch because these daily catch limits apply to a limitless number of people. Yet, the FEAs consider only very limited collection. HEPA requires that an EA assess the potential cumulative impacts of what State regulations allow, not just what some permittees may claim they intend to do with their permits. As the Hawai'i Supreme Court clearly stated, "the properly defined activity for the purposes of the HEPA analysis must encompass the outer limits of what the permits allow and not only the most restrictive hypothetical manner in which the permits may be used." The EISs must address this. Likewise, although the FEAs purport to analyze impacts cumulatively with those of recreational collection permits, the FEAs do not account for the fact that the Agency issues a permit for every application that is submitted, and therefore the take under recreational permits is potentially unlimited as well. And the FEAs admit that, as there is no required reporting for recreational permits, it is currently impossible to know how many of each species are taken under those permits, and therefore, the impact of collection under these permits on species collected under thes permits cannot be quantified. This lack of data must be addressed in the EISs.	Comment noted. The DEIS has been updated, and the new Preferred Alternative limits the number of permits to be issued to 20 fishers. The DEIS used the best available data to evaluate the cumulative impacts from recreational permits.
The analysis of cumulative impacts must include the impact of the commercial aquarium fishery, regardless of the gear used to capture the marine life, combined with non-aquarium commercial and recreational fisheries and other activities that impact population abundance. Commercial and recreational fishing combined with the aquarium fishery have a substantial impact on targeted species. The FEAs should determine cumulative impact of all fishing on target species. In addition, the FEAs must analyze indirect impacts from collection such as vessel traffic and accumulated reef damage due to vessel anchoring and collection practices. As noted earlier, the EISs must also evaluate the potential of cumulative impacts of climate change (warming, coral bleaching, and ocean acidification) on targeted fish species such as decline of coral coverage which have been demonstrated to influence reef fish species diversity and abundance. The FEAs recognize that climate change poses serious threats to Hawai'i's coral reefs and the species targeted by the Applicant, yet ironically claim that climate change impacts coupled with the impacts of implementing the three proposed alternatives are expected to be less than significant. These statements completely deny the research and data that demonstrate what is stated, that climate change impacts, specifically ocean warming, acidification and coral bleaching events will continue, thus further analysis of impacts and exacerbation of impacts due to climate change is required.	Comment noted. The issues mentioned in the comment are addressed in various sections of the DEIS, including the Cumulative Impacts section (5.4.3), direct impacts, and Section 5.4.1.1 of the DEIS which notes that two studies have concluded that the aquarium fishery has no significant impact on coral or the reef ecosystem. Measures included in the Preferred Alternative (e.g., limited permit issuance, Flame Wrasse bag limit, expansion of the Waikiki MLCD) may mitigate potential impacts by limiting the number of aquarium permits issued, limiting the number of Flame Wrasse collected, and expanding the existing Waikiki MLCD.

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It is clear from an analysis of cumulative impacts that many of HEPA's "significance criteria" apply. Most directly, the proposed actions willl likely have a significant effect on the environment due to at least: the loss or destruction of natural and cultural resources; curtailing the range of beneficial uses of the environment; substantial degradation of environmental quality; cumulative effects on the environment; and potentially substantially affecting rare, threatened or endangered species, or its habitat. The scope of the EISs must address these effects. The scope must include a temporal baseline that captures the impacts of collection pressure over time, before the natural populations of targeted species were depleted by this activity. Proper examination of the magnitude of the effect of aquarium collecting on natural populations and the coral reef ecosystem over time requires a look-back period that in the very least begins in 1953 when the aquarium permits were authorized by the state.	Comment noted. The DEIS evaluates the HEPA significance criteria in Section 5.6. The scope of the DEIS evaluates each of the four alternatives based on their impact to the current baseline conditions, because that is the environment which would be impacted by each of the four alternatives.
Environmental impacts from aquarium trade activities have been documented for over forty years. Under the Preferred Alternative, every fish and marine creature, other than corals and those associated with live rock, could be removed from one, or all, of the State of Hawai'i's reefs—with catastrophic effects. This is not speculation: there is currently no law, regulation or enforcement capability that would prevent this from occurring. The potential for unlimited collection is a fact that encompasses the outer limits of what the aquarium permits allow, as was explained earlier. Collecting individual species in high numbers poses a significant threat to coral reef health. As explained herein, herbivorous species, such as Yellow Tangs and Goldring Surgeonfishes, are the most heavily targeted. Herbivorous fish are essential to avoid algal overgrowth of corals and concomitant degradation of the reef. Hermit crabs are also collected in large numbers despite being essential to ecosystem health. Other important functional groups include: planktivores (e.g. Hawai'ian Dascyllus), corallivores (e.g. Fourspot Butterflyfish, Multiband Butterflyfish), fish predators (e.g. Hawkfishes, Hawai'ian Lionfish) and cleaner fishes (e.g. Hawai'ian Cleaner Wrasse). The collection of large numbers of invertebrates including hermit crabs and shrimps that are grazers, scavengers, or cleaners, could potentially have serious ecosystem impacts including reduced resiliency to other threats.	Comment noted. The concept of "unlimited" collection is still speculative and not reasonably foreseeable. Analyzing extreme possibilities is not helpful (and not what the law requires). The law requires an assessment of the "expected consequences" of a proposed action. The Preferred Alternative in the DEIS limits the number of permits to be issued to 20 permits. The DEIS uses the best available data (past commercial aquarium collection) to predict the reasonable outcome of issuance of permits for five additional years. The analysis in the DEIS is limited to the island of O'ahu. As noted in Section 4.4 of the DEIS, Toonen et al. (2011) conclude that the Hawaiian Archipelago is not a single, well-mixed marine community, but rather there are at least four significant multi-species barriers to dispersal along the length of the island chain, and that species that appear capable of extensive dispersal, such as Yellow Tang and Kole, show significant population differentiation within the Hawaiian Archipelago. In addition, there are significant consensus genetic breaks that restrict gene flow between islands, include a barrier between the island of Hawai'i and the rest of the Main Hawaiian Islands (MHI). It is understood that coral reefs are a complicated ecosystem made up of many species that each serve a function. However, given the conclusions in the DEIS that commercial aquarium collection is not significantly impacting the populations of any of the species analyzed on the island of O'ahu , the species are anticipated to continue to serve their functions in the ecosystem. In addition, as noted in Section 5.4.1.1 of the DEIS, Tissot and Hallacher (2003) found no evidence that algal growth was higher in areas of collection versus areas without collection, despite differences in fish abundance.

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The reduction of natural populations of species taken by the aquarium trade in any area (e.g. specific site, zone, coastline, island or statewide), and by any amount, whether one or one hundred percent, indicates an irrevocable commitment and loss of a natural and cultural resource. This very loss curtails the range of beneficial uses that would otherwise be provided by the natural abundance of these populations. As has been long recognized, "The impact of commercial aquarium fish collecting is a complicated issue. The fish community members are highly dependent on one another. There is a constant interaction between predators and competitors, as well as other members of the food web. There is a lot of variability in the system, even when it is not disturbed by man. Reefs seem to undergo natural cycles. At times they may be very abundant. There is also natural variation in the fish community at different locations." The EISs and any discussion of "sustainable" must include the high aesthetic value of this beautiful marine life as well as impacts to the complex relationships inherent in coral reef ecosystems and impacts to overall coral reef health. "Animal communities" are included in the rule definition for "environment," however the FEAs exclude any mention of the impact to fish and invertebrate communities.	Comment noted. This is not an irrevocable action, as commercial aquarium permits may be suspended pursuant to HAR 13-74-3(1) if the department determines that it is necessary for the protection and conservation of aquatic life. In addition, fish will continue to reproduce. The DEIS concludes that there will be no significant reduction in the natural populations of species collected by the aquarium trade. In addition, regarding the aesthetic values of fish, the DEIS concludes that the percent of each population collected would be imperceptible to observers.
The Hawai'i State Wildlife Action Plan (SWAP) states that "Excessive extractive use constitutes a threat to wildlife. Certain reef fishes are harvested for sale in the aquarium trade . . . . These activities are not sustainable on a large scale and impact native wildlife."	Comment noted. The DEIS concludes that collection under the Preferred Alternative represents less than 2.5% of the island-wide populations of 20 species. For the 2 remaining species with population estimates available (Yellow Tang and Flame Wrasse), collection is below This level of take is below what is considered to be sustainable reef fish harvest based on available research (5% - 25%; Ochavillo and Hodgson 2006). 25%. However, collection of both these species may potentially be even lower due to uncertainty in the population estimates and is anticipated to be less than 1% of the Flame Wrasse population. While collection of the Yellow Tang may be above 5% of the population, this species displays high fecundity, and collection under the Preferred Alternative is a lower impact compared to the No Action Alternative. In addition, the Preferred Alternative has additional benefits over the No Action Alternative, including size limits on the Yellow Tang and bag limits on both the Yellow Tang and Flame Wrasse, as well as other species.
The list of species of greatest conservation need includes at least 18 native fish species that are threatened by the aquarium trade and in need of conservation actions to reduce the risk of extinction (see Fig. 2).	Comment noted. The EIS evaluates the impacts of collection on three SGCN species, including the Psychedelic Wrasse, Fisher's Angelfish, and Bandit Angelfish. Appendix B of the EIS includes historic collection data on additional SGCN species.
Butterflyfishes are heavily targeted by the aquarium trade (Fourspot Butterflyfish, Longnose Butterflyfish, Teardrop Butterflyfish, Forcepsfish, Multiband/Copperband). Reported aquarium harvest of those same five species has since plummeted (see Fig. 5). The same is true for other heavily targeted butterflyfish species that have been among the top twenty aquarium fishes collected by the trade since 1976. This sharp decline in reported catch is not an indicator that these species are no longer in demand. Continuing demand is confirmed by several examples: • These species' inclusion in the West Hawai'i White List. • Their exclusion from the O'ahu rules (The O'ahu aquarium rule prohibits take of three butterflyfishes, citing their "coral diets" as the need for the restriction. Since 1999 total reported take of those three species was 50 fish. Zero restrictions were provided for three additional coral eating butterflyfishes, with total reported take of over 51,000 individuals since 1999.) • The Fourspot Butterflyfish catch increase that followed the 2014/2015 warming event and unprecedented fish bloom. Subsequently, catch of the Fourspot Butterflyfish declined to an all-time low. The scope of the EISs must include a temporal baseline that captures the impacts of the heavy collection pressure on these species over time, before their natural populations were depleted by this activity.	Comment noted. Of the five butterflyfish species mentioned specifically in the comment, the DEIS concludes that commercial aquarium collection is anticipated to take less than 1% of the population of the fourspot butterflyfish, forcepfish, and multiband/copperband butterflyfish. The longnose butterflyfish and teardrop butterflyfish are not one of the top 20 collected species in O'ahu (i.e., collection less than 756 individuals per year). The scope of the DEIS evaluates each of the four alternatives based on their impact to the current baseline conditions, because that is the environment which would be impacted by each of the four alternatives.

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In nearly every encounter with commercial aquarium collectors on West Hawai'i reefs, snorkelers and divers have witnessed and documented destructive practices that harm corals, with the most damage coming from vessel anchors and chains. Sticks, buckets, nets, underwater propulsion devices (scooters) are laid in the corals and the fins, knees and legs of collectors often come in contact with the reef—in fact, they are typically described as "crawling across" or "standing" on the corals. The results of these actions include abrasion and coral breakage. Both FEAs refer to a study that determined there was no evidence to indicate the presence of destructive fishing practices (e.g. breaking apart corals to capture hiding fishes).However, the abundance of photographic evidence documenting coral breakage from vessel anchoring and fish capture activities, these impacts cannot be dismissed and must be evaluated in the EISs. Photographs of these practices and their effects can be found at Appendix 2	Comment noted. Section 5.4.1.2 of the DEIS notes that two studies have concluded that the aquarium fishery and aquarium fish collection practices have no significant impact on coral or the reef ecosystem. The Applicant is not aware of any scientific studies documenting damage to coral reefs as a result of commercial aquarium collection in O'ahu.
In addition to the impacts to biodiversity, ecosystem function, and other fisheries, aesthetic and other social values are also heavily impacted. Species experiencing the heaviest collection pressure, with a corresponding reduction in natural abundance, are Hawai'i's most beautiful, charismatic and iconic fishes. The diminished aesthetic value from the cumulative and substantial reductions in species such as Yellow Tangs, butterflyfishes and Moorish Idols, which are dominated by vibrant yellows and oranges and striking white and black patterns, cannot be overestimated (see Fig. 6). These colors are more than aesthetically pleasing, as our eyes are physiologically attuned to them. The frequencies and wavelengths of yellows, oranges and reds allow them to strike our eyes much faster than the other colors. By removing the species with prominent yellow, orange, red or white coloration and markings, the palette and very essence of what makes a coral reef beautiful to the human eye is diminished and degraded. It is impossible to decrease populations of a coral reef's beautiful wildlife without greatly decreasing the natural beauty of the place.	Comment noted. The DEIS concludes that there will be no significant reduction in the natural populations of species taken by the aquarium trade. In addition, regarding the aesthetic values of fish, the DEIS concludes that the percent of each population collected would be imperceptible to observers. As noted in Section 5.2.2.2 of the DEIS, available data do not suggest that commercial aquarium collection has impacted the tourism industry in Hawai'i. Hawai'i's tourism industry achieved new records in total visitor spending and visitor arrivals in 2017, marking the sixth consecutive year of record growth in both categories.
The EISs must acknowledge and address the effects of the trade on the amenity/property values and propose proper mitigation measures. Houses that are within a block or 100 meters of beautiful, clean and healthy coastlines, beaches and coral reefs are more valuable and sell for significantly higher prices than comparable properties elsewhere. The same is true for condos and hotels/hotel rooms which generally command higher room and occupancy rates. Healthy coral reefs are also more likely to prevent beach erosion and, therefore, add value as a form of coastal protection. One and a half percent of the sale price of these properties is attributable to the marine ecosystem. Hawai'i's reef-related property value in 2001 was calculated at $40 million.	Comment noted. The DEIS addresses socioeconomic impacts in Section 5.2. The average sale price of homes in 2014 was $594,440, which was 26.4 percent higher than the average sale price in 2011. In 2015, the total number of home sales increased by 9.3 percent (HDBEDT 2016). The DEIS does not conclude that there are any impacts to housing values; therefore, no mitigation is proposed or required.
The EISs must acknowledge and address the effects of the trade on the recreational value of this marine life and their coral reef homes and propose proper mitigation measures. The annual estimated expenditures related to marine life viewing (i.e. snorkeling and scuba) in Hawai'i is $551 million. Reef-adjacent marine tourism expenditures (including hotel rooms) within 30 km of the coastline are an annual $680 million. These amounts exclude the lost value from declining fish abundance which is captured in willingness to pay surveys and summarized below: Healthier reefs lead to substantial economic gains; Recreational users are willing to pay higher rates for a healthier marine environment; Snorkel/dive businesses benefit when there are more fish for their clients to see; One recent study showed divers were willing to pay $93 to $110 more to dive with abundant fish life; Without new regulations the potential for increasing losses is real; Inability to stem declining reef fish numbers could cause significant losses to dive tourism industry (i.e. reductions in willingness to pay); These consumer surplus losses could range from $1.2 million to $12.2 million annually; Areas with degraded reefs and low fish populations could also see significant losses from a decrease in their share of the global dive market; Anecdotal reports from long-time residents and visitors point to revenue loss already occurring from reduced abundance of beautiful fishes on Hawai'i reefs.	Comment noted. The DEIS addresses socioeconomic impacts in Section 5.2. As noted in Section 5.2.2.2 of the DEIS, available data do not suggest that commercial aquarium collection has impacted the tourism industry in Hawai'i. Hawai'i's tourism industry achieved new records in total visitor spending and visitor arrivals in 2017, marking the sixth consecutive year of record growth in both categories. The DEIS concludes that collection under the Preferred Alternative represents less than 2.5% of the island-wide populations of 20 species. For the 2 remaining species with population estimates available (Yellow Tang and Flame Wrasse), collection is below This level of take is below what is considered to be sustainable reef fish harvest based on available research (5% - 25%; Ochavillo and Hodgson 2006). 25%. However, collection of both these species may potentially be even lower due to uncertainty in the population estimates and is anticipated to be less than 1% of the Flame Wrasse population. While collection of the Yellow Tang may be above 5% of the population, this species displays high fecundity, and collection under the Preferred Alternative is a lower impact compared to the No Action Alternative. In addition, the Preferred Alternative has additional benefits over the No Action Alternative, including size limits on the Yellow Tang and bag limits on both the Yellow Tang and Flame Wrasse, as well as other species. Additionally, Section 5.4.1.1 of the DEIS notes that two studies have concluded that the aquarium fishery and aquarium fish collection practices have no significant impact on coral or the reef ecosystem. Therefore, the DEIS concludes that coral and reef fish viewing opportunities would not be

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	significantly impacted under the Preferred Alternative. The DEIS addresses the cumulative impact of tourism, including damage to coral reef habitat in association with tourism (through coastal development, point source pollution, and recreational activities) in Section 5.4.3.4.
The EIS must acknowledge and address the effects of the trade on the substantial non-use values of this marine life and their coral reef homes and propose proper mitigation measures. Intrinsic and social values associated with coral reefs are diminished by reduced fish populations. Concern for the marine environment has increased in recent years and people now place tremendous value on coral reef ecosystems. Many people value beautiful and healthy coral reef ecosystems as part of their legacy and responsibility to ensure future generations are able to experience them. A 2011 report for the National Oceanic and Atmospheric Administration (NOAA) estimated the passive use annual value of Hawai'i's coral reef ecosystems through a willingness to pay survey of U.S. households. The survey included a visual representation of an overfished and an abundant coral reef (see Fig. 7). The project determined that increased protections and restoration of degraded coral reefs in Hawai'i is worth about $288 to the average U.S. household which aggregated over all U.S. households amounts to a $34 billion annual passive use value for Hawai'i's coral reefs.58 This and other socio-economic values described here provide meaningful insights into the public's concerns and should be addressed in a comprehensive EIS.	Comment noted. The DEIS addresses socioeconomic impacts in Section 5.2, and addresses cultural impacts in Section 5.3 (as well as in the Cultural Impact Assessment, which is Appendix A of the DEIS). The DEIS concludes that collection under the Preferred Alternative represents less than 2.5% of the island-wide populations of 20 species. For the 2 remaining species with population estimates available (Yellow Tang and Flame Wrasse), collection is below This level of take is below what is considered to be sustainable reef fish harvest based on available research (5% - 25%; Ochavillo and Hodgson 2006). 25%. However, collection of both these species may potentially be even lower due to uncertainty in the population estimates and is anticipated to be less than 1% of the Flame Wrasse population. While collection of the Yellow Tang may be above 5% of the population, this species displays high fecundity, and collection under the Preferred Alternative is a lower impact compared to the No Action Alternative. In addition, the Preferred Alternative has additional benefits over the No Action Alternative, including size limits on the Yellow Tang and bag limits on both the Yellow Tang and Flame Wrasse, as well as other species.
As noted earlier and as set forth in HAR §§ 11-200-10 and -16 through -18, a complete analysis and discussion of impacts to cultural resources is required. The EISs must acknowledge and address the direct, indirect, and cumulative impacts on cultural resources. The loss and harm caused by the irrevocable commitment of natural resources equally applies to impacts to cultural resources, as well. The EISs must also acknowledge and address the effects of the trade on Native Hawai'ians traditional reliance on species targeted by the trade for subsistence, such as pāku'iku'i (Achilles Tang) and kole (Gold Ring Surgeonfish), and propose proper mitigation measures.	Comment noted. The DEIS addresses the cultural significance of each of the 23 species analyzed in Section 4.4. A Cultural Impact Assessment has been included as Appendix A of the DEIS, and cultural impacts are addressed there and within Section 5.3 of the DEIS.

