

State of Hawaii
DEPARTMENT OF LAND AND NATURAL RESOURCES
Division of Aquatic Resources
Honolulu, Hawaii 96813

September 25, 2015

Board of Land
and Natural Resources
Honolulu, Hawaii

Request for Approval of Special Activity Permit 2016-12 for Dr. Mark Hixon, University of Hawaii, Department of Biology to Deploy, Install, and Collect Samples from Artificial Coral Modules placed in Waikiki and the Hanauma Bay Marine Life Conservation District (MLCD), Oahu, Subject to an Approved Memorandum of Agreement Between the Department of Land and Natural Resources and the University of Hawaii at Manoa, Office of Research Services

The applicant proposes to conduct activities relating to the deployment, installation and sampling of artificial coral modules onto nearshore reef areas for the purposes of scientific data collection and analysis. The project will provide data on the comparison of successional settlement and colonization of organisms on completely uncolonized surfaces (artificial coral modules) and changes in associated fish populations when simultaneously installed in areas that are completely protected (no take within the Hanauma Bay Marine Life Conservation District (MLCD), Oahu) versus areas with some current regulations (standard regulations within an area offshore of Waikiki, Oahu). The research project would be an important source of information that the Division of Aquatic Resources and other government agencies can use to prepare for climate change and to better manage coral reef ecosystems around the Hawaiian Islands. University of Hawaii at Manoa (UHM) faculty and students could provide the State with valuable analysis of data from areas with strict regulations compared to areas with standard regulations.

The research project would constitute the “taking or altering of any sand, coral, rock, or other geological feature, or specimen in Hanauma Bay” with the deployment and installation of six (6) artificial coral modules consisting 48 (8’x8’x16’) concrete blocks each (288 concrete blocks total) onto a barren sandy area of the Hanauma Bay MLCD. The research project would additionally constitute “the taking of marine life in Hanauma Bay” with the removal of settlement plates (affixed to coral modules) annually to sample (analyze, identify, quantify) settlement and colonization of benthic organisms onto artificial coral modules placed in Hanauma Bay MLCD. The research project would finally constitute the “taking of corals” with the removal of settlement plates (affixed to coral modules) annually to sample (analyze, identify, quantify) settlement and colonization of benthic organisms onto artificial coral modules in placed outside of Waikiki.

During the permit review process, several questions were raised by DAR Aquatic Biologists over the risks and impacts of the deployment and installation of these artificial coral modules. The special conditions within the permit and the Memorandum of

ITEM F-1

Agreement (MOA) have been designed to minimize the impact of this research project and optimize the potential benefits.

We are providing the following point/counterpoint discussion for your review in order to give you the most complete information for your deliberations:

1. Point: The risk of injury or death to nearby coral colonies from potential shifting of artificial coral modules in storm conditions may outweigh the benefits of the information to be gained. The greatest risk from the coral modules would be in the Hanauma Bay MLCD, Oahu. The proposed module site would be in close proximity (within 50 m) to live, intact coral beds. In addition, these coral beds may be at risk of damage during the module installation or from modules shifting after placement.

Counterpoint: Special procedures would be employed to minimize the risk of coral damage. Concrete blocks would be lowered to the seafloor four at a time by boat winch at a precise location predetermined by diver surveys and meeting all conditions of DAR Special Activity Permit. Each module would be constructed on a foundation comprising a 4-foot by 4-foot sheet of ¾-inch fiber cement siding (used in home construction), also lowered by winch. Each module would be constructed underwater by hand by divers assembling 48 standard concrete blocks (8"x8"x16") into a unit measuring 0.9 cubic meters (3 blocks wide x 4 blocks deep x 4 blocks high), with individual placement of concrete blocks, to confirm accurate placement of modules at selected sites. Appropriate buoyancy platforms, such as lift-bags or winches would be used to transport all materials to the deployment site. Each module would be bound by 0.75" high-grade stainless steel bands to form a small (1.4 m x 0.8 m x 0.8 m = 0.9 m³) solitary unit.

Banding of individual concrete blocks into one solitary module and deployment on areas with deep sand may lessen the likelihood that the modules would shift with water motion. Banded consolidated units weigh approximately 806 lbs. each underwater (1344 lbs. total minus 40% of original weight for displacement of water). Principal investigator Dr. Mark Hixon has worked with this identical module design in the U.S. Virgin Islands (52 CReMs, Hixon & Beets 1993) and the Bahamas (20 CReMs, Carr & Hixon 1997) at depths from 20 to 50 feet. In the former study, the effect of Hurricane Hugo to the study site resulted in all but eight of the modules sinking in the sand where they were placed – none moved laterally. While this does not predict that these modules would also sink should a hurricane hit the site, it does provide some information on how the modules responded in previous hurricane conditions in other countries.

Our previous experience with tire in concrete (TIC) modules around Oahu has shown cases when the TIC modules were moved by Hurricane Iniki, they tended to move laterally rather than sink. Should the project modules move instead of sink, they would likely move onto extensive live coral beds and could cause significant damage. The chances of a Category 5 hurricane passing over Hanauma Bay is small but would represent a worst case scenario.

Major impacts to coral colonies are not anticipated because specific measures would be taken to mitigate the shifting of modules or incidental breakage of coral through the installation phase of the research project, with the additional guarantee of consistent

monitoring for shifting movement,. This project may actively facilitate coral recovery and growth, and the fisheries they support, while simultaneously providing data on the successional rates and phases in which these associated organisms colonize or populate the habitat provided by the artificial coral module. The scientific value of the biological data to be collected and the potential generation of twelve new areas that provide suitable habitat for fish and the colonization of benthic organisms, including coral, may out-weigh the risk to the nearby live aggregate coral reef. There is a critical need to better understand the potential impacts of climate change on the marine environment and the information gained through studies like this may be invaluable to our ability to prepare for these changes.

2. Point: The existing benthic organisms under the footprint of the artificial coral modules will be killed.

Counterpoint: Individual modules will be placed in bare sand flat sites intentionally selected for the low compositional density of infaunal or benthic organisms. A comprehensive baseline survey to identify, quantify and document sample amounts of preexisting populations of infaunal organisms is required by the applicant. Prior studies have shown that artificial coral modules are temporary and removable, and their environmental effects are both negligible and highly reversible when the modules are placed on sand flats (Hixon & Beets 1993, Carr & Hixon 1997). Subject to the conditions of the MOA, the applicant shall be responsible to restore the marine areas where the modules are deployed back to the conditions that existed prior to when the modules were deployed. The marine area includes the benthic habitat (substrate and benthic organisms) and its associated marine life (non-benthic organisms). The original environmental conditions will be documented in a report by Dr. Hixon with information gathered during marine surveys identified at the start of the experiment.

3. Point: Deployment and installation of artificial coral modules alters the natural environment of the protected marine life conservation district and underwater park (Hanauma Bay MLCD and Underwater State Park). The sight of artificial habitat structures within a nature park will diminish the experience of the park user.

Counterpoint: The Division and researchers hypothesize that providing shelter for fishes and growth surfaces for corals may enhance the abundance of both fish and coral, especially if some of the resident fish are herbivores. The applicant believes that the end result of the experiment would be the creation of six additional coral reef micro-ecosystems with coral coverage and visual appearances similar to adjacent reef areas within the MLCD. Past experience in the Bahamas has shown that, after years *in situ*, these modules become basically natural features, covered by encrusting organisms, including corals. Given that the physical shelter usually provided by corals enhances the local abundance of reef fishes, and given that herbivorous fishes help to keep deleterious algae from replacing corals, one way to enhance reef resilience in areas where corals are already in low abundance is to provide both shelter for reef fishes and clean growth surfaces for coral colonization. Although Hanauma Bay is already high in coral abundance, the MLCD may benefit from the addition of six coral reef micro-ecosystems, and serve as the control to prove this hypothesis for non-protected areas outside the

MLCD. Only time will show if the amount of encrusting organisms will be sufficient to cover the modules to the point where they will look like a natural reef.

From a native Hawaiian cultural perspective, the artificial coral modules are essentially modern versions of ancient Hawaiian *umu*: stacks of basalt boulders designed to attract fish for harvest. There have also been recent efforts to construct new *umu* in Hawai'i as part of the ongoing community-based management movement.

4. Point: Materials used to construct artificial coral modules may leach chemicals into the surrounding environment.

Counterpoint: Concrete will be Portland Type II with no additives. Concrete and stainless steel bands will not have been used prior to this project for other uses. Modules and Settlement Plates will be cured (i.e. soaked in freshwater) for a minimum of 2 weeks immediately prior to deployment with clean freshwater changes every four (4) days to remove leachate. All modules and settlement plates will be photo-documented after the curing process to show they are clean of organisms or discolorations that might be indicative of chemical leaching prior to deployment.

5. Point: Artificial coral modules may require removal at the end of the research period; are there sufficient resources for the potential removal of the artificial coral reef modules?