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The EISs must also acknowledge and address the Native Hawai'ian cultural and spiritual connections to the reef. Examples include consideration of the reef ecosystem and its associated gods and goddesses and their many kinolau (divine bodily forms). These gods and goddesses include, but are not limited to, the Goddess Hina and her form as Hina 'Opu Hala Ko'a who is the goddess of the coral and who gives birth to the reef itself; or, in her moon form which relates to coral spawning events. The Native Hawai'ian ceremonial practices associated with these types of cultural and religious beliefs must be included in the scope of the EISs. Likewise, many of the particular fish species favored by the aquarium trade also happen to be 'aumakua (family guardians). The taking of these species obviously adversely impacts Native Hawai'ian cultural and religious beliefs and practices. These aspects must be addressed in the EISs. "Malama aina involves asking permission prior to fishing, taking only what you need, sharing your catch with your extended 'ohana or community and having respect for the sacredness of the process. Clearly, harvesting live fish for economic gain and shipping them in a bag for a long, convoluted odyssey, potentially resulting in mortality and waste, violates the very core of these traditional values."67 The aforementioned examples were not adequately addressed in the FEAs and serve to highlight that where cultural impacts are concerned, the need for significant analysis remains.	Comment noted. The DEIS addresses the cultural significance of each of the 23 species analyzed in Section 4.4. A Cultural Impact Assessment has been included as Appendix A of the DEIS, and cultural impacts are addressed there and within Section 5.3 of the DEIS.
A major factor that drives the rates of collection is premature mortality rates in captivity. According to a long-time industry insider, most yellow tangs die with the first month in a hobbyist tank and fewer than 1% of those captured survive one year in captivity. A 2012 study determined that mistreatment in capture, handling, transport, and holding plays a larger factor in these premature deaths than hobbyist inexperience. Hawai'i's Yellow Tang ranks among the top ten fish sold in the marine aquarium trade. As such, it was prominently featured in the study, in both the consumer survey, as one of the nine fish species featured, and in the supply chain analysis, as one of the eighty-five species analyzed which included eleven other species that are captured both in Hawai'i and elsewhere in the Indo-Pacific. The researchers also determined that each step in the supply chain significantly profits from customer purchases to replace fish that die prematurely, and that profits from replacement fish sales are so high, stores have no incentive to take action to reduce deaths.	Comment noted. As stated in Section 2.5 of the DEIS, the DEIS focuses primarily on the effects of aquarium fishing on wild populations of fish species, as it is at the population level that DAR measures changes in species and makes management decisions (e.g., issuance of harvest permits, implementation of bag limits). Therefore, because population effects have already occurred once an individual fish has been removed from the ocean, it is beyond the scope of this analysis to evaluate effects on individual fish once they are removed from the population. Nevertheless, a discussion on post-harvest mortality has been added to Section 5.4.2 of the EIS. The paper referenced here (Cartwright et al. 2012) is focused on marine ornamentals from the "Coral Triangle" (Philippines, east Malaysia, Indonesia, Timor-Leste, Papua New Guinea, and the Solomon Islands), where they commonly use harmful chemicals such as cyanide and dynamite to catch fish, which then leads to extremely high mortality rates in the supply chain. These practices are not used in O'ahu.
A number of practices frequently utilized as cost saving measures by the aquarium trade in Hawai'i are inhumane and significantly contribute to the stressors that accumulate and ultimately lead to premature deaths of captive marine life. They include rapid surfacing and subsequent use of a technique known as "fizzing" to mitigate the resulting barotrauma injury to swim bladders; starving fish for 2 – 10 days prior to transport and spine cutting. Alternatives to these practices include slow surfacing, transport in larger volumes of water to dilute any waste produced by fishes during transport, and transport in hard plastic containers that cannot be punctured by fish spines. Every fish that dies early puts extra pressure on natural resources because of the take of replacements. There is a general consensus in many countries that it is not ethical to trade in live animals, unless their health and welfare are ensured. These unnecessary and early deaths have given the trade a poor image. A $20 million, multi-stakeholder reform effort failed, in part, because of trade reluctance to address, and take steps to reduce, mortality rates. Fifty percent of species among Hawai'i's historical top 20 fish list are either not guaranteed to arrive alive or stay alive longer than 7 – 14 days when purchased from online or "brick and mortar" retailers. Examples are found in Appendix 3.	Comment noted. As stated in Section 2.5 of the DEIS, the DEIS focuses primarily on the effects of aquarium fishing on wild populations of fish species, as it is at the population level that DAR measures changes in species and makes management decisions (e.g., issuance of harvest permits, implementation of bag limits). Therefore, because population effects have already occurred once an individual fish has been removed from the ocean, it is beyond the scope of this analysis to evaluate effects on individual fish once they are removed from the population. Nevertheless, a discussion on post-harvest mortality has been added to Section 5.4.2 of the EIS.

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Comment	Response
Baseline fish population data from the 1970's at Honaunau in West Hawai'i were compared to data gathered in surveys conducted 1998 – 2001. The results indicated that nearly all small bodied surgeonfish, butterflyfish and angelfish (i.e. species targeted by the aquarium trade) declined in abundance. Commercial aquarium collecting was implicated in the decline (see Fig. 8). Similar results were found at Ke'ei where the site had been intermittently surveyed since 1979. "Of the 20 most collected aquarium species, 18 declined in abundance with the species facing the heaviest fishing pressure typically showing the greatest declines." In addition to documenting the impact of aquarium collecting in these areas, these studies also document baselines for abundance levels of aquarium targeted and other impacted species. Examinations of reported catch, as documented by DLNR, serve to further highlight the impacts of the trade. The documentation shows that the initial surveys were conducted during a time when the aquarium trade reported taking fewer than 50,000 fish annually from West Hawai'i reefs. In subsequent years, from 1987 to the final surveys in 2001, reported aquarium fish catch in West Hawai'i ranged between 150,000 and 300,000 individuals taken. Since then the annual West Hawai'i aquarium fish catch has ranged between 250,00 and >450,000 fish. Additionally, with the closure of approximately 32% of the reefs in West Hawai'i with the implementation of the FRAs in 2000, this increased fishing pressure was focused in smaller areas with likely intensified results.	Comment noted. This DEIS focuses on O'ahu, see response to this comment in the Hawai'i DEIS.

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Comment	Response
Another long-term study looked at reefs in South Kohala and determined that reef fish abundance was in "drastic decline" and reefs were in "dire straits". Populations of all of the top five most abundant fish families had declined since the original surveys conducted in 1979-1981 (see Fig. 9). Thirty-one of the thirty-five most abundant fish species had declined, including 19 species targeted by the aquarium trade. Most of the aquarium targeted species had declined by more than 50% and many were down by more than 80%. The extent to which the massive increase in reported take has contributed to this decline must be studied. As the Applicant noted in the FEAs' responses to this comment, the "Dire Straits" report concluded that "the widespread declines in families of fish not typically targeted either for food use or for the aquarium fishery suggest that other, more widespread factors are additionally contributing to the overall long-term declines in fish abundance."[emphasis added] Rather than rebutting the argument that further analysis is needed, this statement only serves to highlight why the EISs must also evaluate the potential of cumulative impacts of other factors (e.g. pollution, and sedimentation) on targeted fish species, such as decline of coral coverage, which have been demonstrated to influence reef fish species diversity and abundance.	Comment noted. This DEIS focuses on O'ahu, see response to this comment in the Hawai'i DEIS.
The areas south of these reefs are subject to some of the most intense aquarium collecting pressure in the state. Aquarium take between Keahole Point and these reefs in South Kohala, in one year alone, exceeds the aquarium take from the entire Great Barrier Reef in Australia, which has a reef area that is 300 times larger than Hawai'i's. For example, in 2014 aquarium collectors reported taking 191,083 fish from this Hawai'i zone. By comparison, 2014 reported aquarium take from the Great Barrier Reef was 112,000.	Comment noted. This DEIS focuses on O'ahu, see response to this comment in the Hawai'i DEIS.

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Comment	**Response**
Abundant populations of herbivorous fishes are critically important to coral reefs. They keep algae from overgrowing corals or preventing new corals from starting. Important families of herbivorous fishes in Hawai'i include surgeonfishes, damselfishes and parrotfishes. The vast majority of fishes taken by the aquarium trade are surgeonfishes. Yellow Tangs are the dominant herbivore in West Hawaii. They are also the most heavily collected species. The Dire Straits study documented a 90% decline in herbivorous surgeonfish and damselfish populations, while parrotfish populations had actually increased over time. This aforementioned 90% decline in herbivores contributed to a 35% reduction in coral cover, a 64% reduction in coral building coralline algae, a 38% increase in algae at one site and a staggering 322% increase in algae at another. DLNR claims that parrotfishes are more important herbivores than surgeonfishes when it comes to keeping algae in check on coral reefs. On these South Kohala reefs, the increased parrotfish populations were not enough to offset the loss of surgeonfishes and damselfishes, and the algae still outcompeted the corals. The notion that surgeonfishes taken by the aquarium trade are not an important component to coral reef health is challenged by this study. The FEAs attempt to downplay the importance of surgeonfishes and other herbivorous fishes taken by the trade by citing a 2003 study by Tissot and Hallacher (described more in the next section) that found no evidence of increased algal growth in areas of collection versus areas without collection, despite reduced fish abundance in the collected areas. However, the authors concluded that the study may not be a good test of that hypothesis for several reasons and that further investigation is warranted. Further, a more recent assessment of ecosystem trends in West Hawai'i includes, among other data, the differences in herbivore biomass and coral cover between reefs on the northern portion of the West Hawai'i coast (which encompasses the South Kohala area described above and extends from Keahole Point, northward) and reefs on the southern portion (from Keahole Point, southward). The data shows that herbivore biomass in the north is significantly lower than that found on the south. Additionally, while the northern reefs are now dominated by algae, and coral cover has declined by ~30%, the same not true for the southern reefs. Notably, though the northern area is~33% smaller than the area to the south, catch reports do not indicate a corresponding reduction in take. In fact, in 2014 take was higher in the north than in the south. The extent to which heavy collection pressure in the north has contributed to this shift must be thoroughly addressed in the Hawai'i EIS. The FEAs also attempt to downplay the importance of herbivores taken by the trade by claiming that they target the smaller fish which are "the least effective sizes for cropping algae." A comparison of adult Yellow Tang densities in the West Hawai'i long-term protected areas (i.e.MPAs) vs. the Open Areas, shows that collection pressure on small, juvenile, Yellow Tangs has reduced the natural abundance of adults, which are 2 – 4 times larger than juveniles, by an average of 60%. The fact remains that algae now dominates many West Hawaii reefs, making it essential that the EISs thoroughly evaluate and mitigate any Applicant impacts that occur as a result of reduced herbivory.	Comment noted. The role of herbivores, and the impact of aquarium collection on these species, is included in Section 5.4 of the DEIS.

Responses to comments received from For the Fishes/The Humane Society of the United States/Center for Biological Diversity/Kalanihale Mololi'i/Moana Ohana Comment dated September 7, 2018

Comment	Response
Two peer reviewed studies documented the magnitude of the effect of aquarium collecting on natural populations of heavily targeted species by the aquarium trade. One, published in 2003 by Tissot and Hallacher, was conducted the two years prior to the establishment of the West Hawai'i Fish Replenishment Areas (i.e. aquarium no-take zones). The next study, by Tissot, et al., was conducted in 2000-2002, three years after those area closures. The results of each study showed that aquarium collectors have a significant effect on the abundance of targeted aquarium fishes (see Fig. 11). The U.S. Coral Reef Task Force described these results as follows: "Severe overfishing for aquarium trade occurs even in the United States: Aquarium fishes outside of reserves [in West Hawai'i] experience significant declines – from 14% to 97%." In a 2010 grant report to NOAA, DLNR documented that "a number of aquarium-targeted species have not responded to the increase in protected areas and have actually decreased in West Hawai'i since 1999" (see Fig. 11). Per DLNR aquarium catch reports, these species are also among the top 20 most harvested fishes. Nonetheless, all but two species, the Moorish Idol and the Hawai'ian Cleaner Wrasse, were included in the West Hawai'i 40 Species White List adopted in 2014. DLNR therefore calls for the continued harvesting of these species, despite knowing that their populations are in decline.	Comment noted. This DEIS focuses on O'ahu, see response to this comment in the Hawai'i DEIS.
Three species identified in the SWAP, the Bandit Angelfish, Bluestripe Butterflyfish, and Hawai'ian Turkeyfish Figure 4 (in gold outline) were included in a DLNR presentation on West Hawai'i Species of Special Concern (Fig. 2) where two were described as routinely seen in the 1970's and now very rare, and one was described as down by 99% in two different areas.	Comment noted. A bag limit of two fish per day already exists for the Bandit Angelfish in O'ahu. Impacts of commercial aquarium collection on Bandit Angelfish are included in Section 5.4 of the DEIS. The Bluestripe Butterflyfish and Hawai'ian Turkeyfish are not within the top 20 species collected on O'ahu, but are SGCN species, and historic collection data is included in Appendix B of the EIS.
In West Hawai'i the decline of butterflyfishes has been well-documented in both population surveys and aquarium catch data. A 2008 presentation on West Hawai'i aquarium species of special concern reported declines in butterflyfish abundance and diversity. Two species were particularly hard hit: the Bluestripe Butterflyfish and the Teardrop Butterflyfish, experienced population declines ranging from 89% - 100% in two West Hawai'i areas (see Fig. 12).	Comment noted. This DEIS focuses on O'ahu, see response to this comment in the Hawai'i DEIS. Historic collection data from O'ahu on the Bluestripe Butterflyfish is included in Appendix B of this DEIS. Teardrop Butterflyfish are not an SGCN and are not in the top 20 fish species collected on O'ahu.
The Bluestripe Butterflyfish is a highly unique, endemic Hawai'ian species that, having no sister species elsewhere in the Indo-Pacific, is also known as a relic (see Fig. 13). Until 1980, this species was among the top twenty fishes collected in West Hawai'i, with an annual average harvest of 347. By 2012, the last year this species appeared on West Hawai'i catch reports, reported harvest had dropped to a total of nine. This species was excluded from the West Hawai'i forty species White List which went into effect in 2014. 2015 Hawai'i SWAP lists the Bluestripe Butterflyfish among the species of greatest conservation need in the 2015 Hawai'i State Wildlife Action Plan. Threatened by the aquarium trade, conservation actions include to "protect current populations, but also to establish further populations to reduce the risk of extinction."	Comment noted. This DEIS focuses on O'ahu, see response to this comment in the Hawai'i DEIS. Historic collection data from O'ahu on the Bluestripe Butterflyfish is included in Appendix B of this DEIS.

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Comment	**Response**
According to DLNR reef surveys and catch data, the Teardrop Butterflyfish has also experienced drastic declines on West Hawai'i reefs (see Fig. 12). This beautiful species is named for the striking upside down black teardrop located mid-body (see Fig. 3). Until 1980, the Teardrop Butterflyfish was among the top ten fishes collected in West Hawai'i with an average annual harvest of 1,454 individuals (see Fig. 14). During the following five years, the harvest rate dropped, but it was still among the top twenty species collected (see Fig. 14). Though collection continued until at least 2013, by the late 1990's DLNR considered Teardrop Butterflyfish as no longer targeted by the aquarium trade and excluded them a list of aquarium targeted species provided to researchers, Brian Tissot and Leon Hallacher, who were embarking on a project to document the magnitude of the effect of aquarium collecting on natural populations. They were, however, included in the surveys to test assumptions since they were similar to targeted species. The researchers encountered just one individual Teardrop Butterflyfish during the entire study and so they were excluded from further analysis. In 2011 a group of divers encountered an aquarium collector at a popular North Kohala dive site. They watched in horror as the collector scooped up the first Teardrop Butterflyfish they had seen in that area in years along with a number of yellow tangs and other fishes (Fig. 15).92 In 2013, the last year Teardrop Butterflyfish appeared on aquarium catch reports, reported take had dropped to a total of ninety, reflecting a 99% drop in annual catch since 1980.93 This species was excluded from the West Hawai'i forty species White List which went into effect in 2014. The exclusion of any formerly collected species from the White List, such as the Bandit Angelfish, Bluestripe Butterflyfish, Hawai'ian Turkeyfish, Teardrop Butterflyfish, or Thornback Cowfish, is not an exemption for a thorough analysis of their current status within the West Hawai'i Regional Fishery Management Area (WHRFMA) and elsewhere on Hawai'i Island, compared to the baseline (i.e. historic natural abundance), nor does it exempt the need for thorough analysis of impacts from collection efforts elsewhere in the state.	Comment noted. This DEIS focuses on O'ahu, see response to this comment in the Hawai'i DEIS. Teardrop Butterflyfish are not a SGCN and are not in the top 20 fish species collected on O'ahu.
The aquarium fishery in West Hawai'i takes 1.8X more reef fish than recreational and other commercial fishing combined. Most of these fish are yellow tangs.	Comment noted. This DEIS focuses on O'ahu, see response to this comment in the Hawai'i DEIS.
"Overall Yellow Tang abundance in 30'-60' hardbottom habitat in West Hawai'i increased by 355,758 individuals from 1999/2000 to 2010-2012 even though Yellow Tang abundance in the Open areas decreased by 21%. This decrease is attributable largely to an increase in the number of aquarium collectors and collected animals relative to the period when the FRAs were established." Over sixty percent of West Hawai'i reefs are open to the aquarium trade. On the reefs in those areas, the impact of the aquarium trade on natural populations of yellow tangs has been a significant reduction in the abundance. For example, natural populations were reduced by over 75% in 2007-2009 and in recent years, by 60% (see Fig. 16). The increase in FRA Yellow Tang abundance that began in 2002, three years after establishment of these protected areas, is a clear example of the impact of the trade on natural populations: when collection pressure is removed, given enough time, populations may be able to rebound. As noted earlier, the overall increase in Yellow Tang abundance that has occurred since 2014 is due to an anomalous recruitment pulse that coincided with warming waters in 2014. Typical recruitment pulses, such as those that occurred in 2002 and 2009, have resulted in short-lived increases in fish populations that were followed by prolonged or short and steep population declines	Comment noted. This DEIS focuses on O'ahu, see response to this comment in the Hawai'i DEIS.

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Comment	Response
We agree with DLNR that the Achilles Tang Conservation Alternative does not provide a scientific basis for concluding that the proposed reduction would be sufficient to sustain the population. Further, in 2014 a bag limit of 10 Achilles Tang per day was imposed on the aquarium trade in an attempt to address declining populations in West Hawai'i. Since 2014, the price has increased, populations have decreased. The FEA proposes to reduce the daily bag limit to 5 per day for commercial aquarium purposes and create a 5 per day bag limit for all consumptive purposes, as well. As with other heavily targeted aquarium species, the natural abundance of Achilles Tangs, as indicated by population densities in long-term protected areas such as MPAs, is substantially diminished by aquarium trade collection pressure. Most importantly, a serious flaw in the DLNR data used by the Applicant to show Achilles Tang catch as a percentage of the Open Area population substantially underestimates the impact of collection pressure. DLNR compared Achilles Tang average reported catch over FY 2013 – 2014 to their CY 2012 – 2013 Achilles Tang Open Area population estimate and determined that catch as a percentage of Open Area population was 32.7%. An examination of catch report data reveals that had they used reported catch from the same time period as the population estimate (i.e. CY 2012 – 2013), Achilles Tang catch as a percentage of Open Area population was substantially higher (see Fig. 18). This exemplifies the potential for extreme over-collection by the trade; the need for a thorough review of annual reported catch numbers and their relationships to the populations of aquarium targeted species in the areas from which they taken; and, the need for mechanisms for real-time assessments and adjustments to protect these vulnerable species.	Comment noted. This DEIS focuses on O'ahu, see response to this comment in the Hawai'i DEIS.
Unlike West Hawai'i, no aquarium fish population data was gathered during the early years of aquarium trade operations on O'ahu reefs. More recent data has been gathered in a yet to be published study by Dr. Gail Grabowsky of Chaminade University and is summarized below. Dr. Grabowsky reached the same conclusions reached by Williams and Walsh in a 2007 report documenting declines in populations of certain fishes on two Hawai'i Island reef areas: commercial aquarium collecting is implicated in the declines; and, the greatest declines are seen in the species that have faced the heaviest fishing pressure. Using the same methods described in earlier research on Hawai'i Island documenting the magnitude of the effect of aquarium collecting on natural populations of heavily targeted species, Dr. Grabowski and her team quantified the abundance of aquarium collected fish at over 20 sites around O'ahu from 2008- 2010. Surveyed species included Yellow tangs, Forcepsfish, the Hawai'ian "Domino" Damselfish, as well as additional butterflyfishes, surgeonfishes, and other fishes targeted by the aquarium trade. The fish population surveys showed that species targeted by the aquarium trade are ten times more abundant at Hanauma Bay, Hawai'i's first marine life conservation district, protected since 1967, than they are on other O'ahu survey sites.	Comment noted. The best available scientific data has been included in the DEIS. Unpublished data from Dr. Grabowski was not available for analysis in the DEIS.
As with the Hawai'i Island studies conducted by Tissot and others, uncollected sites were selected as controls and served as a proxy for estimating natural abundance. The data also showed that aquarium fish are rare at Pupukea and Coconut Island in Kaneohe Bay, both of which are protected similarly to Hanauma Bay, but unlike Hanauma Bay, are easily accessed by poachers. There were no juvenile fish smaller than a silver dollar at Hanauma Bay, which led Dr. Grabowsky to surmise that it may be "that the fish are so depleted on O'ahu that those we see are the "living dead" who cannot effectively maintain a population due to their rarity. This is called the Allee effect and has been documented in other rare species."	Comment noted. The best available scientific data has been included in the DEIS. Unpublished data from Dr. Grabowski was not available for analysis in the DEIS. As noted in the DEIS, the DAR (2019a) concluded that the 2010 and 2014 Hawai'i Island aquarium catch report validation did not indicate substantial underreporting of catch by aquarium collectors. Nevertheless, the cumulative impacts of underreporting and poaching are addressed in Section 5.4.3.6 of the DEIS.
In addition to population surveys, catch data can provide an important view into the status of populations of targeted fishes. As explained elsewhere in these comments, using catch data to estimate the proportion of fishing mortality to total population is highly problematic since catch reports are unverified and both underreporting and non-reporting are highly likely .	Comment noted. As stated in the DEIS, the DAR concluded that the 2010 and 2014 Hawai'i Island aquarium catch report validation did not indicate substantial underreporting of catch by aquarium collectors. Nevertheless, the cumulative impacts of underreporting and poaching are addressed in Section 5.4.3.6 of the DEIS.