Counterpoint: Once constructed, the modules will be single units that can be raised either intact or after being disassembled. The applicant's previous experiments in the U.S. Virgin Islands, he raised entire modules with single large lift bags (specially designed canvass bags tied to each module and filled with air from SCUBA tanks by divers). Once lifted, intact modules could be lifted onto a vessel by a sufficiently large winch (or a winch could be used directly without lift bags). Alternatively, each module can be disassembled and raised in pieces by lift bags and/or a small capacity boat winch. Importantly, these removal protocols do not disturb the seafloor. Past experience in the Bahamas has shown that, after years *in situ*, these modules become basically natural features, covered by encrusting organisms, including corals. The applicant is hopeful that the module will eventually appear like a natural reef and there would be no need to remove it.

Should there be a decision to remove the modules, DAR wants to be sure that there will be sufficient funds and resources to accomplish this task. Beyond the legal responsibilities of the applicant, the Division is also seeking additional assurances from the University of Hawaii, Office of Research Services through an MOA if the applicant's resources are not sufficient to address all future needs.

The applicant is responsible for the deployment, installation, modification, repair and maintenance or removal of the artificial coral modules and any cost associated with the research activity. As an added assurance, a Memorandum of Agreement (MOA) between the Department of Land and Natural Resources and the University of Hawaii, Office of Research Services, would make the ORS responsible for any costs associated with the removal of the modules and for returning the area back to its original condition.

ORS should have sufficient resources to address any needs should they agree to the MOA.

6. Point: The authorization of this research activity would set a precedent and may increase manipulative research activity in Hanauma Bay MLCD or other such managed marine areas.

Counterpoint: This permit authorizes this research project only. Any other applications received for research projects that are submitted to the Division of Aquatic Resources will be reviewed with the regular administrative intentions to keep manipulative research to a minimum in protected or regulated areas, such as MLCDs.

7. Point: Deployment of modules may create a vector for introduction or facilitation of colonization of Aquatic Invasive Species (AIS). Hanauma Bay is relatively isolated from areas with aquatic invasive species and is not known to have many of the more common invasive algae species.

Counterpoint: All materials and tools used in the construction of modules and settling plates would be sterile of any marine organisms when deployed. Deployed settling plates subsequently colonized by benthic organisms and removed from any module would be placed and sealed in individual heavy-gauge plastic bags by divers before being transferred to the surface. After laboratory analyses to determine the species composition and cover/abundance/biomass of each benthic species on each settling plate, the organisms would be either preserved or discarded by standard lab protocols that ensure no chance of return of live organisms to the environment. Divers would regularly survey (weather permitting) the entire surface and holes of each module, and if any aquatic invasive species (AIS) are found on any module, DAR will be notified immediately. Modules deployed in Waikiki would likely be colonized with some invasive species that are common in the local environment. Such colonization of modules will be monitored appropriately and reported to DAR.

Clarification: DAR seeks clarification on whether the BLNR would still approve the permit, even without a signed MOA.

RECOMMENDATION: The Department Recommends

Based on the Department's exemption determination (attached) and the application and record in this matter, the Board **DECLARES, FINDS, and DECIDES**:

- 1) That the actions covered by this permit will have little or no significant effect on the environment and is therefore exempt from the preparation of an environmental assessment;
- 2) To delegate the Chairperson to sign the declaration of exemption on behalf of the Board, for purposes of recordkeeping requirements of chapter 343, HRS, and chapter 11-200, HAR;
- 3) To authorize and approve, with stated conditions, the proposed special activity permit;
- 4) To delegate the Chairperson to sign the special activity permit on behalf of the Board;

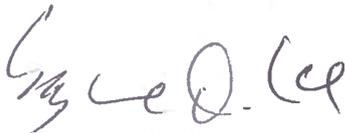
- 5) To delegate the Chairperson to sign the Memorandum Of Agreement on behalf of the Board; and
- 6) To delegate the Chairperson to sign the right of entry permit on behalf of the Board for the use of state submerged lands.

Respectfully submitted,



Alton Miyasaka
Acting Administrator

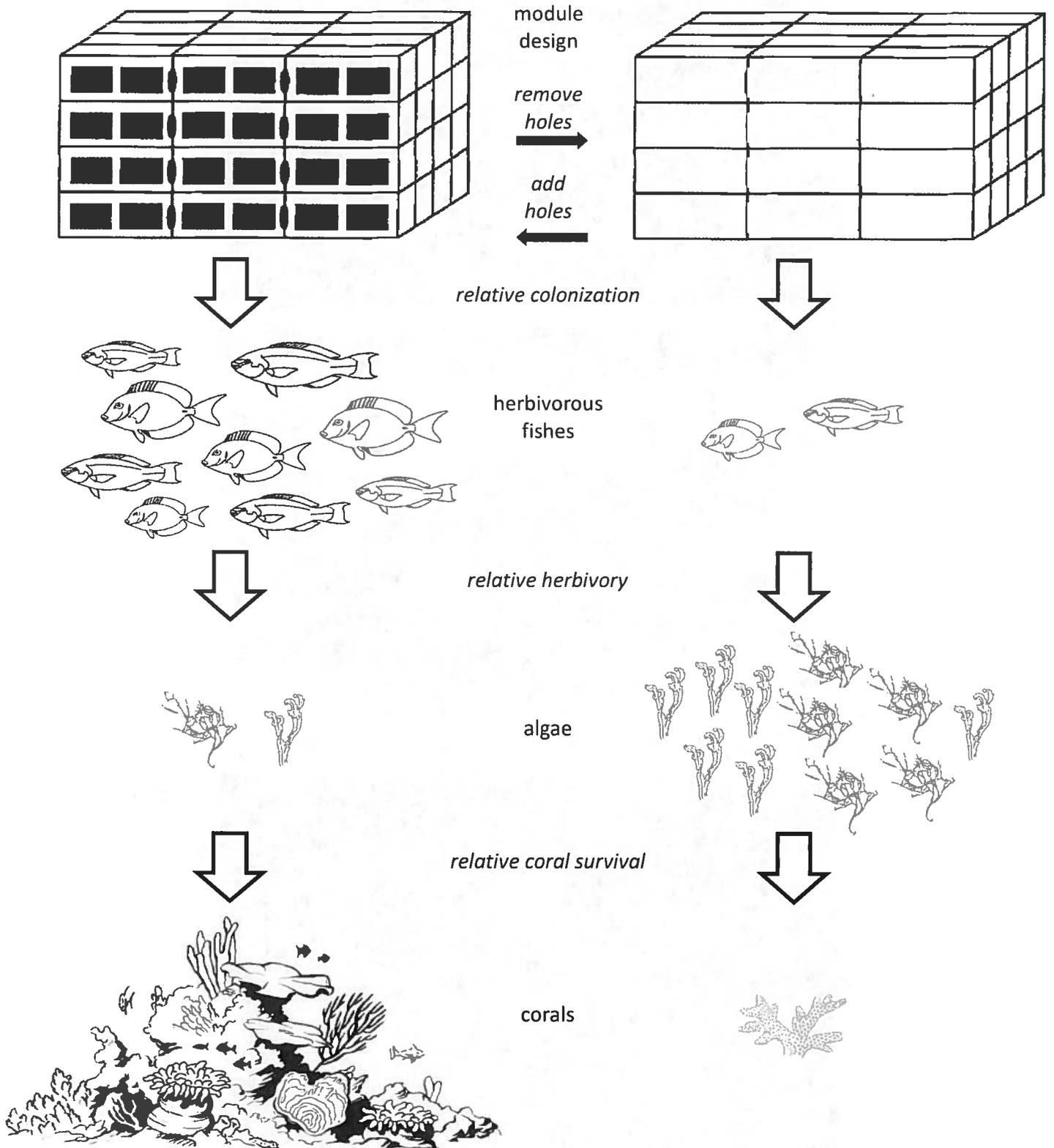
APPROVED FOR SUBMITTAL:



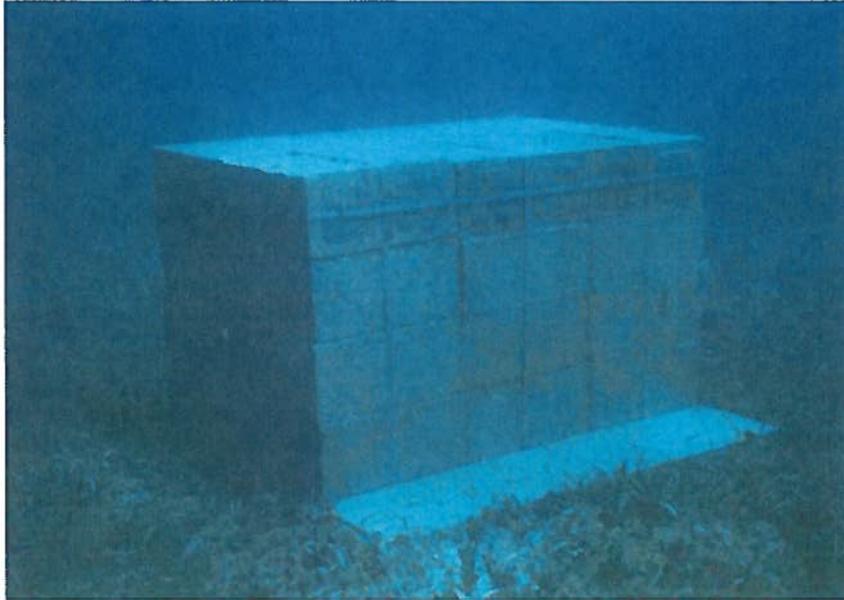
SUZANNE D. CASE
Chairperson

CReme: Coral Resilience Module Experiment

Hypothesis: Dead corals with intact structure (simulated by left module) recover because they provide shelter for herbivorous fishes, which reduce algal cover, thereby fostering coral recruitment & survival.