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Comment	**Response**
However, where baseline population data are absent, and where consumer demand exists for a particular species or family group, it is highly likely that substantial declines of reported catch reflect reduced abundance of the target sizes—juveniles in most cases—of those species or families Hawai'i's reefs. In fact, historical catch reports have been used to document the collapse of the aquarium fishery on southwest O'ahu reefs after hurricane Iwa hit Hawai'i in 1982 and damaged many reefs. Per anecdotal reports from a number of aquarium collectors, the storm destroyed important habitat for yellow tangs and other targeted species. This resulted in the migration of many fishes to undamaged coral reef areas. Aquarium collectors then concentrated their efforts on these sites and within a few short years, populations of species targeted by the trade completely collapsed. Referring to these data, researchers noted that since yellow tangs are in high demand, these declines reflect the situation on these reefs (i.e. reduced abundance of the small yellow tangs targeted by the trade) (Walsh et al. 2004). Catch reports from 2016 confirm that yellow tang populations have yet to recover (see Fig. 17, 18).	Comment noted. The DEIS includes the best available science, including the 2016 CREP population estimated (CREP 2018).
The Bluestripe Butterflyfish (see Fig. 13) was among the top fifteen aquarium fishes captured on O'ahu through the five-year period that ended in 1995. As of the five-year period that ended in 2015, reported catch had declined by 79% from the five-year period that ended in 1980. In 2016, reported catch dropped an additional 15% (see Fig. 19). As previously noted, the Bluestripe Butterflyfish is listed among the species of greatest conservation need in the 2015 Hawai'i SWAP. Despite this listing and the alarming decline in reported catch, no take limits were placed on this species in the O'ahu Aquarium Rule.	Comment noted. Historic collection data from O'ahu on the Bluestripe Butterflyfish is included in Appendix B of this DEIS.
Reported catch of the Teardrop Butterflyfish has also experienced drastic declines on O'ahu reefs (see Fig. 19). During the ten-year period 1976-1985, the Teardrop Butterflyfish was among the top ten fishes collected on O'ahu with an average annual harvest of 2,558 individuals (see Fig. 19). During the following five years, the harvest rate dropped, but it was still among the top twenty species collected. As of the five-year period that ended in 2015, reported catch had declined by 94% from the five-year period that ended in 1980. In 2016, reported catch dropped an additional point (see Fig. 19).	Comment noted. Teardrop Butterflyfish are not an SGCN and are not in the top 20 fish species collected on O'ahu.
The Bandit Angelfish is another beautiful and highly unique, endemic Hawai'ian species with a color pattern unlike that of any other angelfish on Earth (see Fig. 20). The Bandit Angelfish has been among the top twenty aquarium fishes captured on O'ahu on and off since 1976, most recently in During the five-year period 1976-1980, annual reported catch averaged 1,380 individuals (see Fig. 19). After that, annual reported catch rarely exceeded 600 individuals and from 1996-2005 the average was less than 100. As of the five-year period that ended in 2015, reported catch had declined by 64% from the 1976-1980 high (see Fig. 19).	Comment noted. Impacts to the Bandit Angelfish are disclosed in Section 5 of the EIS. All action alternatives include the existing size/bag limit on the Bandit Angelfish, outlined in Section 1.2.3 of the EIS.
Catch reports also indicate increasing consumer demand for this precious species in the landed value data. From 1976-2003 the average landed value for a Bandit Angelfish was \$10. By 2004 it had jumped to \$54 and in recent years has skyrocketed to \$137 each. A similar pattern was noted for Bandit Angelfishes captured in West Hawai'i and prompted University of Hawai'i (UH) and DAR researchers to point out that decreasing catch combined with increasing value signals a real population decline. Not surprisingly, the Bandit Angelfish is also listed among the species of greatest conservation need in the 2015 Hawai'i State Wildlife Action Plan. Threatened by the aquarium trade, conservation actions include to "protect current populations, but also to establish further populations to reduce the risk of extinction." The O'ahu aquarium rule established a daily bag limit of two Bandit Angelfishes greater than 5.5 inches in length. Commercial data does not capture fish sizes so the impact of this size limit cannot be determined.	Comment noted. Impacts to the Bandit Angelfish are disclosed in Section 5 of the EIS. All action alternatives include the existing size/bag limit on the Bandit Angelfish, outlined in Section 1.2.3 of the EIS.

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Comment	**Response**
Rules governing the take of certain aquarium species on O'ahu were adopted in 2014. The development and adoption of these rules was highly controversial because they were not scientifically sound and did not address the concerns of stakeholders outside the aquarium trade. Over 4,000 testimonies were received by DAR, and 98% of the comments preferred that aquarium collecting should end altogether or in the very least should include limits on the number of permits issued, and scientific and community- based limits on species and take levels. Many comments noted that the so-called "limits" allowed take that far exceeded the number of animals historically taken by the trade, and in fact, allowed limitless catch because they included no restrictions on input (i.e. permit limits), and no meaningful restrictions on output (species or take limits). Among those opposed to the rules was coral reef and marine fisheries biologist, Frazer McGilvray, who was the DAR Administrator at the time. Mr. McGilvray opposed the rules because they were neither based on science, nor were they developed under a multi-stakeholder approach. The written and oral testimony Mr. McGilvray presented to the board governing DLNR included the following: "All stakeholders should be consulted and everyone's opinion should be taken into account. There appears to be no scientific basis for the proposed bag limits for each species. The proposed take limits were akin to setting a speed limit at 400 MPH. These rules do not address the take of undersize, sexually immature fish. The majority of yellow tang allowed to be taken under this rule are immature and have not contributed to the future of the species. These rules, driven by the demands of the trade, are contrary to good natural resource management.	Comment noted. . The Applicant is proposing a limited issuance of permits, creation of a bag limit for the Flame Wrasse, and expansion of the Waikiki MLCD (in addition to existing regulations put in place in 2014). The Applicant can only propose but not ensure regulations; therefore, it is up to the DLNR to make these binding (e.g., changing the law/regulation or including a condition of the permit).
The take of juveniles is generally prohibited in other fisheries, but not by the aquarium trade. The take of adults is allowed, but only where good management practices govern the take in other fisheries, but not by the aquarium trade. The taking of 100 immature yellow tang per person per day is not consistent with good natural resource management when there are more than 50 licensed aquarium collectors on O'ahu. It is my belief that these rules require further work and are not yet ready for adoption." The DLNR submittal to the board conceded that the proposed limits were not intended to reduce take, but were, instead, based on animal welfare. This statement does not stand up to scrutiny since no animal welfare experts or groups familiar with the aquarium trade were consulted, and in fact, the concerns of several of these groups were dismissed outright. The 2014 O'ahu rules also imposed bag limits for certain sizes of three species were also imposed: a minimum and maximum (i.e. slot) limit for yellow tangs and maximum size limits for kole (bag limits of two of each size) and Bandit Angelfishes (bag limit of two). While there has been some discussion of the poor survival rates of very small yellow tangs, no such discussion was documented for the larger sizes. Finally, because aquarium catch reports do not capture fish sizes, it is impossible to determine or even estimate the impact of a size limit in the aquarium fishery." However, catch reports do show that despite the combined catch, size and vessel limits, yellow tang catch in 2015 and 2016 exceeded historical reported catch. This was due to an unprecedented warm water event that bleached and killed many corals, but also brought large numbers of young fishes to Hawai'i's reefs during 2014 and 2015.	Comment noted. The Applicant is proposing a limited issuance of permits (20) and expansion of the Waikiki MLCD. All alternatives that involve the issuance of Aquarium Permits would continue to require permit holders to abide by the existing bag and size limits for the Yellow Tang. Collection of Yellow Tang by the 20 fishers who would be issued Aquarium Permits under the Preferred Alternative is anticipated to be over 50% lower than historic rates. Additional collection by others may occur without the use of fine mesh nets (i.e., other fishers collecting under a CML, as is currently occurring under the No Action Alternative). Nonetheless, total collection of Yellow Tang under the Preferred Alternative is a lower impact compared to the No Action Alternative.

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The O'ahu FEA's discussion of other regulated species describes the Achilles Tang, Bandit Angelfish, and Hawai'ian Cleaner Wrasse as "not collected to the level of the top twenty collected species." However, according to both historical and recent catch data, this is inaccurate. These three species have historically, and recently in one case, been among the top twenty collected species on O'ahu as follows: Achilles Tang was among the top twenty during the five-year period that ended in 1985; Bandit Angelfish was among the top twenty during the five-year period that ended in 1980 and again in 2014, 2015 and 2016; Hawai'ian Cleaner Wrasse among the top twenty during the five-year period that ended in 1980. Bandit Angelfish have been described earlier, and Achilles Tangs are both a culturally important food source and an important herbivore on the reef. The Hawai'ian Cleaner Wrasse plays a particularly critical role in the reef ecosystem by feeding on parasites, dead tissue and mucus of reef and other fishes (see Fig. 21). In 2008 the West Hawai'i aquarium trade included the Hawai'ian Cleaner Wrasse in its list of Species of Special Concern that should not be captured, citing the key role the play in maintaining the "health of the reef population, as the doctors of the sea". Obviously this species plays a similar role on reefs throughout Hawai'i. This is another clear example of how the dictates of the North American aquarium trade are driving extremely poor management decisions. The cumulative impact of long term sustained heavy collecting pressure on these and other species, and its effects on coral reef ecosystems must be fully evaluated and proper mitigation must be proposed in the EISs.	Comment noted. The top 20 collected species analyzed in the EIS are based on the total collection between 2000 and 2017. As stated in Section 4.4.5 of the DEIS, the Hawaiian Cleaner Wrasse was the 26th most collected species, the Achilles Tang was 33rd and the Bandit Angelfish was 47th. Impacts to all three species are disclosed in Section 5 of the DEIS.
In addition to fishes, marine invertebrates such as hermit crabs, Feather Duster Worms, sea stars and snails, are taken in very high numbers by commercial aquarium collectors. These invertebrates play a key role in the coral reef environment, and their overharvesting may have serious ecological consequences. The EISs must address the very large numbers of invertebrates that are taken and proper mitigation measures must be proposed.	Comment noted. Impacts to invertebrates are disclosed in Section 5.4 of the DEIS. However, as summarized in Table 5-6 of the DEIS, collection of invertebrates is anticipated to be the same under any of the four alternatives under consideration, as collection of invertebrates is not dependent upon issuance of an Aquarium Permit.
The O'ahu FEA proposes to expand the Waikiki Marine Life Conservation District MLCD by 740 acres, and to prohibit only commercial aquarium collection within that expanded area. We concur with the Agency that this alternative is problematic for a number of reasons, including its lack of proper scientific review of the impacts. While it is expected that once collection pressure is removed, there may be a beneficial impact of increasing populations of targeted species, it is also expected that without concurrent reductions in allowable take, populations in the areas open to collection are likely to experience further declines as a result of increased pressure that result from reduced access elsewhere, as has been demonstrated in West Hawai'i.	Comment noted. Section 5.4.1.3 of the EIS includes the following information on direct benefits of the expanded Waikiki MLCD: Friedlander et al. (2007) found that biomass within the existing Waikiki MLCD was 2.5 times higher than adjacent control sites. While the expanded area of the Waikiki MLCD would only be closed to commercial aquarium collection, similar areas in West Hawai'i have shown that fish from protected Fish Replenishment Areas (where only commercial and recreational fishing is banned, and other forms of fishing can continue) will seed unprotected areas (Christie et al. 2010). The use of areas closed to aquarium collection in West Hawai'i was implemented in 1999, and the DAR has determined that it has been "very successful" at driving increased in Yellow Tang populations (the most heavily targeted aquarium fish in West Hawai'i; DAR 2019a). It is assumed that the expanded Waikiki MLCD would have similar benefits as the Fish Replenishment Areas on Hawai'i Island.

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In addition, the O'ahu FEA proposes a bag limit of 10 Flame Wrasses per day. We concur with the Agency that this proposal lacks a scientific basis for concluding that a bag limit of 10 per day would be sufficient. Not only would the bag limit apply to a limitless number of people, and as such, would neither limit actual take nor would it help to restore or protect populations from increasing collection pressure, it also fails to address the potential for extirpation of Flame Wrasses on coral reefs shallower than 98 feet where collection pressure is the greatest. As pointed out in the O'ahu FEA, a recent study found zero Flame Wrasses shallower than 98 feet on West Hawai'i reefs.163 Rather than an indication that Flame Wrasses spend much of their time in deeper waters, an idea forwarded in both FEAs with no reference, the absence of Flame Wrasses in their natural range is more likely an indicator of severe over-collection by the trade in the shallower depths they once inhabited. Flame Wrasses naturally occur at depths over 50 feet. SCUBA divers, including two of the Commenters, have for decades consistently encountered harems of Flame Wrasses at depths ranging from 50 – 90 feet on multiple dive sites, as long as the sites weren't accessed by the aquarium trade. On sites accessed by the trade, Flame Wrasses at those depths have completely disappeared. Historical catch records indicate that collection pressure on O'ahu populations of Flame Wrasses has dramatically increased: hundreds were annually captured prior to 2008; since then, annual catch has ranged between 1,000 - >4,000.166 The potential for Flame Wrasses to disappear from shallower reefs around O'ahu, as they have from West Hawai'i, is very real. This increasing collection pressure must be acknowledged and addressed in the EISs.	Comment noted. The Preferred Alternative in the DEIS limits the number of permits to 20. The paper referenced in the FEA and DEIS (Kane and Tissot 2017) is the support for the conclusion that Flame Wrasse are found in higher densities at deeper depths. The commenter does not provide support for the conclusion that the lack of Flame Wrasse presence is due to overcollection.
The applicant continues to base both FEAs on the premise that fish collection is considered sustainable if only removes less than 5% to 25% of the entire population (annually), but the reasoning behind this threshold is flawed. The FEAs stated that "research suggests that collection between 5% and 25% of a reef fish population is sustainable for various reef fish species in the Philippines that are similar to those on the White List (e.g., tang, wrasse, butterflyfish, angelfish, and triggerfish)" based on a Reef Check report by Ochavillo and Hodgson (2006). However, the EISs should not use these thresholds because: These thresholds for sustainable ornamental fish collection are species–specific based on estimated natural mortality rates (M) and fishing mortality at maximum sustainable yield (FMSY) or year-per-recruit analysis. Natural mortality rates for reef fishes are based on growth rates and length and thus are also area-specific. Mortality is based on catch data. Yield-per-recruit analysis should be derived from several annual surveys. Thus, these parameters should be specifically calculated for Hawai'ian reef fish targeted by the aquarium industry as highlighted in Ochavillo & Hodgson (2006); The 5%-25% threshold indicates "a good rule-of-thumb of collection limit" for coral reef fishes in the Philippines. This does not mean it is a good rule of thumb for collecting reef fishes in Hawai'i; Most ornamental fish species in the Ochavillo and Hodgson (2006) are species different from those on the White list.	Comment noted. The DEIS uses the best available science in the analysis, and there are currently no O'ahu-specific thresholds. However, the Ochavillo and Hodgson (2006) thresholds were established using data from fish from the same families and guilds as those collected in O'ahu. As stated in the EIS, similar data for the species collected on O'ahu are not available to determine species-specific sustainable thresholds; therefore, this research represents the best available science.
Only a few species share the same genus or species (butterflyfish, a couple of wrasses, one angelfish, a couple of damselfish, one tan and one triggerfish). Thus, it is questionable whether this fairly wide threshold (5%-25%) is representative and applicable to Hawai'ian species; Finally, this report is not peer-reviewed research, it is a field manual: Marine Aquarium Trade for Coral Reef Monitoring Protocol with a Data Analysis and Interpretation Manual. This field manual was designed in part to: "provide a scientific basis for recommending sustainable levels of collection." The FEAs continue to assume that current fish abundance for target species is the baseline, and thus 1% to 5% of individuals remove from the population would be considered sustainable. But this is wrong. The FEAs still do not acknowledge that current population abundance of most of these fish species is already depleted due to in part to heavy exploitation by the aquarium trade since at least the 1970's and habitat degradation. The total allowable collection/catch for each species must be calculated based on information on natural mortality rates and the available and limited information on collection/catch records, specific to the geographic areas and locations where they are taken throughout the state.	Comment noted. The DEIS uses the best available science in the analysis. The scope of the DEIS evaluates each of the five four alternatives based on their impact to the current baseline conditions, because that is the environment which would be impacted by each of the five four alternatives. Under the Preferred Alternative, collection of 20 of the 22 species with population estimates would be below 2.5% of current population estimates. For the 2 remaining species with population estimates available (Yellow Tang and Flame Wrasse), collection is below This level of take is below what is considered to be sustainable reef fish harvest based on available research (5% - 25%; Ochavillo and Hodgson 2006). 25%. However, collection of both these species may potentially be even lower due to uncertainty in the population estimates and is anticipated to be less than 1% of the Flame Wrasse population. While collection of the Yellow Tang may be above 5% of the population, this species displays high fecundity, and collection under the Preferred Alternative is a lower impact compared to the No Action Alternative.