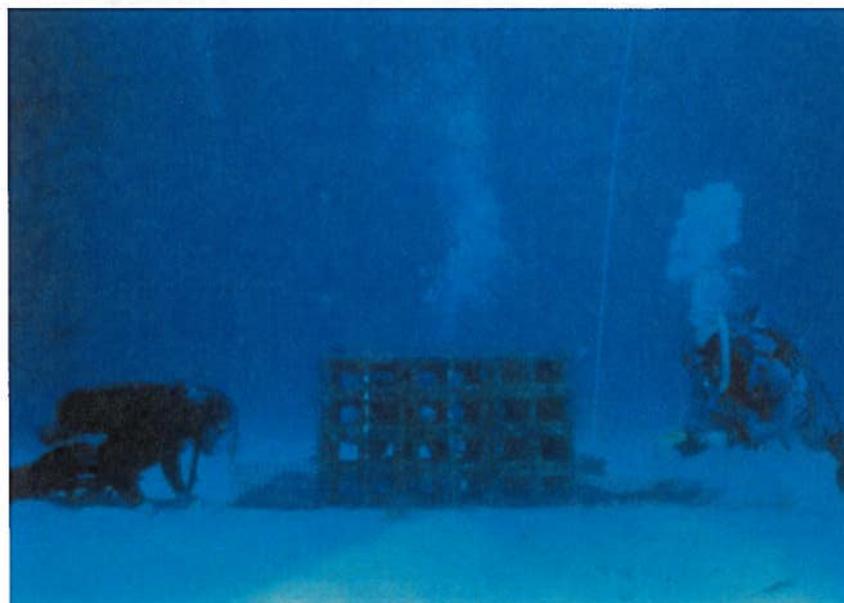
Examples of Prior CReMs



new holeless module
(U.S. Virgin Islands)



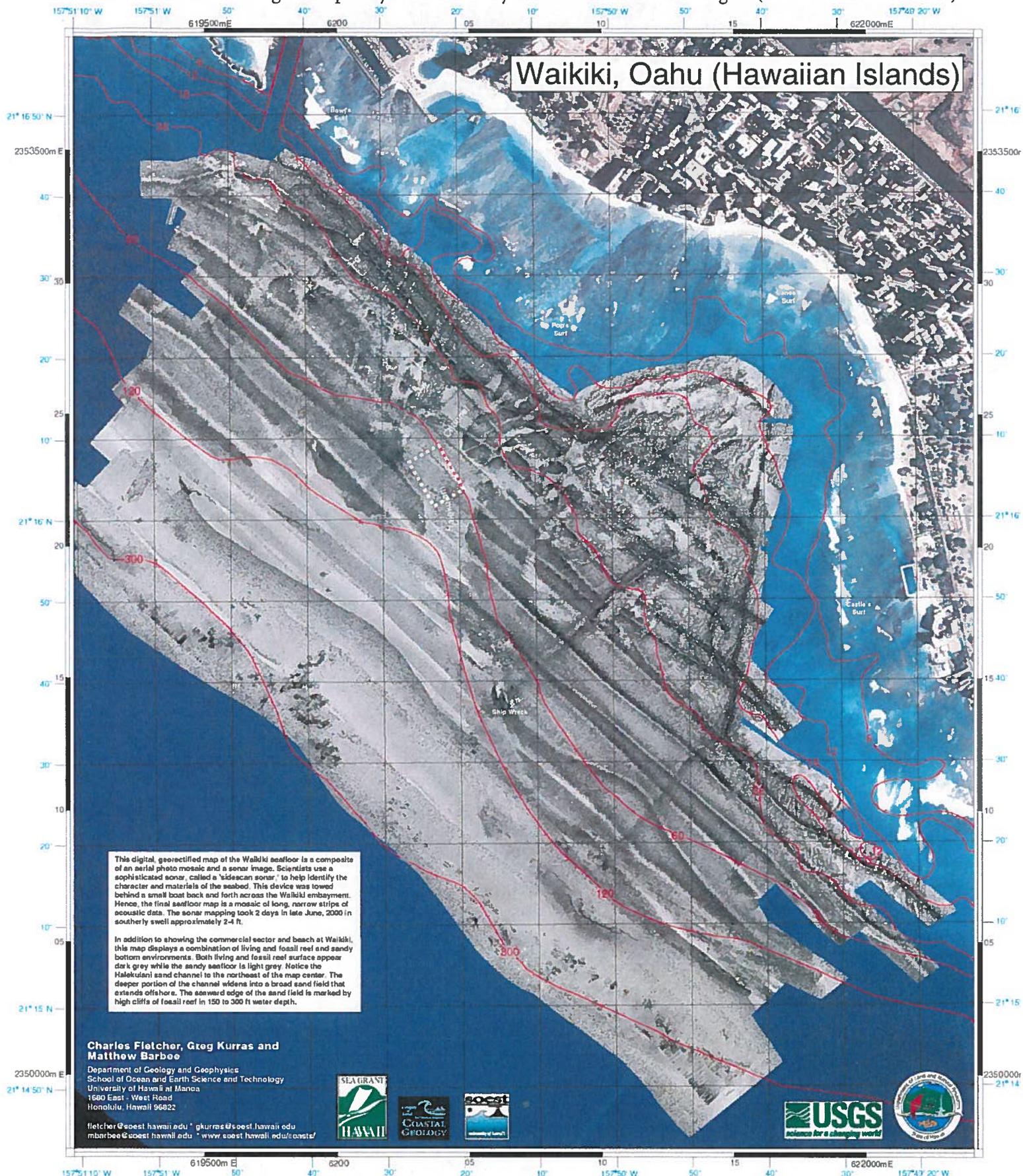
old holed module
(Bahamas) – note
abundance of fish,
corals, sponges, etc.



size of module
relative to divers
(Bahamas)

photos:
Mark Hixon

150 m x 200 m rectangle completely encloses study area of 6 modules in 2x3 grid (50 m between modules)



Waikiki, Oahu (Hawaiian Islands)

This digital, georectified map of the Waikiki seafloor is a composite of an aerial photo mosaic and a sonar image. Scientists use a sophisticated sonar, called a 'sidecan sonar', to help identify the character and materials of the seabed. This device was towed behind a small boat back and forth across the Waikiki embayment. Hence, the final seafloor map is a mosaic of long, narrow stripes of acoustic data. The sonar mapping took 2 days in late June, 2000 in southerly swell approximately 2-4 ft.

In addition to showing the commercial sector and beach at Waikiki, this map displays a combination of living and fossil reef and sandy bottom environments. Both living and fossil reef surface appear dark grey while the sandy seafloor is light grey. Notice the Halekuanani sand channel to the northeast of the map center. The deeper portion of the channel widens into a broad sand field that extends offshore. The seaward edge of the sand field is marked by high cliffs of fossil reef in 150 to 300 ft water depth.

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Scale 1:15000



Circle and arrow in feet

DAVID Y. IGE
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

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September 25, 2015

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

KEKOA KALUHIWA
FIRST DEPUTY

JEFFREY T. PEARSON
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
KAAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

TO: Division of Aquatic Resources File

THROUGH: Suzanne D. Case, Chairperson

FROM: Alton Miyasaka, Acting Administrator
Division of Aquatic Resources

A handwritten signature in blue ink, appearing to read "Alton Miyasaka".

SUBJECT: Declaration of Exemption from the Preparation of an Environmental Assessment under the Authority of Chapter 343, HRS, and Chapter 11-200, HAR, for a Special Activity Permit to Dr. Mark Hixon, University of Hawaii, Department of Biology.

The following permitted activities are found to be exempted from preparation of an environmental assessment under the authority of Chapter 343, HRS and Chapter 11-200, HAR:

Project Title: Special Activity Permit to Dr. Mark Hixon, University of Hawaii, Department of Biology, to deploy, install, and collect samples from artificial coral modules placed in Waikiki and Hanauma Bay Marine Life Conservation District (MLCD), Oahu, subject to an approved Memorandum of Agreement with the University of Hawaii at Manoa, Office of Research Services.

Permit Number: SAP 2016-12.