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	In addition, the Preferred Alternative has additional benefits over the No Action Alternative, including size limits on the Yellow Tang and bag limits on both the Yellow Tang and Flame Wrasse, as well as other species.
The Coral Reef Ecosystem Program (CREP) data used in the FEAs for the entire Islands of Hawai'i and O'ahu (based on 2010-2016 surveys) continue to not be representative of regional population abundance such as in East Hawai'i and the West Hawai'i Regional Fishery Management Area (WHRFMA), and should not be used to estimate regional proportions of fish catch. Population abundance estimates for fish species for the entire island of Hawai'i are not representative of regional fish abundances such as East Hawai'i and WHRFMA. The CREP data collect fish data from 257 stationary point count locations around Hawai'i between depths of 0-98 feet. In contrast, the West Hawai'i Aquarium Project (WHAP) collected data from 25 transect survey sites from WHRFMA area between depths of 30-60 feet. It is well established that population abundances of reef fish species in Hawai'i, especially relatively small-size species that are targeted by the aquarium industry, are highly variable in space depending on reef complexity, depth and wave exposure, and in time (within and among years) depending on the season, mortality, recruitment to the population, and environmental factors. The relative proportion abundance of fish species taken annually by the aquarium industry should be based on regional total abundances and regional catch records (e.g., aligned with the aquarium fish trip report zones; or, as in Hawai'i DEA, Table 6). Allowable levels of take should be determined in conjunction with the wishes of Hawai'i residents and visitors who strongly desire that fish populations are restored to their naturally occurring (i.e. unfished) levels of abundance on the majority of Hawai'i reefs.	Comment noted. As stated in Section 4.4 of the DEIS, around the island of Hawai'i, there is connectivity between adjacent reefs (up to 184 km)(Christie et al. 2010). It is assumed that this would also be applicable to the smaller island of O'ahu. Therefore, using island-wide population estimates to analyze impacts is appropriate.
The Hawai'i FEA continue to assume that current island-wide and regional targeted fish population estimates are healthy and not impacted and this represents a shifting in baselines. Population abundance of most of these fish species has declined over the past decades due to overexploitation and habitat degradation and thus they cannot be considered baselines. Strong scientific evidence shows that coral reefs of the main Hawai'ian Islands, especially near higher human population densities (where exploitation pressure is the highest), have significantly less abundance and biomass of reef fish species than more isolated islands due to overfishing.	Comment noted. This DEIS focuses on O'ahu, see response to this comment in the Hawai'i DEIS.

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The allowable number of individuals that could be collected from aquarium fish populations must be substantially less than those stated by the FEA because most of these species are already depleted. Fishing effort has substantially increased for aquarium fish species on the Island of Hawai'i as well as for certain species, such as Flame Wrasses on O'ahu. Prime-targeted species on both islands have significantly declined due to overharvesting. For example, population abundance of one of the most heavily exploited species, yellow tang (Zebrasoma flavescens), on the west coast of the Big Island of Hawai'i (West Hawai'i) declined 45% due to exploitation in areas open to fishing/collection from 1999 to 2007. Yellow Tang abundance is closely tied to annual levels of recruitment, and after good recruitment levels from 2008 – 2013, Yellow Tang abundance in the Open Areas improved, but was still 4.7% lower than the 1999 – 2000 Open Area baseline. As noted earlier, an anomalous recruitment pulse in 2014 is likely behind the increase in abundance seen since then. Even when including marine managed areas (MMAs) such as fish replenishment areas (FRA), where collection is prohibited and abundances are five times higher than in open areas, the population abundance of yellow tangs on West Hawai'i is substantially less than historical levels. The established networks of MMAs have definitely worked to increase yellow tangs and some other fish species in the West Hawai'i FRAs, but not all species have responded positively, and some have actually decreased overall since the FRAs were established. The extent to which collection pressure—whether in the Open Areas or due to poaching—is driving the decline of heavily targeted aquarium species in the areas closed to the trade must be studied. While the FEA attempts to minimize the impacts of collection pressure by proposing that "factors other than aquarium collecting [are] also affecting their populations," it remains highly likely that the main cause is collection pressure. An example of the effect of collection pressure on populations in MMA's is found in the significant decline of Yellow Tangs in those areas from 2004-2009 which coincided with Yellow Tang reported catch during that period that was substantially higher (e.g. in 2004 and 2006 it was more than double that reported in 2002). Given the relative long life-span of yellow tangs (>40 yrs) and increasing fishing intensity, these MMAs are just becoming sources for the aquarium fishing industry. The recovery of this species to past levels is unlikely if fishing/collection intensity continues or increases in the future.	Comment noted. This DEIS focuses on O'ahu, see response to this comment in the Hawai'i DEIS. The Preferred Alternative in the DEIS includes a new bag limit for the Flame Wrasse, limiting collection to 10 individuals per day. In addition, the Preferred Alternative would limit the number of permits to 20 fishers and expand the existing Waikiki MLCD.
As mentioned above, there is no requirement for recreational aquarium collectors to report catch. For commercial collectors, while reports are required, catch report compliance is substantially low on the Islands of Hawai'i and O'ahu and thus catch records grossly underestimate the real impact of the aquarium fishery. The number of permits reporting catch in the islands of Hawai'i and O'ahu was approximately half of the number of commercial aquarium permits issue annually from 2000 to 2017. On average, 47% (40 out 85) of commercial aquarium permit holders reported their catch between 2000 and 2017 in O'ahu. Similarly, on average, 56% (33 out 59) of commercial permit holders in the Island of Hawai'i (WFRFMA and East Hawai'i combined) reported their catch during the past 18 years (see Table 3 in the DEA of Island of Hawai'i). Although commercial aquarium fishers are required to report their monthly catch on an aquarium fish catch report, the compliance is clearly significantly low.	Comment noted. As stated in the DEIS, the DAR concluded that the 2010 and 2014 Hawai'i Island aquarium catch report validation did not indicate substantial underreporting of catch by aquarium collectors. While the commenter points to differences between the number of permits issued and the number reporting, a difference in these values is not indicative of underreporting. Rather, as stated in Section 5.2.1 of the DEIS, to avoid duplicate fish catch reporting, only a principal diver is required to report the catch and effort for the dive team (DAR, pers. comm., 2018). This process ensures that reported catch data are not duplicated in the State's system. However, this reporting mechanism can lead to confusion by outside observers, as the total number of permit holders is higher than the number of permit holders reporting data, giving the appearance of under reporting. Analysis by the DAR (2019) has shown that actual underreporting of catch is small, with a 3.5% difference between the number of animals reported caught and sold in 2010 and a 0.4% difference in 2014, which likely represent live releases and mortality. Nevertheless, the cumulative impact of poaching and underreporting is analyzed in Section 5.4.3.6 of the DEIS.

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This is a systemic problem that undermines the evaluation of the real impact that the aquarium fishery has on target species, the coral reef ecosystem, and the people that depend on them in Hawai'i. As such the impact of the aquarium fishing industry is likely larger than is reported, which has been discussed in the scientific literature. As a former DLNR employee succinctly wrote regarding aquarium catch reports: "The reliability of the data depends upon the sincerity of the permittees." There is no verification system, such as that provided by independent observers, to ensure the accuracy of self-reported data. One additional major impediment to accurate data stems from the lack of a license requirement for marine dealers and/or exporters. Currently there is a requirement for dealers (i.e. those who buy directly from aquarium collectors) to report their purchases. According to DLNR, the effect is that "dealer reporting is essentially on a voluntary basis and a few dealers are not reporting in whole or in part. DLNR cannot know whether a "few" or a dozen dealers are not reporting, but without a requirement for these businesses to have licenses, many operate beneath the radar and serve as a conduit for moving unreported catch out of the state. Establishing a marine dealer/exporter license has long been a priority for those within DLNR concerned about Hawai'i's marine resources, because it would enable the department to verify catch reports, identify unlicensed collectors (and all commercial fishers), identify dealers and helped with generating economic data about the fisheries. Without this information DLNR/DAR has no accurate data on health of fish populations. According to a former DAR Commercial Fisheries manager, Karl Brookins, the process of establishing the license was abandoned due to lack of funding.	Comment noted. As stated in the DEIS, the DAR concluded that the 2010 and 2014 Hawai'i Island aquarium catch report validation did not indicate substantial underreporting of catch by aquarium collectors. While the commenter points to differences between the number of permits issued and the number reporting, a difference in these values is not indicative of underreporting. Rather, as stated in Section 5.2.1 of the DEIS, to avoid duplicate fish catch reporting, only a principal diver is required to report the catch and effort for the dive team (DAR, pers. comm., 2018). This process ensures that reported catch data are not duplicated in the State's system. However, this reporting mechanism can lead to confusion by outside observers, as the total number of permit holders is higher than the number of permit holders reporting data, giving the appearance of under reporting. Analysis by the DAR (2019) has shown that actual underreporting of catch is small, with a 3.5% difference between the number of animals reported caught and sold in 2010 and a 0.4% difference in 2014, which likely represent live releases and mortality. Nevertheless, the cumulative impact of poaching and underreporting is analyzed in Section 5.4.3.6 of the DEIS.
In addition, the combined average of total fish and invertebrates collected under aquarium permits from East Hawai'i and the WHRFMA annually from 2000-2017 should not be used as reference for future annual collections. The lack of collection data for East Hawai'i from 2001 to 2004 lowers the calculated average and underestimates the number of fish collected. A more accurate estimation is to use data collected after 2005 when collection data from East Hawai'i resumed. As such the combined average fish and invertebrates collected under Aquarium Permits from East Hawai'i and the WHRFMA annually from 2005-2017 was 392,006 individuals instead of 355,381 (see Fig. 22). This updated estimate, which accounts for 36,625 more individuals, along with a value representing underreporting, should be used as the reference point for the Hawai'i EIS to calculate proportion of the population that is being taken by the fishery island wide. We note that Table 8 in the Hawai'i FEA has not "been updated to exclude any years without data in the averaging for East Hawai'i data," as stated in the Applicant's response.	Comment noted. This DEIS focuses on O'ahu, see response to this comment in the Hawai'i DEIS.
As discussed above, there is no reliable data on how many fish and other species are actually taken pursuant to aquarium permits in any given year. The FEAs repeatedly referred to a lack of data for numerous species. For example: "Because specific species of hermit crabs are not reported on aquarium permits reporting forms, it is not possible to know which species are collected, with the exception of zebra hermit crabs"; "Due to this underestimation, it is not possible to know the exact proportion of Flame Wrasse population that would be collected. . . ."; For Psychadelic (Redtail) Wrasse, Tinker's Butterflyfish, Longfin Anthias, Flame Wrasse, Fisher's Angelfish, and Eyestripe Surgeonfish (Palani), open area populations and catch as a percent of the open area populations are not available, because species "occur[] in habitats not adequately surveyed by transects." This data is necessary in order for the EISs to properly assess impacts. Furthermore, the Agency must conduct stock assessments of species before it is able to determine a sustainable rate of take. Clearly the Agency has not done so, as DLNR personnel have stated that to do so would take over a decade for just 40 fish species, out of the more than 287 fish and invertebrate species the Agency identifies as targeted by the trade (found at Appendix 4). Without such data, the Agency cannot meaningfully assess the environmental impacts of commercial aquarium collection. Such assessments must be completed prior to the issuance of the EISs, and in the face of any uncertainty, the EISs' analyses must err on the side of caution to protect these vulnerable species.	Comment noted. As stated in the DEIS, the DAR concluded that the 2010 and 2014 Hawai'i Island aquarium catch report validation did not indicate substantial underreporting of catch by aquarium collectors. The DEIS uses the best available data for analysis. This includes CREP (2018) population estimates for 22 of the 23 species analyzed. The one species without a population estimates ais the Bandit Angelfish, which has an average collection of 209 individuals per year, and an existing size/bag limit (see Section 1.2.3 of the EIS).

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HEPA also requires EAs to consider mitigation measures. Such a discussion is plainly absent from both DEAs. The new Preferred Alternatives ignore the vast majority of comments submitted on the DEAs and instead focus on just two species, Achilles Tangs on Hawai'i Island and Flame Wrasses on O'ahu. They also ignore the many comments naming locations where the impacts of collecting pressure are of concern, and instead arbitrarily name Waikiki as an area where no commercial collection would occur in the future.	Comment noted. The DEIS states in Section 5.6 that no significant adverse effects would occur as a result of the Preferred Alternative. Therefore, mitigation for impacts is not warranted and no mitigation measures would be implemented. Sections 5.2.4, 5.3.3 and 5.4.4 specifically address mitigation for socioeconomics, cultural resources and biological resources. It should be noted that the DEIS does include a limited permit issuance alternative as the Preferred Alternative, as well as a bag limit for the Flame Wrasse and an expansion of the Waikiki MLCD. Public comments on the DEA and FEA were fully considered during the development of the DEIS. Individuals and groups who requested to be consulted parties for the DEIS are listed in Section 6.0, and comments and responses are included in Appendix C of the DEIS. A Cultural Impact Assessment (CIA) was prepared that includes additional consulted parties, and is included as Appendix A of the DEIS.
The Agency's letter of determination stated that "because the applicant can propose but not ensure regulations aimed at protecting and restoring populations of aquarium fish, [the Agency] is interested in proposals for self-regulation by aquarium permit holders which could be incorporated into permit conditions even in the absence of or prior to establishing other regulations to accomplish the same purposes." We dispute the value of any self-regulation measure. Meaningful change must be binding on the industry, and a meaningful alternatives analysis requires the Applicant to propose binding measures.	Comment noted. As stated by the DLNR, the Applicant cannot ensure enforcement. The Applicant is proposing a limited issuance of permits, creation of a bag limit for the Flame Wrasse, and expansion of the Waikiki MLCD. The Applicant can only propose but not ensure regulations; therefore, it is up to the DLNR to make these binding (e.g., changing the law/regulation or including a condition of the permit). Any permit issued would require the permit holder to abide by all conditions of the permit.
A reasonable alternative would require the Agency to first determine: 1) the life history, spawning grounds and offspring/recruitment patterns for each species to be collected for aquarium purposes (see DLNR list of aquarium species at Appendix 4); 2) natural abundance (i.e. unfished) levels and complete stock assessments, for each island as a whole in addition to each collection zone, for those same species (see DLNR map of aquarium fish zones at Appendix 5); 3) a definition for "sustainable" as it relates to the natural abundance of coral reef species taken for aquarium purposes; and 4) annual total allowable catch, by species, designed to restore and then sustain natural abundance levels, with negligible impacts as defined in the Queensland Ecological Risk Assessment of the Marine Aquarium Fish Fishery, for each species to be taken for aquarium purposes, in each zone. After making these necessary threshold determinations, the Agency should issue limited numbers of Aquarium Permits, by zone and by species with corresponding total allowable catch limits, per the above parameters. Additionally, the Agency should require Aquarium Collection Permits, for all take for aquarium purposes, regardless of the method of collection.	Comment noted. The alternatives included in the DEIS address the issues raised by the commenter as follows: 1) the DEIS includes overviews of known ecology of each of the 23 species analyzed in Section 4.4.. 2) the DEIS is limited to the island of O'ahu. As stated in Section 4.4, there is assumed to be connectivity around each island based on data from Hawai'i Island (Christie et al. 2010), but genetic breaks between islands (Toonen et al. 2011). Therefore, population data from the island of O'ahu (CREP 2018) are used as the basis of the DEIS analysis. The most recent population data are used as the baseline, because that is the environment which would be impacted by each of the four alternatives. 3) the DEIS defines "sustainable" as collection of 5% to 25% or less of the population, based on the available research by Ochavillo and Hodgson (2006). 4)the Queensland Ecological Risk Assessment of the Marine Aquarium Fishery defines "negligible" as "insignificant impacts to populations (dynamics/structure/size)". The DEIS concludes that collection under the Preferred Alternative represents less than 2.5% of 20 of the 22 fish species analysed with population estimates. For the 2 remaining species with population estimates available (Yellow Tang and Flame Wrasse), collection is below This level of take is below what is considered to be sustainable reef fish harvest based on available research (5% - 25%; Ochavillo and Hodgson 2006). 25%. However, collection of both these species may potentially be even lower due to uncertainty in the population estimates and is anticipated to be less than 1% of the Flame Wrasse population. While collection of the Yellow Tang may be above 5% of the population, this species displays high fecundity, and collection under the Preferred Alternative is a lower impact compared to the No Action Alternative. The Preferred Alternative in the DEIS limits the number of commercial aquarium permits to 20, includes a new bag limit for the Flame Wrasse, and expands the Waikiki MLCD.

Responses to comments received from For the Fishes/The Humane Society of the United States/Center for Biological Diversity/Kalanihale Mololi'i/Moana Ohana Comment dated September 7, 2018

Comment	Response
HEPA also requires an EIS to consider mitigation measures. With minor exceptions, such a discussion is plainly absent from both FEAs. Decades of Applicant actions have directly impacted more than 200 species and indirectly impacted an unknown number of additional vertebrate and invertebrate species found in Hawai'i's coral reefs, one of the most complex ecosystems on Earth, where the fate of each species is determined by the existence, abundance and diverse actions of a multitude of other species that inhabit or otherwise rely upon these unique places. Yet, the FEAs claim there are no significant impacts whatsoever, and therefore, propose no mitigation measures outside of those found in the Preferred Alternatives, related to just two species and one area, which were designed to mitigate potential impacts to cultural resources only. In addition to proposing mitigation measures to address biological and related impacts to the various socio-economic values described herein, the EISs must also propose mitigation for impacts to cultural resources and for the ethical concerns and harm done to the animals, themselves, also described herein.	Comment noted. The DEIS states in Section 5.6 that no significant adverse effects would occur as a result of the Preferred Alternative. Therefore, mitigation for impacts is not warranted and no mitigation measures would be implemented. Sections 5.2.4, 5.3.3 and 5.4.4 specifically address mitigation for socioeconomics, cultural resources and biological resources.
PIJAC additionally failed to conduct the required early consultations prior to submitting its DEAs/FEAs. HEPA requires that the application must "at the earliest practicable time, . . . consult with . . . those citizen groups and individuals which the approving agency reasonably believes to be affected." In this case, it is clear from the long history of litigation that Commenters, at the very least, should have been consulted. PIJAC should also have consulted Native Hawai'ian groups and experts such as Gail Grabowsky. As a result of this failure to abide by HEPA's mandate of early consultation, the FEAs fail to analyze all impacts, and are skewed toward a favorable result for industry.	Comment noted. PIJAC engaged with interested parties prior to publication of the DEA (Section 6.5 in the O'ahu FEA). The DEAs were widely distributed to a range of parties prior to publication. Public comments on the DEA and FEA were fully considered during the development of the DEIS. Individuals and groups who requested to be consulted parties for the DEIS are listed in Section 6.0, and comments and responses are included in Appendix C of the DEIS. A Cultural Impact Assessment (CIA) was prepared that includes additional consulted parties, and is included as Appendix A of the DEIS.

Final Environmental Assessment,
Issuance of Commercial Aquarium Permits for the Island of Oahu

The final environmental assessment (FEA) for the Oahu commercial aquarium fishery states a finding of no significant impact but the Department of Land and Natural Resources (DLNR) has determined the need for a full environmental impact statement (EIS) instead. To initiate the EIS review, DLNR has announced the EIS preparation notice. The reasons why DLNR has determined the need for an EIS are listed in their letter dated July 26, 2018 to Mr. Scott Glenn, Office of Environmental Quality Control. The letter has two main sections: 1) a list of areas where the FEA needs further analysis and 2) a series of reasons for the determination. My comments will be in the form of, a general comments section, followed by my thoughts on each of the DLNRs two sections.

Section 1: General Comments

I find the DLNR comments full of assumptions and inaccuracies. I also find their reasoning for now requiring an EIS, illogical and not factually based. Given these observations, I am concerned that DLNR no longer has the technical expertise to adequately and objectively evaluate this document.

It appears the DLNR doesn't understand its own regulations. The aquarium permit is somewhat of a misnomer. The aquarium permit issued under Section 188-31, HRS, is a small mesh net exemption and not a general aquarium collecting permit. The legal minimum net mesh size is two inches stretched. An exemption to this minimum net mesh size is authorized by permit. This seeming small difference is important because the agency action is issuance of the permit that provides a small mesh net exemption (SMNE). The permit is not to collect aquarium fish, regardless of gear used. For purposes of clarity, I will use the term SMNE permit instead of aquarium permit in this document. The attempts to expand the analysis into non-permit activities are outside of the scope of the action.

It sounds like DLNR response was written by someone obviously biased against aquarium collecting and could have been crafted by the plaintiffs in the recent lawsuit against the DLNR. The thinking and the words chosen seem strangely familiar of the arguments made during the legal action. I also disagree with the Department's reasons for requiring an EIS and continue to support the FEA determination of no significant impact. My arguments for my disagreement will be further explained later in this document.

The DLNR appears to have completely changed its position that the aquarium fishery is sustainable to a position that it is now believes the fishery is unsustainable, despite the fact that collecting under permit has been stopped since the beginning of 2018, resulting in the impacts of collecting being drastically reduced. The DLNR does not explain why they have reversed their position.

Regarding the areas where the FEA were lacking, I disagree with most of the points made. Even if, for discussion only, the FEA were lacking these points, this would not trigger the need for an EIS. A revised DEA, including all these points, could have adequately addressed these concerns. It was my understanding that DLNR intended to work with the applicant to address any deficiencies prior to acceptance of the FEA. This, apparently, did not happen.

Section 2: My Comments on DLNR's Identified Analysis Needs

1) The take of aquarium fish as an irrevocable commitment to loss or destruction of natural or cultural resources. The take of individual fish itself is loss or destruction of natural resources;

the sustainability question is whether the annual take of cumulative numbers of fish as a percentage of estimated population results in irrevocable loss or destruction of populations of fish;

DLNRs thinking seems to be that the loss of an individual fish constitutes a loss under Chapter 343, HRS, then all actions taken by anyone anywhere would similarly require an EA. Does DLNR also consider the take of living microscopic organisms should be included in its broad application of the view of loss of natural resources? Does DLNR also believe that a State camping permittee breathing the air at a designated camp site requires an EA/EIS? How does it conclude that a 5% to 25% take of a species to be a "destruction of populations of fish?"

Chapter 343, HRS, focus is on the significant effect of use of the resources and not whether such use constitutes a loss. In many cases, the use of a resource results in its inevitable loss. To be relevant, the loss of a fish should to be viewed within the context of whether that use causes a significant effect. It's obvious that the loss of one fish doesn't mean the extinction of the species and doesn't constitute a significant effect. As such, going down the "rabbit hole" of trying to identify and characterize each loss is irrelevant to the question of significant effect. It should therefore, also be considered irrelevant for the purposes of Chapter 343, HRS.

Conclusion: By making Comment #1, DLNR seems to have totally ignored the whole DEA/FEA. It should more clearly identify why it believes the FEA did not adequately address the question of impacts. The statement does not provide enough guidance on how the applicant should proceed.

2) The manner in which the take of aquarium fish curtails the uses of the environment, including aquatic invasive algae control, the tourism industry, and the overall integrity of diverse aquatic ecosystems;

It is unclear how the collecting of aquarium fish is related to invasive algae control and the tourism industry. The causes of alien algae introductions are unrelated to aquarium collecting. The current regulatory measures include rules on ballast water and hull fouling. Once alien species are found in Hawaii, control methods include, among others, physical removal and urchin plantings. The premise that aquarium fish collecting is a controlling factor for alien algae growth and spread is wildly speculative. No scientific evidence supports this contention.

As noted in my comments on Comment #1, the permit impacts to tourism are outside of the environmental impacts requirement of Chapter 343, HRS, and outside of the scope of the agency action. Tourism is man-made, not part of the natural environment, and is irrelevant to this analysis. It would be an analysis of permit impacts on tourism's impacts on the environment.

It is unclear what the term "overall integrity of diverse aquatic ecosystems" means. It is a popular term and non-scientific. Biologically, ecosystems are dynamic and ever changing. Because natural conditions are always changing, the ecosystem constantly adjusts to these changes. If one component of the system no longer functions, the system compensates for this and creates a different function. This is the nature of living systems. It is unclear what "overall integrity" of an ever-changing system means. If integrity of the ecosystem functions is what is intended, then any change to the system that doesn't cease the system's ability to function, does not cease its integrity. Ecosystems are also viewed relative to scale. The ecosystem within a drop of water is different from the ecosystem within the region of the Hawaiian Islands is different from the ecosystem of the Pacific basin. It is unclear which ecosystem Comment #2 is referring to. Lastly, I am assuming “aquatic” should be limited to “marine” instead.

Conclusion: By making Comment #2, DLNR seems to have totally ignored the whole DEA/FEA. It should more clearly identify why it believes the FEA did not adequately address the question of impacts. The statement does not provide enough guidance on how the applicant should proceed.

3) The extent to which the take of aquarium fish conflicts with the state's long-term environmental goals;

Governor Ige’s 30 by 30 Sustainability Plan calls for the effective management of at least 30% of the State’s shorelines by the year 2030. The fishery does not conflict with, and would actively support, the plan. The DLNR has obviously taken the position that the fishery is unsustainable and in conflict with the plan. The requirement to have an SMNE permit and the issuance of those permits is a form of effective management of the shoreline and consistent with the plan. It is unclear how having the permit isn’t in support of plan.

Conclusion: By making Comment #3, DLNR seems to have totally ignored the whole DEA/FEA. It should more clearly identify why it believes the FEA did not adequately address the question of impacts. The statement does not provide enough guidance on how the applicant should proceed.

4) The impact of the take of aquarium fish on cultural practices in the state; and

Conclusion: By making Comment #4, DLNR seems to have totally ignored the whole DEA/FEA. It should more clearly identify why it believes the FEA did not adequately address the question of impacts. The statement does not provide enough guidance on how the applicant should proceed. For further comments, see Section 3, Reason #7.

5) The cumulative effect of the commercial take of aquarium fish using fine mesh nets when combined with the effects of:
   (a) the commercial take of aquarium fish by other legal methods;
   (b) the take of aquarium fish for recreational purposes; and
   (c) the commercial and non-commercial take of aquarium fish species for consumption as food, particularly including Achilles Tang and kole;

Conclusion: Comment #5 appears to include non-permit actions. Such an analysis would be outside of the scope of the EA and should not be included. See my further discussions under Comment #6 immediately following this discussion.

6) It is also necessary to analyze the potential impacts under the no action alternative resulting from non-issuance of aquarium permits, including the increased take of larger, reproductively mature aquarium fish using legal mesh nets.

Comment #6 is an interesting take on the no action alternative. It is unclear whether the no action alternative is required as part of the Chapter 343, HRS, analysis. If it is not required, then Comment #6 would be discretionary. For the sake of discussion only, if the no action alternative is included, what is the no action alternative being taken? Section 188-31, HRS, authorizes the Department to issue aquarium permits. It has done so since the 1970s. The government action then is clearly the issuance of aquarium permits. As the Legislature authorized the Department to require and issue SMNE permits, the Department doesn't have the legal option to issue or not issue SMNE permits, it must issue the permits.

The Supreme Court did not invalidate the authority of the State to require SMNE permits, but that the process of permit issuance was subject to Chapter 343, HRS. The issuance of permits is on hold, until the Chapter 343, HRS, review is completed. In my view, there is no actual no action alternative. The agency action, then, is to issue SMNE permits or not. Since not issuing permits is not a legal option, the DLNR must issue small mesh net exemption permits.

Conclusion: Since the agency action is the issuance of permits, activities not requiring a small mesh net exemption permit, should not be considered within the scope of the EA.

Section 3: My Comments on DLNR's Reasons for EIS Requirement

DLNR has issued a previous FONSI determination for a "programmatic" EA for the Fish Aggregating Device System and did not require an EIS. I've listed all of the stated DLNR reasons and will provide my specific responses/comments to each reason as follows.

1) The FEA identifies the scope of analysis as one year and states that an EA with updated data and analysis would need to be completed on an annual basis. This improperly segments the analysis which must include the long-term and cumulative impacts over time of aquarium collection.

Disagree: The FEA provided a detailed analysis of commercial aquarium landings over a broad number of years to document patterns of collections that would be used to further determine "impacts" at the species level for those species most often collected. This long term review of the data is in response to the need for the analysis of potential long term impacts and is not an annual determination as reason #1 seems to imply. The draft Environmental Assessment (DEA) suggested annual reviews, which I noted in my previous comments as inappropriate for EAs, as a follow up measure for future EAs. This suggestion did not limit the analysis to only a one year time period and should not be assumed to be an annual analysis. As such, the document does not support the contention that the EA "segments the analysis" into solely an annual analysis. The document uses multiple years of historical data to provide a long-term analysis to come to a current determination. The document also provides a methodology for future reviews but should not be viewed as a predictor of events that have not yet occurred.

Conclusion: The DLNR's contention that the lack of a long term analysis provides a valid reason for requiring an EIS is not supported.

2) There is no statistical analysis of population growth compared to the life span of each fish and the number of years to and size of first reproduction against which this annual proposed take can be measured for purposes of estimating sustainable take.

Agree: There is no analysis of population growth because such an analysis would be an unnecessary waste of time and resources. My reasons why this is unnecessary are many. The data needed to conduct a population analysis, as implied by reason #2, does not currently exist. I am assuming that reason #2 should actually read each fish **species** and not each fish as currently worded. To attempt to determine this information at the individual fish level would increase the cost over a million fold, assuming that each species has more than a million individuals. One estimate of the number of individual fish in the aquarium fishery are likely over 10 million. Current scientific thinking suggests that roughly 99% of individuals born will not survive to adulthood. Even if such a study were initiated, most individuals would not survive long enough to provide information useful to this analysis.

Current scientific approaches to determine sustainable take levels instead look at fishery wide data rather than species or individual level data. The most common and practical approach combines all species within the fishery into one combination species and to analyze this one species to look at this question. This approach would also be useful in determining a cumulative impact analysis. This enables at least a preliminary indicator of the sustainability of a fishery. Regardless of the method chosen, the eventual goal is to determine a sustainable take level.

Disagree: A sustainable take level is required to manage this fishery.
I would argue that a calculated or set take level is not necessary to manage a fishery. The sustainable take level is a man-made goal and a theoretical estimate of a biological threshold. Under the federal model, the overfishing limit is an estimate because the status of the resources is constantly changing. There is also an element of risk that the overfishing limit is inaccurate given scientific uncertainty. The level of risk one is willing to take is subjective. The base level of risk is 50%. At this risk level, there is a 50% chance that the overfishing limit will be reached. However, the less data there is to calculate the overfishing limit, the more uncertain that estimate.

The DLNR has historically managed the State's marine resources without a known sustainable take level. It appears that not having a take level does not prevent DLNR from managing those resources. The State was managing the take of its resources long before the concept of a sustainable take level was developed.

Disagree: A sustainable take level is required to be in compliance with Chapter 343, HRS.
Chapter 343, HRS, requires a review of action impacts on the environment. A sustainable take level is one of many ways to measure those impacts. It is not the only way and sometimes it is not the best way. A sustainable take level is only as good as the data used to calculate it. A better way is by monitoring fishing effort derived from commercial landings data and then to confirm any results with the fishers to verify if the data is an accurate reflection of their experiences in the fishery. The fishers can tell when something is wrong with the resources long before any data shows it. Fishing performance is arguably a better way to measure resource status in some cases. The model used to calculate sustainable take may be flawed. The model also is dependent on good data. If either the model or the data are flawed, then the take level is flawed.

Conclusion: Given that the data needed to conduct an analysis on population growth does not currently exist and is not expected to exist within the next five years, no analysis could be done because the necessary information does not exist. The argument that an EIS should be done because there was no such analysis done in the EA is illogical since it could not be done for an EIS either. Requiring an EIS would not magically cause such an analysis to be possible.

Conclusion: The DLNR's contention that an EIS should include a statistical analysis of population growth is not supported.

3) With regard to proposed levels of sustainable catch, using "5% to 25%" annual take of estimated populations as proposed in several research papers, we note that 5% to 25% is a wide range, and the precautionary principle calls for applying the lowest estimated percentage of sustainable take in the absence of scientific certainty.

Disagree: The precautionary principle “implies that there is a social responsibility to protect the public from exposure to harm, when scientific investigation has found a plausible risk (Wikipedia).” Some people might take the next step and state further that the principle also calls on decision makers to act, even when there is a lack of scientific information. The DLNR misrepresents that the principle calls for the lowest estimated percentage to be applied. This would be inconsistent with the tenets of the precautionary principle. Neither does the principle stipulate that the lowest percentage of sustainable take be applied to all species in the fishery. Either the DLNR is uninformed about what the precautionary principle actually says or they’re purposely trying to distort the principle to fit their needs.

Conclusion: The DLNR’s contention that the precautionary principle provides a valid reason for requiring an EIS is not supported.

4) We note also that there are no bag limits for most species, and that the fishery as currently regulated does not limit the number of permits, so that the annual take as a percentage of estimated population could rise significantly. Alternatives of overall annual take limits, a limited entry aquarium fishery program, and restrictions including full moratoria on the take of herbivores, species of special concern, and species evidencing severe population declines have not been proposed or analyzed.

Disagree: It is not within the scope of the FEA to place restrictions on the fishery. Such decisions are solely within the purview of the DLNR and it is their responsibility to propose restrictions it deems necessary. It is also not within the scope of the FEA to analyze imaginary regulatory restrictions that are DLNR purview and responsibility. It is the agency responsibility to explain why there are so few bag limits, not the applicant.

Disagree: No bag limits for most species. Bag limits are a common fishery management tool used worldwide but the DLNR does not appear to understand this basic fishery management tool and what it is used for. Bag limits are a way to distribute or allocate effort in a fishery. Its purpose is to maximize the number of fishers who can participate in the fishery and prevents the fishery from being captured by only a few fishers. The aquarium fishery is already subject to bag limits in excess of those placed on any other type of fishery. For example, non-commercial SMNE permittees are limited to five organisms per person per day. No other person is limited in the same way. The reason this bag limit was implemented for SMNE permittees was not because of a concern of “overfishing” but that the non-commercial SMNE permittee did not have a need to take more than this daily number to supply their personal aquariums. Those who did have such a need could apply for a commercial SMNE permit and not be subject to this restriction. Oahu commercial SMNE permittees are under existing bag limit restrictions for those species that would normally be taken in larger numbers. No other person is limited in the same way. Again, the purpose of these restrictions was not because of a concern for overfishing but to reduce the potential for waste in the fishery resulting when new entrants in the fishery, who do not have the experience to know the carrying capacity of their vessels, overcrowd their holding facilities onboard. Overcrowding of onboard holding facilities causes unnecessary damage to fish as they suffer split fins, body cuts, and other injuries that would render the animal unsuitable for commercial sale.

Disagree: Limit the number of aquarium permits. Limited entry (LE) is a common fishery management tool used worldwide but the DLNR does not appear to understand this basic fishery management tool and what it is used for. LE is an economic tool and not a biological one. The main purpose for LE systems is to prevent overcapitalization in the fishery. Overcapitalization occurs when there are too many fishers in a fishery to economically support all fishers. Those fishers who are marginally operating in the fishery will fish harder, which produces more fish but reduces fish prices, thereby exacerbating their financial problems. They end up fishing harder but making less money. Lower fish prices hurt everyone in the fishery as all fishers try to recover this revenue drop. The resources suffer in this scenario and LE artificially limits the number of fishers that potentially harm the fishery. The number of commercial aquarium collectors on Oahu has decreased since 2008 so there is no evidence that there are too many fishers. With the fishery currently not experiencing overcapitalization, there would be no justification for a LE system for this fishery. The DLNR seems to think that aquarium take will rise significantly, but provides no evidence of such a contention. The reality is the opposite. Hawaii is losing market share to overseas suppliers and expansion in the Hawaii market does not appear imminent in the foreseeable future.

It is unclear why DLNR is asking the applicant to consider additional restrictions on a fishery that is operating sustainably at its current level. There are a multitude of measures that could be analyzed but what would be the point? The DLNR has stated in its testimonies on several bills in 2017 (HB1457, SB 1240, and SB 220) that it believes that the fishery is operating sustainably. It is also unclear why the DLNR is requiring an EIS when the DEA and its own legislative testimony contend that the fishery is fine. The aquarium fishery has been essentially closed since the beginning of 2018 so there is likely no new information that would suggest that the fishery has suddenly changed from sustainable to unstainable, given the current situation.

Conclusion: The DLNR’s contention that the lack of alternative analysis provides a valid reason for requiring an EIS is not supported.

5) The FEA asserts that certain types of fish such as Flame Wrasse, Psychedelic Wrasse, and Fisher's Angelfish inhabit waters deeper than the CREP monitoring studied, resulting in populations being underestimated and thus the annual take as a percentage of estimated population being overestimated. In addition, we note the proposed alternatives for reduction in bag limits for Flame Wrasse, but do not see a scientific basis for concluding that the proposed reduction would be sufficient to sustain the population.

Reason #5 seems to suggest that the DLNR is confused. Since the DLNR has not refuted the FEA findings that 1) the current Flame Wrasse population is being underestimated (there is a high likelihood that there are more individuals in the wild than the survey data indicate) and 2) that the current levels of take are sustainable (even with the population being underestimated), then there would be no scientific or biological evidence that suggests that further reductions are needed. Put simply, the current analysis should be biased towards showing a significant impact but it doesn’t. It shows that despite this bias, there still is no significant impact. What would be the point in doing an analysis of an additional reduction (bag limits) if there is no significant impact already? The Flame Wrasse bag limits are being suggested as a social remedy to the misguided perception that Flame Wrasses are being unsustainably fished. The DLNR seems to be asking the FEA to show that a proposed new bag limit for Flame Wrasses would be enough to sustain a population that is already being sustainably fished, without the new bag limit. If the Flame Wrasse is being sustainably fished without a bag limit, wouldn't it be more sustainable with an additional bag limit? Why would you need to scientifically prove this?

Conclusion: The DLNR's contention that the lack of an analysis for a proposed Flame Wrasse bag limit somehow provides a valid reason for requiring an EIS is not supported.

6) We note the proposed alternative for an expansion of the Waikiki Marine Life Conservation District, but do not see a scientific review of the beneficial impact of Fishery Replenishment Areas on restoring populations, such as has been demonstrated in West Hawai'i, nor an analysis of the optimal placement of Fishery Replenishment Areas on O'ahu to protect and restore populations of aquarium fish.

Reason #6 seems to imply that the DLNR is not convinced that there are benefits from marine managed areas (MMAs) and wants to see a review of these benefits in the EIS to justify this contention. If this is the case, then why is the DLNR promoting MMAs as a possible mechanism to manage fisheries. The DLNR should already have its own scientific review of the Waikiki MLCD since this is their facility. It is expected that the DLNR should already be fully aware of the pros and cons of MMAs and would not need to see such a review in the EIS. Ultimately, the DLNR should decide whether more MMAs are needed to increase fish populations, how many and how large these MMAs need to be, and most importantly, what would be the management goals for establishing or expanding such areas. Where would one place Oahu if there were no need to restore those populations? It would seem to me that the proposed MMA measures are an option for the DLNR to consider rather than the applicants responsibility to analyze all such options in an EIS.

DLNR appears to be confused about the purposes of MMAs. MMAs are an ecosystem management tool, not a fishery management tool. Put simply, MMAs manage the area within their boundaries but do not manage the fishery beyond the boundaries. A fishery management tool manages the take of the fishery wherever it occurs.

Conclusion: The DLNR's contention that the lack of a scientific review of the benefits of the Waikiki Marine Life Conservation District provides a valid reason for requiring an EIS is not supported.

7) Cultural impacts of aquarium fishing need significantly more analysis than provided in the FEA. The OEQC guidelines should be followed for assessing cultural impacts, including consulting with traditional cultural practitioners and other knowledgeable informants and sources about cultural resources, cultural practices, and the proposed action's potential impacts. Traditional Hawaiian practices and subsistence uses, local place-based and life-cycle knowledge, and traditional Hawaiian cultural significance of each type of aquarium fish taken should be reviewed. The indirect impact of modem technologies for highly efficient catch methods on traditional harvest capabilities should be included in the analysis.

It is my understanding that the Chapter 343, HRS, requirements regarding cultural impacts fall into the category of what impacts the aquarium fishery might have on traditional and cultural uses of the resources. As aquarium collecting was never part of a Hawaiian traditional or cultural use, it is unclear how such collecting might impact such uses. If the contention is that collecting removes those organisms that are also used by native Hawaiians, then provided the agency action still allows native Hawaiians to continue to practice their traditional and culture use, there would be no significant impact to those practices.

Regarding the “modern technologies” contention, the equipment used to collect aquarium fish has not significantly changed since the mid-1950s when SCUBA was developed. Monofilament nets were developed many years before the 1950s and were in use before World War II. If over 70 years old technologies are what are being referred to here, these technologies have existed longer than the fishery itself.

Even if DLNR believes that the cultural impacts analysis (CIA) were not adequately addressed in the FEA, why did DLNR accept the FEA and not instruct the applicant to expand on this small portion of the DEA prior to publishing the FEA? Revising the DEA to include the CIA would have precluded the need for an EIS. The cultural impacts analysis is required in both the EA and EIS so the same analysis would have been needed in both documents.