Project Description: The research permit, as described below, would allow for the deployment, installation, and collection of samples from artificial coral modules placed in Waikiki (the 'Āpuakehau or Halekulani sand channel off Waikīkī, about 1 km offshore) and Hanauma Bay Marine Life Conservation District (MLCD), subject to an approved Memorandum of Agreement (MOA) with the University of Hawaii at Manoa (UHM), Office of Research Services (ORS) for research purposes. Artificial Coral Modules will be deployed for a minimum of 10 years subject to the conditions of this permit and the MOA upon bare sand within coral reef habitat in the waters of Oahu from September 25, 2015 through September 24, 2016. The taking of corals is prohibited under section 13-95-70, Hawaii Administrative Rules (HAR), unless authorized by a permit issued under section 187A-6, Hawaii Revised Statutes (HRS). The taking of marine life in Hanauma Bay is prohibited

under section 13-28-2 (1), HAR, unless authorized by a permit issued under section 187A-6, HRS. The taking or altering of any sand, coral, rock, or other geological feature, or specimen in Hanauma Bay is prohibited under section 13-28-2 (2), HAR, unless authorized by a permit issued under section 187A-6, HRS.

Living coral is well documented to be an essential habitat for reef fisheries, providing shelter and food sources for a variety of invertebrates and fishes. Unfortunately for the people of Hawai‘i, the coral bleaching event of October 2014 showed that local reefs are susceptible to increasing stress from rapidly accelerating ocean warming and acidification, in addition to ongoing siltation and eutrophication from uncontrolled runoff and seepage. Indeed, much of the exposed coastline of Hawai‘i has low cover of living coral, only partially due to physical stress caused by large ocean waves. Overfishing of herbivorous fishes, especially parrotfishes (*uhu*), facilitates the replacement of corals by benthic algae, especially invasive seaweeds.

This situation poses a dilemma for reef managers: How can humans actively foster coral recovery and growth, and thus the ecological resilience of coral reefs and the fisheries they support? Given that the physical shelter usually provided by corals enhances the local abundance of reef fishes, and given that herbivorous fishes help to keep deleterious algae from replacing corals, one way to enhance reef resilience in areas where corals are already in low abundance is to provide both shelter for reef fishes and clean growth surfaces for coral colonization.

The researchers of this project hypothesize that providing shelter for fishes and growth surfaces for corals will enhance the abundance of both fish and coral, especially if some of the fish are herbivores. If this hypothesis is true, then the researchers predict that concrete modules with many holes (simulating dead but structurally intact corals) will be colonized by many fishes, and herbivores among those fishes (and sea urchins) will keep the surfaces of the module clean so that corals can settle and grow. The researchers also predict that control modules with no holes (simulating dead and collapsed corals) will be colonized by few fish, so such modules will be overgrown by algae. If these treatments are subsequently reversed (i.e., holes are plugged in holed modules, and holes are added to holeless modules), then we expect the patterns of fish and coral abundance to reverse, thereby corroborating the hypothesis in both space and time.

This pilot demonstration project aims to test these ideas by providing both shelter for reef fishes and clean growth surfaces for corals and other benthos by deploying cubic-meter concrete “artificial coral modules” placed on sand flats over 50 feet deep off the south shore of O‘ahu, where human impacts are more evident than most of the archipelago. Co-principal investigators Dr. Megan Donahue (Hawaii Institute of Marine Biology - HIMB) and Dr. Celia Smith (UHM) are confident that these depths are appropriate for the anticipated results of this study. Principal investigator Dr. Mark Hixon has worked with this identical module

design in the U.S. Virgin Islands (52 CReMs, Hixon & Beets 1993) and the Bahamas (20 CReMs, Carr & Hixon 1997) at depths from 20 to 50 feet. In earlier studies “artificial coral modules” were referred to as Coral Resilience Modules (CReMs). In the former study, extremely powerful Hurricane Hugo resulted in the all but 8 of the modules sinking in the sand where they were placed – none moved laterally.

It is essential that one set of modules be placed at a sheltered site where fishing is prohibited to ensure that herbivores are not removed, yet it is also desirable to have another set of modules placed in a more typical location. The only workable, and indeed, ideal non-fishing area is the deep sand flat in the Hanauma Bay Marine Life Conservation District (MLCD). The closed area in the Waikīkī MLCD is far too shallow, as is the Coconut Island – Hawai‘i Marine Laboratory Refuge (which is highly atypical of the remainder of Hawai‘i), and the Pūpūkea MLCD (which includes Waimea Bay) is far too exposed to huge winter swells. Providing a more typical study site for comparison with Hanauma Bay will be the mouth of the ‘Āpuakehau or Halekulani sand channel off Waikīkī, about 1 km offshore (outside of any MLCD).