Conclusion: The DLNR’s contention that the lack of an adequate CIA provides a valid reason for requiring an EIS is not supported in view of the availability of other options.

8) Enforcement and compliance needs and challenges are key factors in the effectiveness of fisheries management, and should be analyzed as part of the environmental analysis.

Chapter 343, HRS, requires a written document that describes the potential environmental impacts and concerns of the aquarium fishery. It is my understanding that enforcement and compliance are state government functions and are not required as part of these environmental requirements. They should not be included in this EA nor an EIS. I have not seen any EA or EIS that includes such an analysis.

Conclusion: The DLNR’s contention that an enforcement and compliance analysis should be included in the EA or EIS is not required under State law.

Thank you for this opportunity to provide comments.

Alton Miyasaka
September 3, 2018

Responses to comments received from Alton Miyasaka
Comment dated September 3, 2018

Comment	Response
I find the DLNR comments full of assumptions and inaccuracies. I also find their reasoning for now requiring an EIS, illogical and not factually based. Given these observations, I am concerned that DLNR no longer has the technical expertise to adequately and objectively evaluate this document. It appears the DLNR doesn't understand its own regulations. The aquarium permit is somewhat of a misnomer. The aquarium permit issued under Section 188-31, HRS, is a small mesh net exemption and not a general aquarium collecting permit. The legal minimum net mesh size is two inches stretched. An exemption to this minimum net mesh size is authorized by permit. This seeming small difference is important because the agency action is issuance of the permit that provides a small mesh net exemption (SMNE). The permit is not to collect aquarium fish, regardless of gear used. For purposes of clarity, I will use the term SMNE permit instead of aquarium permit in this document. The attempts to expand the analysis into non-permit activities are outside of the scope of the action.	Comment noted. A DEIS has been prepared. The proposed action is issuance of commercial aquarium permits for 20 fishers on the island of O'ahu; however, additional details have been added to the No Action Alternative to quantify the collection that would occur without issuance of these permits (using a CML).
It sounds like DLNR response was written by someone obviously biased against aquarium collecting and could have been crafted by the plaintiffs in the recent lawsuit against the DLNR. The thinking and the words chosen seem strangely familiar of the arguments made during the legal action. I also disagree with the Department's reasons for requiring an EIS and continue to support the FEA determination of no significant impact. My arguments for my disagreement will be further explained later in this document.	Comment noted.
The DLNR appears to have completely changed its position that the aquarium fishery is sustainable to a position that it is now believes the fishery is unsustainable, despite the fact that collecting under permit has been stopped since the beginning of 2018, resulting in the impacts of collecting being drastically reduced. The DLNR does not explain why they have reversed their position.	Comment noted.
Regarding the areas where the FEA were lacking, I disagree with most of the points made. Even if, for discussion only, the FEA were lacking these points, this would not trigger the need for an EIS. A revised DEA, including all these points, could have adequately addressed these concerns. It was my understanding that DLNR intended to work with the applicant to address any deficiencies prior to acceptance of the FEA. This, apparently, did not happen.	Comment noted.
DLNRs thinking seems to be that the loss of an individual fish constitutes a loss under Chapter 343, HRS, then all actions taken by anyone anywhere would similarly require an EA. Does DLNR also consider the take of living microscopic organisms should be included in its broad application of the view of loss of natural resources? Does DLNR also believe that a State camping permittee breathing the air at a designated camp site requires an EA/EIS? How does it conclude that a 5% to 25% take of a species to be a "destruction of populations of fish?"	Comment noted.
Chapter 343, HRS, focus is on the significant effect of use of the resources and not whether such use constitutes a loss. In many cases, the use of a resource results in its inevitable loss. To be relevant, the loss of a fish should to be viewed within the context of whether that use causes a significant effect. It's obvious that the loss of one fish doesn't mean the extinction of the species and doesn't constitute a significant effect. As such, going down the "rabbit hole" of trying to identify and characterize each loss is irrelevant to the question of significant effect. It should therefore, also be considered irrelevant for the purposes of Chapter 343, HRS.	Comment noted. Section 2.5 of the DEIS defines the scope of analysis, including that the impact to the fish species is analyzed at the population level.

Responses to comments received from Alton Miyasaka
Comment dated September 3, 2018

Comment	Response
Conclusion: By making Comment #1, DLNR seems to have totally ignored the whole DEA/FEA. It should more clearly identify why it believes the FEA did not adequately address the question of impacts. The statement does not provide enough guidance on how the applicant should proceed.	Comment noted.
It is unclear how the collecting of aquarium fish is related to invasive algae control and the tourism industry. The causes of alien algae introductions are unrelated to aquarium collecting. The current regulatory measures include rules on ballast water and hull fouling. Once alien species are found in Hawaii, control methods include, among others, physical removal and urchin plantings. The premise that aquarium fish collecting is a controlling factor for alien algae growth and spread is wildly speculative. No scientific evidence supports this contention.	Comment noted. The impact of commercial aquarium collection on tourism and herbivores/algae control is discussed in Section 5.0 of the DEIS.
As noted in my comments on Comment #1, the permit impacts to tourism are outside of the environmental impacts requirement of Chapter 343, HRS, and outside of the scope of the agency action. Tourism is man-made, not part of the natural environment, and is irrelevant to this analysis. It would be an analysis of permit impacts on tourism's impacts on the environment.	Comment noted. The impacts of commercial aquarium collection on the tourism industry is discussed in Section 5.0 of the DEIS.
It is unclear what the term "overall integrity of diverse aquatic ecosystems" means. It is a popular term and non-scientific. Biologically, ecosystems are dynamic and ever changing. Because natural conditions are always changing, the ecosystem constantly adjusts to these changes. If one component of the system no longer functions, the system compensates for this and creates a different function. This is the nature of living systems. It is unclear what "overall integrity" of an ever-changing system means. If integrity of the ecosystem functions is what is intended, then any change to the system that doesn't cease the system's ability to function, does not cease its integrity. Ecosystems are also viewed relative to scale. The ecosystem within a drop of water is different from the ecosystem within the region of the Hawaiian Islands is different from the ecosystem of the Pacific basin. It is unclear which ecosystem Comment #2 is referring to. Lastly, I am assuming "aquatic" should be limited to "marine" instead.	Comment noted. The scope of analysis for the DEIS is the nearshore waters of the island of O'ahu.
Conclusion: By making Comment #2, DLNR seems to have totally ignored the whole DEA/FEA. It should more clearly identify why it believes the FEA did not adequately address the question of impacts. The statement does not provide enough guidance on how the applicant should proceed.	Comment noted.
Governor Ige's 30 by 30 Sustainability Plan calls for the effective management of at least 30% of the State's shorelines by the year 2030. The fishery does not conflict with, and would actively support, the plan. The DLNR has obviously taken the position that the fishery is unsustainable and in conflict with the plan. The requirement to have an SMNE permit and the issuance of those permits is a form of effective management of the shoreline and consistent with the plan. It is unclear how having the permit isn't in support of plan.	Comment noted.

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Conclusion: By making Comment #3, DLNR seems to have totally ignored the whole DEA/FEA. It should more clearly identify why it believes the FEA did not adequately address the question of impacts. The statement does not provide enough guidance on how the applicant should proceed.	Comment noted.
Conclusion: By making Comment #4, DLNR seems to have totally ignored the whole DEA/FEA. It should more clearly identify why it believes the FEA did not adequately address the question of impacts. The statement does not provide enough guidance on how the applicant should proceed. For further comments, see Section 3, Reason #7.	Comment noted.
Conclusion: Comment #5 appears to include non-permit actions. Such an analysis would be outside of the scope of the EA and should not be included. See my further discussions under Comment #6 immediately following this discussion.	Comment noted. A DEIS has been prepared, and cumulative impacts are discussed in Section 5.0 of the DEIS.
Comment #6 is an interesting take on the no action alternative. It is unclear whether the no action alternative is required as part of the Chapter 343, HRS, analysis. If it is not required, then Comment #6 would be discretionary. For the sake of discussion only, if the no action alternative is included, what is the no action alternative being taken? Section 188-31, HRS, authorizes the Department to issue aquarium permits. It has done so since the 1970s. The government action then is clearly the issuance of aquarium permits. As the Legislature authorized the Department to require and issue SMNE permits, the Department doesn't have the legal option to issue or not issue SMNE permits, it must issue the permits. The Supreme Court did not invalidate the authority of the State to require SMNE permits, but that the process of permit issuance was subject to Chapter 343, HRS. The issuance of permits is on hold, until the Chapter 343, HRS, review is completed. In my view, there is no actual no action alternative. The agency action, then, is to issue SMNE permits or not. Since not issuing permits is not a legal option, the DLNR must issue small mesh net exemption permits. **Conclusion**: Since the agency action is the issuance of permits, activities not requiring a small mesh net exemption permit, should not be considered within the scope of the EA.	Comment noted. A No Action Alternative is included in the DEIS and includes commercial aquarium collection without the use of fine mesh nets.
Disagree: The FEA provided a detailed analysis of commercial aquarium landings over a broad number of years to document patterns of collections that would be used to further determine "impacts" at the species level for those species most often collected. This long term review of the data is in response to the need for the analysis of potential long term impacts and is not an annual determination as reason #1 seems to imply. The draft Environmental Assessment (DEA) suggested annual reviews, which I noted in my previous comments as inappropriate for EAs, as a follow up measure for future EAs. This suggestion did not limit the analysis to only a one year time period and should not be assumed to be an annual analysis. As such, the document does not support the contention that the EA "segments the analysis" into solely an annual analysis. The document uses multiple years of historical data to provide a long-term analysis to come to a current determination. The document also provides a methodology for future reviews but should not be viewed as a predictor of events that have not yet occurred.	Comment noted. The analysis period for the DEIS has been revised to 5 years.

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Conclusion: The DLNR's contention that the lack of a long term analysis provides a valid reason for requiring an EIS is not supported.	
Agree: There is no analysis of population growth because such an analysis would be an unnecessary waste of time and resources. My reasons why this is unnecessary are many. The data needed to conduct a population analysis, as implied by reason #2, does not currently exist. I am assuming that reason #2 should actually read each fish **species** and not each fish as currently worded. To attempt to determine this information at the individual fish level would increase the cost over a million fold, assuming that each species has more than a million individuals. One estimate of the number of individual fish in the aquarium fishery are likely over 10 million. Current scientific thinking suggests that roughly 99% of individuals born will not survive to adulthood. Even if such a study were initiated, most individuals would not survive long enough to provide information useful to this analysis. Current scientific approaches to determine sustainable take levels instead look at fishery wide data rather than species or individual level data. The most common and practical approach combines all species within the fishery into one combination species and to analyze this one species to look at this question. This approach would also be useful in determining a cumulative impact analysis. This enables at least a preliminary indicator of the sustainability of a fishery. Regardless of the method chosen, the eventual goal is to determine a sustainable take level.	Comment noted. The DEIS uses the best available science.
Disagree: A sustainable take level is required to manage this fishery. I would argue that a calculated or set take level is not necessary to manage a fishery. The sustainable take level is a man-made goal and a theoretical estimate of a biological threshold. Under the federal model, the overfishing limit is an estimate because the status of the resources is constantly changing. There is also an element of risk that the overfishing limit is inaccurate given scientific uncertainty. The level of risk one is willing to take is subjective. The base level of risk is 50%. At this risk level, there is a 50% chance that the overfishing limit will be reached. However, the less data there is to calculate the overfishing limit, the more uncertain that estimate. The DLNR has historically managed the State's marine resources without a known sustainable take level. It appears that not having a take level does not prevent DLNR from managing those resources. The State was managing the take of its resources long before the concept of a sustainable take level was developed. Disagree: A sustainable take level is required to be in compliance with Chapter 343, HRS. Chapter 343, HRS, requires a review of action impacts on the environment. A sustainable take level is one of many ways to measure those impacts. It is not the only way and sometimes it is not the best way. A sustainable take level is only as good as the data used to calculate it. A better way is by monitoring fishing effort derived from commercial landings data and then to confirm any results with the fishers to verify if the data is an accurate reflection of their	Comment noted. The DEIS concludes that collection under the Preferred Alternative represents less than 2.5% of the island-wide populations of 20 of the 22 species with population estimates. For the 2 remaining species with population estimates available (Yellow Tang and Flame Wrasse), collection is below 25%. This level of take is below or within what is considered to be sustainable reef fish harvest based on available research (5% - 25%; Ochavillo and Hodgson 2006). However, collection of Yellow Tang and Flame Wrasse may potentially be even lower due to uncertainty in the population estimates and is anticipated to be less than 1% of the Flame Wrasse population. While collection of the Yellow Tang may be above 5% of the population, this species displays high fecundity, and collection under the Preferred Alternative is a lower impact compared to the No Action Alternative. In addition, the Preferred Alternative has additional benefits over the No Action Alternative, including size limits on the Yellow Tang and bag limits on both the Yellow Tang and Flame Wrasse, as well as other species.

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experiences in the fishery. The fishers can tell when something is wrong with the resources long before any data shows it. Fishing performance is arguably a better way to measure resource status in some cases. The model used to calculate sustainable take may be flawed. The model also is dependent on good data. If either the model or the data are flawed, then the take level is flawed.	
Conclusion: Given that the data needed to conduct an analysis on population growth does not currently exist and is not expected to exist within the next five years, no analysis could be done because the necessary information does not exist. The argument that an EIS should be done because there was no such analysis done in the EA is illogical since it could not be done for an EIS either. Requiring an EIS would not magically cause such an analysis to be possible. **Conclusion**: The DLNR's contention that an EIS should include a statistical analysis of population growth is not supported.	Comment noted. A DEIS has been prepared using the best available science.
Disagree: The precautionary principle "implies that there is a social responsibility to protect the public from exposure to harm, when scientific investigation has found a plausible risk (Wikipedia)." Some people might take the next step and state further that the principle also calls on decision makers to act, even when there is a lack of scientific information. The DLNR misrepresents that the principle calls for the lowest estimated percentage to be applied. This would be inconsistent with the tenets of the precautionary principle. Neither does the principle stipulate that the lowest percentage of sustainable take be applied to all species in the fishery. Either the DLNR is uninformed about what the precautionary principle actually says or they're purposely trying to distort the principle to fit their needs. **Conclusion**: The DLNR's contention that the precautionary principle provides a valid reason for requiring an EIS is not supported.	Comment noted.
Disagree: It is not within the scope of the FEA to place restrictions on the fishery. Such decisions are solely within the purview of the DLNR and it is their responsibility to propose restrictions it deems necessary. It is also not within the scope of the FEA to analyze imaginary regulatory restrictions that are DLNR purview and responsibility. It is the agency responsibility to explain why there are so few bag limits, not the applicant. Disagree: No bag limits for most species. Bag limits are a common fishery management tool used worldwide but the DLNR does not appear to understand this basic fishery management tool and what it is used for. Bag limits are a way to distribute or allocate effort in a fishery. Its purpose is to maximize the number of fishers who can participate in the fishery and prevents the fishery from being captured by only a few fishers. The aquarium fishery is already subject to bag limits in excess of those placed on any other type of fishery. For example, non-commercial SMNE permittees are limited to five organisms per person per day. No other person is limited in the same way. The reason this bag limit was implemented for SMNE permittees was not because of a concern of "overfishing" but that the non-commercial SMNE permittee did not have a need to take more than this daily number to supply their personal aquariums. Those who did have such a need could apply for a commercial SMNE permit and not be subject to this restriction. Oahu commercial SMNE permittees are under existing bag limit restrictions for those species	

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that would normally be taken in larger numbers. No other person is limited in the same way. Again, the purpose of these restrictions was not because of a concern for overfishing but to reduce the potential for waste in the fishery resulting when new entrants in the fishery, who do not have the experience to know the carrying capacity of their vessels, overcrowd their holding facilities onboard. Overcrowding of onboard holding facilities causes unnecessary damage to fish as they suffer split fins, body cuts, and other injuries that would render the animal unsuitable for commercial sale. Disagree: Limit the number of aquarium permits. Limited entry (LE) is a common fishery management tool used worldwide but the DLNR does not appear to understand this basic fishery management tool and what it is used for. LE is an economic tool and not a biological one. The main purpose for LE systems is to prevent overcapitalization in the fishery. Overcapitalization occurs when there are too many fishers in a fishery to economically support all fishers. Those fishers who are marginally operating in the fishery will fish harder, which produces more fish but reduces fish prices, thereby exacerbating their financial problems. They end up fishing harder but making less money. Lower fish prices hurt everyone in the fishery as all fishers try to recover this revenue drop. The resources suffer in this scenario and LE artificially limits the number of fishers that potentially harm the fishery. The number of commercial aquarium collectors on Oahu has decreased since 2008 so there is no evidence that there are too many fishers. With the fishery currently not experiencing overcapitalization, there would be no justification for a LE system for this fishery. The DLNR seems to think that aquarium take will rise significantly, but provides no evidence of such a contention. The reality is the opposite. Hawaii is losing market share to overseas suppliers and expansion in the Hawaii market does not appear imminent in the foreseeable future. It is unclear why DLNR is asking the applicant to consider additional restrictions on a fishery that is operating sustainably at its current level. There are a multitude of measures that could be analyzed but what would be the point? The DLNR has stated in its testimonies on several bills in 2017 (HB1457, SB 1240, and SB 220) that it believes that the fishery is operating sustainably. It is also unclear why the DLNR is requiring an EIS when the DEA and its own legislative testimony contend that the fishery is fine. The aquarium fishery has been essentially closed since the beginning of 2018 so there is likely no new information that would suggest that the fishery has suddenly changed from sustainable to unstainable, given the current situation. Conclusion: The DLNR's contention that the lack of alternative analysis provides a valid reason for requiring an EIS is not supported.	Comment noted. Regulations and enforcement are within the purview of the State of Hawai'i. Nevertheless, the DEIS Preferred Action does include a new bag limit for the Flame Wrasse, limits the issuance of permits to 20 fishers and includes an expansion of the Waikiki MLCD. A section on enforcement and compliance is included in Section 1.2.5 of the EIS.
Reason #5 seems to suggest that the DLNR is confused. Since the DLNR has not refuted the FEA findings that 1) the current Flame Wrasse population is being underestimated (there is a high likelihood that there are more individuals in the wild than the survey data indicate) and 2) that the current levels of take are sustainable (even with the population being underestimated), then there would be no scientific or biological evidence that suggests that further reductions are needed. Put simply, the current analysis should be biased towards showing a significant impact but it doesn't. It shows that despite this bias, there still is no significant impact. What	Comment noted.

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would be the point in doing an analysis of an additional reduction (bag limits) if there is no significant impact already? The Flame Wrasse bag limits are being suggested as a social remedy to the misguided perception that Flame Wrasses are being unsustainably fished. The DLNR seems to be asking the FEA to show that a proposed new bag limit for Flame Wrasses would be enough to sustain a population that is already being sustainably fished, without the new bag limit. If the Flame Wrasse is being sustainably fished without a bag limit, wouldn't it be more sustainable with an additional bag limit? Why would you need to scientifically prove this? **Conclusion**: The DLNR's contention that the lack of an analysis for a proposed Flame Wrasse bag limit somehow provides a valid reason for requiring an EIS is not supported.	
Reason #6 seems to imply that the DLNR is not convinced that there are benefits from marine managed areas (MMAs) and wants to see a review of these benefits in the EIS to justify this contention. If this is the case, then why is the DLNR promoting MMAs as a possible mechanism to manage fisheries. The DLNR should already have its own scientific review of the Waikiki MLCD since this is their facility. It is expected that the DLNR should already be fully aware of the pros and cons of MMAs and would not need to see such a review in the EIS. Ultimately, the DLNR should decide whether more MMAs are needed to increase fish populations, how many and how large these MMAs need to be, and most importantly, what would be the management goals for establishing or expanding such areas. Where would one place Oahu if there were no need to restore those populations? It would seem to me that the proposed MMA measures are an option for the DLNR to consider rather than the applicants responsibility to analyze all such options in an EIS. DLNR appears to be confused about the purposes of MMAs. MMAs are an ecosystem management tool, not a fishery management tool. Put simply, MMAs manage the area within their boundaries but do not manage the fishery beyond the boundaries. A fishery management tool manages the take of the fishery wherever it occurs. **Conclusion**: The DLNR's contention that the lack of a scientific review of the benefits of the Waikiki Marine Life Conservation District provides a valid reason for requiring an EIS is not supported.	Comment noted. Section 5.4.1.3 of the EIS includes the following information on direct benefits of the expanded Waikiki MLCD: Friedlander et al. (2007) found that biomass within the existing Waikiki MLCD was 2.5 times higher than adjacent control sites. While the expanded area of the Waikiki MLCD would only be closed to commercial aquarium collection, similar areas in West Hawai'i have shown that fish from protected Fish Replenishment Areas (where only commercial and recreational fishing is banned, and other forms of fishing can continue) will seed unprotected areas (Christie et al. 2010). The use of areas closed to aquarium collection in West Hawai'i was implemented in 1999, and the DAR has determined that it has been "very successful" at driving increased in Yellow Tang populations (the most heavily targeted aquarium fish in West Hawai'i; DAR 2019a).
It is my understanding that the Chapter 343, HRS, requirements regarding cultural impacts fall into the category of what impacts the aquarium fishery might have on traditional and cultural uses of the resources. As aquarium collecting was never part of a Hawaiian traditional or cultural use, it is unclear how such collecting might impact such uses. If the contention is that collecting removes those organisms that are also used by native Hawaiians, then provided the agency action still allows native Hawaiians to continue to practice their traditional and culture use, there would be no significant impact to those practices. Regarding the "modern technologies" contention, the equipment used to collect aquarium fish has not significantly changed since the mid-1950s when SCUBA was developed. Monofilament nets were developed many years before the 1950s and were in use before World War II. If over 70 years old technologies are what are being referred to here, these technologies have existed longer than the fishery itself.	Comment noted. A Cultural Impact Assessment has been developed and is included as Appendix A of the DEIS.

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Even if DLNR believes that the cultural impacts analysis (CIA) were not adequately addressed in the FEA, why did DLNR accept the FEA and not instruct the applicant to expand on this small portion of the DEA prior to publishing the FEA? Revising the DEA to include the CIA would have precluded the need for an EIS. The cultural impacts analysis is required in both the EA and EIS so the same analysis would have been needed in both documents. **Conclusion**: The DLNR's contention that the lack of an adequate CIA provides a valid reason for requiring an EIS is not supported in view of the availability of other options.	Comment noted. A Cultural Impact Assessment has been developed and is included as Appendix A of the DEIS.
Chapter 343, HRS, requires a written document that describes the potential environmental impacts and concerns of the aquarium fishery. It is my understanding that enforcement and compliance are state government functions and are not required as part of these environmental requirements. They should not be included in this EA nor an EIS. I have not seen any EA or EIS that includes such an analysis. **Conclusion**: The DLNR's contention that an enforcement and compliance analysis should be included in the EA or EIS is not required under State law.	Comment noted. A section on enforcement and compliance is included in Section 1.2.5 of the EIS.

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HRD 18-8561B

August 30, 2018

Suzanne Case, Chair
Department of Land and Natural Resources
P.O. Box 621
Honolulu, HI 96809

Re: Comments on Draft Environmental Assessment for the Issuance of Commercial Aquarium Permits for the Island of Oʻahu

Aloha e Chair Case:

The Administration of the Office of Hawaiian Affairs (OHA) is writing to comment on the Final Environmental Assessment for the Issuance of Commercial Aquarium Permits for the Island of Oʻahu (FEA), which was prepared by the applicant, Pet Industry Joint Advisory Council (PIJAC). OHA previously commented on the Draft Environmental Assessment (DEA) in a letter dated April 30, 2018.

We appreciate that the DLNR has determined that the project may have a significant environmental impact, thus requiring the preparation of a Draft Environmental Impact Statement (DEIS). OHA notes that the applicant has submitted an FEA with an anticipated finding of no significant impact, contrary to DLNR's finding that the action may have a significant impact. OHA is concerned that several issued raised in our April 30, 2018 letter have not been addressed in the FEA but we are hopeful that through appropriate consultation, the DEIS will address these issues.

OHA is the constitutionally established body responsible for protecting and promoting the rights of Native Hawaiians. Hawaiʻi law mandates OHA to "[s]erve as the principal public agency in the State of Hawaiʻi responsible for the performance, development, and coordination of programs and activities relating to native Hawaiians and Hawaiians; . . . and [t]o assess the policies and practices of other agencies impacting on native Hawaiians and Hawaiians, and conducting advocacy efforts for native Hawaiians and Hawaiians." Hawaiʻi Revised Statutes (HRS) § 10-3.

Proposed Action and Scope of Analysis

As stated in our April 30, 2018 letter, the proposed action remains unclear. According to the FEA's title and throughout the FEA, the FEA identifies the proposed action as the issuance of permits.[1] For example, the FEA states that "the DLNR's issuance of Aquarium Permits is not anticipated to result in significant beneficial or adverse impacts."[2] The project summary also states that the proposed action is the issuance of permits "ensuring lawful, responsible, and sustainable commercial collection of various aquarium fish species from nearshore habitats pursuant to Aquarium Fishing Permits issued under HRS §188-31."[3] It is OHA's understanding that the action that requires compliance with the Hawai'i Environmental Policy Act (HEPA) is aquarium collection conducted under permits issued pursuant to HRS § 188-31.[4] OHA recommends that the DEIS clarify the proposed action and that the applicant ensures that environmental impacts associated with the collection of commercial aquarium fish are analyzed.

As raised in OHA's April 30, 2018 letter, the DLNR has determined that the one-year scope of analysis "improperly segments the analysis, which must include the long-term and cumulative impacts over time of aquarium collection."[5] OHA anticipates that the DEIS will include a broader scope of analysis and include a consideration of all consequences on the environment, including both direct and indirect effects, in accordance with Hawai'i Administrative Rules § 13-200-17(i).

Alternatives Analysis

The FEA considers three alternative actions, the proposed action (preferred alternative), issuance of commercial permits under existing regulations (identified as "status quo" in the FEA), and no action. The preferred alternative is the issuance of permits under existing regulations with daily bag limit for Flame Wrasse of ten per day and an expansion of the Waikīkī Marine Life Conservation District (Waikīkī MLCD) to the southern tip of the Honolulu Harbor Kapālama Canal Fish Management Area. Under the preferred alternative no commercial aquarium fish collection will occur within the expanded Waikīkī MLCD but no restrictions will be placed on other fisheries.[6] OHA appreciates that the applicant has identified a new alternative in the FEA but recommends that the DEIS consider additional alternatives as suggested in our April 30, 3018 letter, and gives particular attention to "alternatives that might enhance environmental quality or avoid, reduce, or minimize some or all of the adverse environmental effects, costs, and risks."[7]

Cultural Impacts

OHA appreciates that the DLNR has determined that the cultural impacts of the proposed action need significantly more analysis than provided in the FEA.[8] The FEA maintains, however,

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[1] Final Environmental Assessment, Issuance of Commercial Aquarium Permits for the Island of O'ahu (June 2018) (FEA) at 1, 7, 11, 12.
[2] FEA at 11.
[3] FEA at Project Summary.
[4] *See* Umberger v. Dep't of Land and Natural Resources, SCWC-13-0002125 35 (September 6, 2017).
[5] Letter dated July 26, 2018, from Suzanne D. Case, Chair, DLNR, to Scott Glenn, OEQC, regarding Final Environmental Assessment, Notice of Determination.
[6] FEA at 13.
[7] HAR§ 11-200-17(f).
[8] Letter dated July 26, 2018, from Suzanne D. Case, Chair, DLNR, to Scott Glenn, OEQC, regarding Final Environmental Assessment, Notice of Determination (DLNR July 26, 2018 Letter).

that the proposed action "does not involve an irrevocable commitment or loss or destruction of any natural or cultural resource."[9] OHA reiterates its concerns about the FEA's almost complete lack of analysis regarding the significant potential cultural impacts of the action. In our April 30, 2018 letter, we raised concerns that the cultural resource section of the DEA provided only limited, general information from two sources without addressing the potential impacts the proposed action may have on cultural resources and practices, including practices specific to both species and place. OHA appreciates that the applicant included one additional source, Volume 1: Ka Hana Lawaiʻa a me Nā Koʻa o Nā Kai ʻEwalu: A History of Fishing Practices and Marine Fisheries of the Hawaiian Islands (Maly and Maly 2003)[10] in the FEA and that the cultural resources section acknowledges that "the ocean, its ecosystem, and the practice of fishing were and continue to be important in Native Hawaiian culture and tradition."[11] OHA is concerned, however, that the applicant has determined that the preferred alternative would have a less than significant direct impact on subsistence fishing and cultural resources[12] without conducting a cultural impact assessment in accordance with the Office of Environmental Quality Control's Guidelines for Assessing Cultural Impacts (guidelines).[13]

Although the FEA's discussion of cultural resources includes valuable information from Maly and Maly, the FEA fails to include other relevant information from this source that could have been useful in identifying cultural impacts. For example, the FEA states,

> In comments received from (OHA), OHA expressed a concern that traditional practices included gathering and consuming recently recruited juveniles. However, the source cited by OHA (Maly and Maly 2003) states that traditional practices included collecting smaller species of fish, but did not specifically state that subsistence fishers target juvenile fish of certain species.[14]

Contrary to this statement, Maly and Maly, does in fact, provide various examples of subsistence uses of juvenile fish species. For example, the source states,

> The following small-fry are seen along shore – they are swift of motion: the young (*pua* or flowers) of the mullet or *anae* (when of medium size it is called *ama-ama*), of the *awa*, *aholehole*, *hinana*, *nehu*, *iao*, *piha*, *opuu-puu*, *ohua-palemo*, *paoa*, *oluhe-luhe*, *ohune*, *moi-lii*, and the *akeke*. All of these fish are used as food. Doubtless I have omitted the mention of some.[15]

OHA again recommends that the applicant apply the guidelines for assessing cultural impacts and consult with traditional cultural practitioners and other knowledgeable informants and sources about cultural resources, cultural practices, and the proposed action's potential impacts and include this information in the DEIS. In addition to conducting consultation, the guidelines

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[9] FEA at 78.
[10] KEPĀ MALY & ONAONA MALY, VOLUME 1: KA HANA LAWAIʻA A ME NĀ KOʻA O NĀ KAI ʻEWALU: A HISTORY OF FISHING PRACTICES AND MARINE FISHERIES OF THE HAWAIIAN ISLANDS (2003).
[11] FEA at 20.
[12] FEA at 58.
[13] Office of Environmental Quality Control, *Guide to the Implementation and Practice of the Hawaii Environmental Policy Act* (Guidelines) (2012), http://oeqc2.doh.hawaii.gov/OEQC_Guidance/2012-GUIDE-to-the-Implementation-and-Practice-of-the-HEPA.pdf.
[14] FEA at 57.
[15] MALY & MALY at 10.

recommend conducting ethnographic and other culturally related documentary research and lists various examples of research materials. OHA recommends that the applicant refer to these guidelines when conducting its cultural impacts assessment for the DEIS.

OHA looks forward to participating in consultation for the development of the DEIS. Should you have any questions, please contact Teresa Kaneakua, OHA Lead Compliance Specialist, at (808) 594-0231 or teresak@oha.org, or Wayne Tanaka, Senior Public Policy Advocate at (808) 594-1945 or waynet@oha.org.

ʻO wau iho nō me ka ʻoia ʻiʻo,

Kamanaʻopono M. Crabbe, Ph.D.
Ka Pouhana, Chief Executive Officer

KC:tk

C: David Sakoda, DLNR (*via email: david.sakoda@hawaii.gov*)
Jim Lynch, Pet Industry Joint Advisory Council (*via email: jim.lynch@klgates.com*)
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(*via email: terry.vandewalle@stantec.com*)

Responses to comments received from State of Hawai'i Office of Hawaiian Affairs
Comment dated August 30, 2018

Comment	**Response**
As stated in our April 30, 2018 letter, the proposed action remains unclear. According to the FEA's title and throughout the FEA, the FEA identifies the proposed action as the issuance of permits. For example, the FEA states that the "DLNR's issuance of Aquarium Permits is not anticipated to result in significant beneficial or adverse impacts." The project summary also states that the proposed action is the issuance of permits "ensuring lawful, responsible, and sustainable commercial collection of various aquarium fish species from nearshore habitats pursuant to Aquarium Fishing Permits issued under HRS § 188-31 ." It is OHA's understanding that the action that requires compliance with the Hawai'i Environmental Policy Act (HEPA) is aquarium collection conducted under permits issued pursuant to HRS § 188-31. OHA recommends that the DEIS clarify the proposed action and that the applicant ensures that environmental impacts associated with the collection of commercial aquarium fish are analyzed.	Comment noted. As stated in the DEIS, the proposed action is issuance of 20 Aquarium Permits for O'ahu. The environmental consequences include the impacts of commercial aquarium collection that would occur if these 20 permits were issued. The "Proposed Action" on the project summary page states that the proposed action is "Collection of aquarium fish pursuant to the issuance of 20 Commercial Aquarium Permits issued under HRS §188-31 and related permits ensuring lawful, responsible, and sustainable commercial collection of various aquarium fish species from nearshore habitats of O'ahu.".
As raised in OHA's April 30, 2018 letter, the DLNR has determined that the one-year scope of analysis "improperly segments the analysis, which must include the long-term and cumulative impacts over time of aquarium collection." OHA anticipates that the DEIS will include a broader scope of analysis and include a consideration of all consequences on the environment, including both direct and indirect effects, in accordance with Hawai'i Administrative Rules § 13-200-17(i).	Comment noted. The DEIS includes a 5-year analysis period.
The FEA considers three alternative actions, the proposed action (preferred alternative), issuance of commercial permits under existing regulations (identified as "status quo" in the PEA), and no action. The preferred alternative is the issuance of permits under existing regulations with daily bag limit for Flame Wrasse of ten per day and an expansion of the Waikiki Marine Life Conservation District (Waikiki MLCD) to the southern tip of the Honolulu Harbor Kapalama Canal Fish Management Area. Under the preferred alternative no commercial aquarium fish collection will occur within the expanded Waikiki MLCD but no restrictions will be placed on other fisheries. OHA appreciates that the applicant has identified a new alternative in the FEA but recommends that the DEIS consider additional alternatives as suggested in our April 30, 3018 letter, and gives particular attention to "alternatives that might enhance environmental quality or avoid, reduce, or minimize some or all of the adverse environmental effects, costs, and risks."	Comment noted. Additional alternatives have been evaluated in the DEIS., as well as a section on alternatives considered but dismissed.
OHA appreciates the DLNR has determined that the cultural impacts of the proposed action need significantly more analysis than provided in the FEA. The FEA maintains, however, that the proposed action "does not involve an irrevocable commitment or loss or destruction of any natural or cultural resource." OHA reiterates its concerns about the FEA's almost complete lack of analysis regarding the significant potential cultural impacts of the action. In our April 30, 2018 letter, we raised concerns that the cultural resource section of the DEA provided only limited, general information from two sources without addressing the potential impacts the proposed action may have on cultural resources and practices, including practices specific to both species and place. OHA appreciates that the applicant included one additional source, Volume 1: Ka Hana Lawai'a a me Na Ko'a o Na Kai 'Ewalu: A History of Fishing Practices and Marine Fisheries of the Hawaiian Islands (Maly and Maly 2003) in the FEA and that the cultural resources section acknowledges that "the ocean, its ecosystem, and the practice of fishing were and continue to be important in Native Hawaiian culture and tradition." OHA is concerned, however, that the applicant has determined that the preferred alternative would	Comment noted. A Cultural Impact Assessment has been developed and is included in Appendix A of the DEIS.

Responses to comments received from State of Hawai'i Office of Hawaiian Affairs
Comment dated August 30, 2018

Comment	Response
have a less than significant direct impact on subsistence fishing and cultural resources without conducting a cultural impact assessment in accordance with the Office of Environmental Quality Control's Guidelines for Assessing Cultural Impacts (guidelines).	
Although the FEA's discussion of cultural resources includes valuable information from Maly and Maly, the FEA fails to include other relevant information from this source that could have been useful in identifying cultural impacts. For example, the FEA states, "In comments received from (OHA), OHA expressed a concern that traditional practices included gathering and consuming recently recruited juveniles. However, the source cited by OHA (Maly and Maly 2003) states that traditional practices included collecting smaller species of fish, but did not specifically state that subsistence fishers target juvenile fish of certain species." Contrary to this statement, Maly and Maly, does in fact, provide various examples of subsistence uses of juvenile fish species. For example, the source states, "The following small-fry are seen along shore — they are swift of motion: the young (*pua* or flowers) of the mullet or *anae* (when of medium size it is called *ama-ama*), of the *awa, aholehole, hinana, nehu, iao, piha, opuu-puu, ohua-palemo, paoa, oluhe-luhe, ohune, moi-lii*, and the *akeke*. All of these fish are used as food. Doubtless I have omitted the mention of some."	Comment noted. Additional cultural information on the 23 fish species analyzed has been added to the DEIS, and a Cultural Impact Assessment was developed and is included in Appendix A of the DEIS.
OHA again recommends that the applicant apply the guidelines for assessing cultural impacts and consult with traditional cultural practitioners and other knowledgeable informants and sources about cultural resources, cultural practices, and the proposed action's potential impacts and include this information in the DEIS. In addition to conducting consultation, the guidelines recommend conducting ethnographic and other culturally related documentary research and lists various examples of research materials. OHA recommends that the applicant refer to these guidelines when conducting its cultural impacts assessment for the DEIS.	Comment noted. A Cultural Impact Assessment has been developed and is included in Appendix A of the DEIS.

From:	Robert Culbertson
To:	Sakoda, David
Subject:	AQ testimony - FEA
Date:	Wednesday, September 05, 2018 8:41:06 PM

I am filing these remarks in response to the recently issued Final Environmental Assessment on the application for issuance of commercial Aquarium permits. The logic of finding "No Significant Impact" and favoring the industry's "preferred alternative" belies the facts on the ground and dismisses the cogent testimony of local stakeholders, concerned visitors, the State Senate Committee on Water and Land, State Division of Aquatic Resources, Office of Hawaiian Affairs and most notably, the plethora of authentic conservation groups in Hawaii. Thankfully, an honorable rendering of its inadequacies has led the accepting authority to further require a more in depth study - a full Environmental Impact Statement.

It is troubling that the documents proffered so far have failed to give any appreciation to the background of complaints and conflicts that led to the need for a change in policy in the first place. Despite unfounded assertions (and circular 'conclusions') that the current Aquarium activities and practices are having no "significant" impacts, the deficient records (only about 50% reporting compliance) and flawed studies (shining examples of sustainability from the Philippines?) and the historical accounts of user conflicts on every island begs to differ! This is a classic example that 'death by a thousand cuts' or in these cases 'flipper crunches' and other routine injuries to living coral colonies (including the symbiotic relationships with fish being extracted!) amounts to a **considerable** and undeniable impact as weighed against leaving the marine organisms unmolested. In a time when the mounting threats to the health of *our* reefs from unavoidable causes such as global warming loom large, *having any impacts that are avoidable and gratuitous can certainly tip the balance to a point of no return sooner than we think*!

It is obvious that carefully crafted limiting alternatives were created to frame the industry's predilection for industrial proficiency and serving consumer demand rather than serving the public interest. As a former Department of Aquatic Resources administrator Frazer McGilvray noted in public testimony before the Board of Land and Natural Resources, "These rules, driven by the demands of the trade, are contrary to good natural resource management...There appears to be no scientific basis for the bag limits for each species. The majority of yellow tang allowed to be taken under this rule are immature and have not contributed to the future of the species."

The applicant also fails to appreciate or detail among the various socioeconomic impacts, the immeasurable value of the marine ecosystem in aesthetic and culturally meaningful terms. The applicant's use of visitor arrival trends and statistics is a poor proxy for the importance of our near shore environment for visitors and residents. In fact, the authors of the document simply dismiss the aesthetic concerns by saying. "the FEAs conclude that the percent of each population collected would be imperceptible to observers." On the contrary! Both residents and long time repeat visitors have testified on being, in many cases, 'shocked' at the perceived deficit of fishes in many memorable places. Perhaps worst of all are the Hawaiian cultural values which are summarily dismissed through blatant disregard. Obviously, there is no "Aloha" in this business! And no Aloha means no Hawaii as it is known around the world!

The drive for unregulated profits in this business over the last few decades has succeeded only in pauperizing our resources while for centuries they had been used for subsistence under wise guidance and management. But, as DLNR's management policies have evolved over time, they appear to have coincidentally begun to value and align more with traditional practices and philosophy again. Now, under the **"hierarchy of uses"** principle, that agency is required to preserve these 'public trust' resources first and foremost. Only a healthy ecosystem may admit to any other succeeding orders of human demands. Public use and recreation is the next step down to consider if no patterns of abuse and damage are resulting. Then, and *only if* and when the other priorities are met can some commercial interests be permitted under the most stringent oversight ***exactly because*** the lucrative and often insatiable demands of capitalism will tempt the participants to cut corners (exceed bag limits), to shirk responsibilities (fail to make required reports), and even try to 'capture' the regulating authorities with political and/or financial favors. This applicant must not attempt to contort this policy and the legal process, ethical norms and traditions in pursuit of profits for a few!

I must also note for the record this report's socioeconomic analysis painstakingly skirts the public's interest in ending the trade as it has been measured numerous times; always overwhelmingly in opposition, and always progressing in that sentiment as more time passes.

Finally, I conclude that t

After reading its voluminous repetitions of canned responses to hundreds of testimonies, this document has the appearance of having been delivered on order of an industry that knows its days, much like those in the past of the commercial whaling industry, the devastating Sandalwood trade, and the latest retreats from captive animal exhibits, are ending. Likewise, it is time to end this destructive trade now!

Mahalo,

Mark Tang
Hilo, HI

Responses to comments received from Mark Tang
Comment dated September 5, 2018

Comment	Response
I am filing these remarks in response to the recently issued Final Environmental Assessment on the application for issuance of commercial Aquarium permits. The logic of finding "No Significant Impact" and favoring the industry's "preferred alternative" belies the facts on the ground and dismisses the cogent testimony of local stakeholders, concerned visitors, the State Senate Committee on Water and Land, State Division of Aquatic Resources, Office of Hawaiian Affairs and most notably, the plethora of authentic conservation groups in Hawaii. Thankfully, an honorable rendering of its inadequacies has led the accepting authority to further require a more in depth study - a full Environmental Impact Statement.	Comment noted. A DEIS has been prepared.
It is troubling that the documents proffered so far have failed to give any appreciation to the background of complaints and conflicts that led to the need for a change in policy in the first place. Despite unfounded assertions (and circular 'conclusions') that the current Aquarium activities and practices are having no "significant" impacts, the deficient records (only about 50% reporting compliance) and flawed studies (shining examples of sustainability from the Philippines?) and the historical accounts of user conflicts on every island begs to differ! This is a classic example that 'death by a thousand cuts' or in these cases 'flipper crunches' and other routine injuries to living coral colonies (including the symbiotic relationships with fish being extracted!) amounts to a **considerable** and undeniable impact as weighed against leaving the marine organisms unmolested. In a time when the mounting threats to the health of *our* reefs from unavoidable causes such as global warming loom large, *having any impacts that are avoidable and gratuitous can certainly tip the balance to a point of no return sooner than we think*!	Comment noted. As noted in Section 5.2.1 of the DEIS, the DAR (2019) concluded that the 2010 and 2014 Hawai'i Island aquarium catch report validation did not indicate substantial underreporting of catch by aquarium collectors. Nevertheless, the cumulative impacts of poaching and underreporting are included in Section 5.4.3.6 of the EIS. The environmental consequences of commercial aquarium collection are discussed in Section 5.0 of the DEIS.
It is obvious that carefully crafted limiting alternatives were created to frame the industry's predilection for industrial proficiency and serving consumer demand rather than serving the public interest. As a former Department of Aquatic Resources administrator Frazer McGilvray noted in public testimony before the Board of Land and Natural Resources, "These rules, driven by the demands of the trade, are contrary to good natural resource management...There appears to be no scientific basis for the bag limits for each species. The majority of yellow tang allowed to be taken under this rule are immature and have not contributed to the future of the species."	Comment noted. Additional alternatives have been added to the DEIS, including a section on alternatives considered but dismissed from further consideration. Rulemaking is within the purview of the State of Hawaii.
The applicant also fails to appreciate or detail among the various socioeconomic impacts, the immeasurable value of the marine ecosystem in aesthetic and culturally meaningful terms. The applicant's use of visitor arrival trends and statistics is a poor proxy for the importance of our near shore environment for visitors and residents. In fact, the authors of the document simply dismiss the aesthetic concerns by saying. "the FEAs conclude that the percent of each population collected would be imperceptible to observers." On the contrary! Both residents and long time repeat visitors have testified on being, in many cases, 'shocked' at the perceived deficit of fishes in many memorable places. Perhaps worst of all are the Hawaiian cultural values which are summarily dismissed through blatant disregard. Obviously, there is no "Aloha" in this business! And no Aloha means no Hawaii as it is known around the world!	Comment noted. Impacts to socioeconomics and cultural resources are discussed in Section 5.0 of the DEIS. A Cultural Impact Assessment (Appendix A of the DEIS) has also been conducted.
The drive for unregulated profits in this business over the last few decades has succeeded only in pauperizing our resources while for centuries they had been used for subsistence under wise guidance and management. But, as DLNR's management policies have evolved over time, they appear to have coincidentally begun to value and align more with traditional practices and philosophy again. Now, under the **"hierarchy of uses"** principle, that agency is required to	Comment noted. Existing regulations, as well as enforcement and compliance, are discussed in Section 1.2 of the EIS. As noted in Section 5.2.1 of the DEIS, the DAR (2019) concluded that the 2010 and 2014 Hawai'i Island aquarium catch report validation did not indicate substantial underreporting of catch by

Responses to comments received from Mark Tang
Comment dated September 5, 2018

Comment	Response
preserve these 'public trust' resources first and foremost. Only a healthy ecosystem may admit to any other succeeding orders of human demands. Public use and recreation is the next step down to consider if no patterns of abuse and damage are resulting. Then, and *only if* and when the other priorities are met can some commercial interests be permitted under the most stringent oversight ***exactly because*** the lucrative and often insatiable demands of capitalism will tempt the participants to cut corners (exceed bag limits), to shirk responsibilities (fail to make required reports), and even try to 'capture' the regulating authorities with political and/or financial favors. This applicant must not attempt to contort this policy and the legal process, ethical norms and traditions in pursuit of profits for a few!	aquarium collectors. Nevertheless, the cumulative impacts of poaching and underreporting are included in Section 5.4.3.6 of the EIS.
I must also note for the record this report's socioeconomic analysis painstakingly skirts the public's interest in ending the trade as it has been measured numerous times; always overwhelmingly in opposition, and always progressing in that sentiment as more time passes.	Comment noted. During the public comment period on the Draft Environmental Assessment, a total of 836 responses were received: 435 supported the conclusions of the DEA and issuance of commercial aquarium permits; 398 did not support the conclusions of the DEA and opposed issuance of commercial aquarium permits; and 3 did not express support or opposition. These comments, and the FEA, can be found online here: http://oeqc2.doh.hawaii.gov/EA_EIS_Library/2018-08-08-OA-FEA-EISPN-Oahu-Commercial-Aquarium-Permits.pdf
Finally, I conclude that this piece of busy work adds nothing constructive to the challenge of conserving Hawaii's environment and preserving its iconic sea creatures. After reading its voluminous repetitions of canned responses to hundreds of testimonies, this document has the appearance of having been delivered on order of an industry that knows its days, much like those in the past of the commercial whaling industry, the devastating Sandalwood trade, and the latest retreats from captive animal exhibits, are ending. Likewise, it is time to end this destructive trade now!	Comment noted.

APPENDIX D

Distribution List for the DEIS

Distribution List for the DEIS

GOVERNMENT OF THE STATE OF HAWAI'I(S)

Agency	Mailing Address	Electronic Mail or Internet Address	Telephone
State of Hawai'i Department of Agriculture	1428 S. King Str. Honoluolu, HI 96814	hdoa.info@hawaii.gov	(808) 973-9550
State of Hawa i'i Department of Accounting and General Services	P.O . Box 119 Honolulu, HI 96810	dags@hawaii.gov	(808) 586-0400
State of Hawai'i Department of Business. Economic Development and Tourism	P.O. Box 2359 Honolulu, HI 96804	dbedt.director@hawaii.gov	(808) 586-2355
State of Hawai'i Department of Business, Economic Development and Tourism, Research Division Library	No. 1, Capitol District Bldg. 250 S. Hotel Street, Ste. 435 Honolulu, HI 96813	Joseph.A.Roos@dbedt.hawaii.gov Tammy.Lam@hawaii.gov	(808) 586-2481
State of Hawai'i Department of Business, Economic Development and Tourism, Strategic Industries Division	235 S. Beretania St., 5th flr. Honolulu, HI 96813	dbedt.energyoffice@hawaii.gov	(808) 587-3812
State of Hawai'i Department of Business, Economic Development and Tourism, Office of Planning Attn: Mary Alice Evans, Director	235 S. Beretania St., 6th Floor Honolulu, HI 96813	http://hawaii.gov/dbedt/op/ maryalice.evans@hawaii.gov	(808) 587-2846
State of Hawai'i Department of Defense	3949 Diamond Head Road Honolulu, HI 96816	hi.dod.pa@icloud.com	(808) 733-4258
State of Hawai'i, Department of Education, Hawaii State Library, Hawai'i Documents Center	478 S. King Street Honolulu, HI 96813	https://www.librarieshawaii.org/locations/index.htm	(808) 586-3555
State of Hawai'i Department of Hawaiian Home Lands	P.O. Box 1879 Honolulu, HI 96805	dhhl.icro@hawaii.gov	(808) 620-9501
State of Hawai'i, Department of Health, Environmental Health Administration	P.O . Box 3378 Honolulu, HI 96801	webmail@doh.hawaii.gov	(808) 586-4424
State of Hawai'i, Department of Land and Natural Resources	P.O. Box 621, Honolulu, HI 96809	dlnr@hawaii.gov	(808) 587-0400
State of Hawai'i Department of Land and Natural Resources State Historic Preservation Division	601 Kamokila Blvd., Rm. 555 Kapolei, HI 96707	Alan.S.Downer@hawaii.gov	(808) 692-8015
State of Hawai'i Department of Transportation	869 Punchbowl Street Honolulu, HI 96813	dotpao@hawaii.gov	(808) 587-2160
University of Hawai'i Water Resources Research Center	2540 Dole Street, Room 283 Honolulu, HI 96822	thomas@hawaii.edu	(808) 956-7847
University of Hawai'i Environmental Center Patricia Hirakawa	2500 Dole Street Krauss Annex 19 Honolulu, HI 96822	hirakawa@hawaii.edu	(808) 956-7362
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University of Hawai'i Kaua'i Community College Library	3-1901 Kaumualii Highway Lihu'e, HI 96766	kcclib@hawaii.edu	(808) 245-8233

Office of Hawaiian Affairs	711 Kapi'olani Blvd., Suite 500 Honolulu, HI 96813	info@oha.org	(808) 594-1835
Legislative Reference Bureau Library	State Capitol 415 S. Beretania St., Rm. 005 Honolulu, HI 96813	lrb@capitol.hawaii.gov	(808) 587-0690

GOVERNMENT OF THE CITY AND COUNTY OF HONOLULU (O)

Agency	Mailing Address	Electronic Mail or Internet Address	Telephone
City and County of Honolulu Board of Water Supply	630 S. Beretania Street Honolulu, HI 96813	http://www.hbws.org/cssweb/display.cfm?sid=1181	(808) 748-5000
City and County of Honolulu Department of Customer Services Municipal Library	558 S. King Street City Hall Annex Honolulu, HI 96813-3006	http://www1.honolulu.gov/csd/lrmb/references.htm	(808)768-3757
City and County of Honolulu Department of Design and Construction	650 S. King St., 11th Floor Honolulu, HI 96813	http://www1.honolulu.gov/ddc/aboutus.htm	(808) 768-8480
City and County of Honolulu Department of Environmental Services	1000 'Ulu'ohi'a St., Ste. 308 Kapolei, HI 96707	http://envhonolulu.org/	(808) 768-3486
City and County of Honolulu Department of Facility Maintenance	1000 'Ulu'ohi'a St., Ste. 308 Kapolei, HI 96707	http://www1.honolulu.gov/dfm/	(808) 768-3343
City and County of Honolulu Department of Planning and Permitting	650 S. King St., 7th Floor Honolulu, HI 96813	http://www.honoluludpp.org/	(808) 768-8000
City and County of Honolulu Department of Parks and Recreation	1000 'Ulu'ohi'a St., Ste. 308 Kapolei, HI 96707	http://www1.honolulu.gov/parks/	(808) 768-3001
City and County of Honolulu Department of Transportation Services	650 S. King St., 3rd Floor Honolulu, HI 96813	http://www1.honolulu.gov/dts/	(808) 768-8303

GOVERNMENT OF THE UNITED STATES OF AMERICA (USA)

Federal Agency	Mailing Address	Electronic Mail or Internet Address	Telephone
Department of the Interior, Geological Survey, Pacific Islands Water Science Center	677 Ala Moana Boulevard, Ste. 415, Honolulu, HI 96813	santhony@usgs.gov	(808) 587-2400
Department of the Interior Fish and Wildlife Service	300 Ala Moana Boulevard, Rm. 3-122, Honolulu, HI 96850-0056	pifwo_admin@fws.gov	(808) 792-9400
Department of Commerce National Marine Fisheries Service	Pacific Islands Regional Office 1611 Kapi'olani Boulevard, Suite 1110 Honolulu, HI 96814	pirohonolulu@noaa.gov	(808) 944-2200
Department of the Interior National Parks Service	Pacific Islands Support Office 300 Ala Moana Boulevard, Rm. 6-226 Honolulu, HI 96850	melia_lane-kamahele@nps.gov	(808) 541-2693
Department of Agriculture National Resources Conservation Service	Pacific Islands Area Office PO Box 50004 Honolulu, HI 96850	travis.thomason@usda.gov	(808) 541-2600

Department of Transportation Federal Aviation Administration	300 Ala Moana Boulevard, Rm. 7-128 Honolulu, HI 96850-7128	kevin.h.nishimura@faa.gov	(808) 312-6030
Department of Transportation Federal Transit Administration	90 7th Street, Suite 15-300 San Francisco, CA 94103	ted.matley@dot.gov	(415) 734-9490
Department of Homeland Security Coast Guard	Commander, 14th Coast Guard District, 300 Ala Moana Boulevard, Room 9-204, Honolulu, HI 96850-4982		(808) 535-3325

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Library or Depository	Mailing Address	Electronic Mail or Internet Address	Telephone
Wahiawa Public Library	820 California Ave. Wahiawa, HI 96786	http://www.librarieshawaii.org/locations/index.htm	(808) 622-6345
Kapolei Public Library	1020 Manawai St. Kapolei, HI 96707	http://www.librarieshawaii.org/locations/index.htm	(808) 693-7050
Pearl City Public Library	1138 Waimano Home Rd. Pearl City, HI 96782	http://www.librarieshawaii.org/locations/index.htm	(808) 453-6566
Kailua Public Library	239 Kuulei Rd Kailua, HI 96734	http://www.librarieshawaii.org/locations/index.htm	(808) 266-9911

NEWS MEDIA (NM)

Organization	Mailing Address	Electronic Mail or Internet Address	Telephone
Honolulu Star Advertiser	Restaurant Row 7, Waterfront Plaza, Suite 210, 500 Ala Moana Boulevard, Honolulu, HI 96813	citydesk@staradvertiser.com	(808) 529-4747
Hawai'i Tribune Herald David Bock, Publisher and Editor	P.O. Box 767 Hilo, HI 96721	dbock@hawaiitribune-herald.com	(808) 930-7323
West Hawai'i Today Tom Hasslinger, Editor	P.O. Box 789, Kailua-Kona, HI 96745-0789	thasslinger@westhawaiitoday.com	(808) 329-93 I I
The Garden Island	P.O. Box 231, Lihu'e, HI 96766	neagle@thegardenisland.com	(808) 245-3681
Maui News	100 Mahalani Street, Wailuku, HI 96793	citydesk@mauinews.com	(808) 244-3981
Moloka'i Dispatch	P.0. Box 482219, Kaunakakai, HI 96748	editor@themolokaidispatch.com	(808) 552-278 I

ELECTED AND OTHER OFFICIALS (EO)

Official	Mailing Address	Electronic Mail or Internet Address	Telephone
U.S. Senator - Mazie K. Hirono	300 Ala Moana Blvd., Rm 3-106 Honolulu, HI 96850	hawaiioffice@hirono.senate.gov	(808) 522-8970
U.S. Senator - Brian Schatz	300 Ala Moana Blvd., Rm 7-212 Honolulu, HI 96850	brian_schatz@schatz.senate.gov	(808) 523-2061
U.S. Representative - Ed Case	2443 Rayburn House Office Building Washington, DC 20515	ed.case@mail.house.gov	(202) 225-2726
U.S. Representative - Tulsi Gabbard	1433 Longworth House Office Building Washington, DC 20515	tulsiOffice@mail.house.gov	(202)225-4906

Distribution List for the DEIS

State Senator - Dru Mamo Kanuha Senate District 3	Hawaii State Capitol, Rm. 206	senkanuha@Capitol.hawaii.gov	(808) 586-9385
State Senator - Lorraine Inouye Senate District 4	Hawaii State Capitol, Rm. 210	seninouye@capitol.hawaii.gov	
State Senator - Kai Kahele Senate District 1	Hawaii State Capitol, Rm 213	senkkahele@capitol.hawaii.gov	
State Representative - Ryan Yamane House District 37	Hawaii State Capitol, Rm. 420	repyamane@capitol.hawaii.gov	
State Representative - Richard P. Creagan House District 5	Hawaii State Capitol, Rm. 427	repcreagan@capitol.hawaii.gov	
State Representative - Nicole E. Lowen House District 6	Hawaii State Capitol, Rm. 425	replowen@Capitol.hawaii.gov	
State Representative- David A. Tarnas House District 7	Hawaii State Capitol, Rm. 328	reptarnas@Capitol.hawaii.gov	(808) 586-8510
Honolulu City and County Council Chair and Presiding Officer - Ikaika Anderson	530 South King St., Rm 202 Honolulu, HI 96813	ianderson@honolulu.gov	(808) 768-5003
Mayor Kirk Caldwell	530 South King St., Rm 300 Honolulu, HI 96813	honolulu.gov/mayor	(808) 768-4141

CONSULTED PARTIES AND COMMENTERS UNDER SECTION 11-200-15, HAR(CP)

Name	Mailing Address	Electronic Mail or Internet Address	Telephone
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Inga Gibson, Policy Director, Pono Advocacy, LLC		ponoadvocacy@gmail.com	
Mike Nakachi, President, Moana Ohana	PO Box 4454 Kailua-Kona, HI 96745	mikenakachi@hawaii.rr.com	
Kealoha Pisciotta, Mauna Kea Anaina Hou and Kai Palaoa	PO Box 5864 Hilo, HI 96720	keomaivg@gmail.com	
Miyoko Sakashita, Oceans Director, Senior Counsel, Center for Biological Diversity	1212 Broadway, Suite 800 Oakland, CA 94612	miyoko@biologicaldiversity.org	
Rene Umberger, Executive Director, For the Fishes	PO Box 1894 Kihei, HI 96753	rene@forthefishes.org	
Teresa E. Kaneakua, 'Aho Hui Kia'i Kanawai Lead Compliance Specialist, Office of Hawaiian Affairs	560 N. Nimitz Hwy., Suite 200 Honolulu, HI 96817		
Robert Flatt		robert@fishes.com	
Alton Miyasaka		amiyasaka7@cs.com	
Mark Tang		dancingcloudrefuge@gmail.com	
Jojo Tanimoto, Aha Moku Island Council		guavaland622@gmail.com	