Three pairs of artificial coral modules will be deployed at each study site. Each artificial coral module is simply 48 standard 8”x8”x16” concrete blocks bound by 0.75” high-grade stainless steel bands to form a small (1.4 m x 0.8 m x 0.8 m = 0.9 m³) habitat for fishes as well as corals and other benthos. These structures have previously been highly successful in attracting many fish and being colonized by rich benthos in both the U.S. Virgin Islands (52 CReMs, Hixon & Beets 1993) and the Bahamas (20 CReMs, Carr & Hixon 1997). Importantly, prior studies have shown that artificial coral modules are temporary and removable, and their environmental effects are both negligible and highly reversible when the modules are placed on sand flats (Hixon & Beets 1993, Carr & Hixon 1997). Modules will be deployed on deep sand flats in pairs to allow comparisons of artificial coral modules with 24 holes vs. control modules with no holes. The distance between modules in each pair will be at least 50 meters, as will be the distance to any natural reef. (See Special Activity Permit Application for diagrams or artificial coral modules and maps for location of module placement).

Following deployment, SCUBA divers will periodically census all fishes and mobile invertebrates associated with each module by species and body size. Divers will also monitor photographically the species and coverage of sessile benthos (corals, algae, etc.), periodically filming all 5 sides of each module. Importantly, no organisms will be harmed or removed, except small (50 cm²) calcium carbonate settling plates that will be attached temporarily to the module bands and taken to the lab for identification of small benthos and algae (including new settlers) that cannot be identified visually underwater. After the colonization of each pair of modules has stabilized (defined as either slow change or seasonal cycles through time), then treatments will be reversed: holes will be plugged (with large rubber stoppers) to remove shelter in holed coral modules, and holes will be added to holeless control modules

by removing plugs (cement walls) from the holes of concrete blocks. These treatments will test experimentally whether shelter for fishes indirectly affects coverage of live coral in both space (between-module comparisons at the same time) and time (within-module comparisons through time).

The researchers cannot predict *a priori* how long the experiments must run for robust results, but anticipate at least 10 years. By statistically comparing patterns of abundance of fish and benthic species between module treatments (24 holes vs. no holes), the predictions of the hypothesis will be tested. Results will be published in peer-reviewed scientific journals.

If coral resilience modules are shown to be effective in enhancing the local density of herbivores and corals, then there is a benefit to the people of Hawai'i. The video and photo-documentation of the modules will provide clear visual images of the differences between reefs with abundant herbivores and corals compared to reefs with fewer herbivores and corals (mostly algae), thereby fostering sustainable behavior and policies. This pilot project will test the feasibility of this benefit.

From a native Hawaiian cultural perspective, the artificial coral modules are essentially modern versions of ancient Hawaiian *umu*: stacks of basalt boulders designed to attract fish for harvest. We will seek a protocol ceremony to dedicate our artificial *umu*. Additionally, Dr. Kaipo Perez (Hanauma Bay County Park employee) reports efforts to construct new *umu* in Hawai'i as part of the ongoing community-based management movement, and we are discussing possible collaborative research and educational efforts.

UHM students, including the Marine Option Program, will be involved in this project from the outset, assisting in scouting study sites, deploying modules, and monitoring modules. The entire project will be filmed to provide a short documentary illustrating the importance of fostering the ecological resilience of our coral reefs by enhancing habitat for fishes, especially herbivores that help to foster coral growth by controlling algae. Media releases, posters, public presentations, and other public outreach efforts will also be provided. Researchers also hope to involve both the Hanauma Bay and Waikiki Aquarium educational centers in public outreach regarding both this project and the general importance of fostering the ecological resilience of Hawai'i's coral reefs.

Consulted Parties: Dave Gulko, Aquatic Biologist, DAR (Oahu), Catherine Gewecke, Aquatic Biologist, DAR (Oahu), Alton Miyasaka, Aquatic Biologist, DAR (Oahu), Dr. Kaipo Perez (Honolulu County Department of Parks and Recreation).

Exemption Determination: After reviewing HAR § 11-200-8, including the criteria used to determine significance under HAR § 11-200-12, DLNR has concluded that the activities under this permit would have minimal or no significant effect on the environment, and that issuance of the permit is categorically exempt from the

requirement to prepare an environmental assessment based on the following analysis:

1. All activities associated with this permit have been evaluated as a single action.

Since this permit involves the same study methodology used throughout the permit period, the categorical exemption determination here will treat all planned activities as a single action under §11-200-7, HAR.

2. The Exemption Class for Scientific Research with no Serious or Major Environmental Disturbance Appears to Apply. HAR § 11-200-8(a)(5) exempts the class of actions which involve "basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource." This exemption class has been interpreted to include activities such as Mark Hixon's research applications being proposed.

3. Cumulative Impacts of Actions in the Same Place and Impacts with Respect to the Potentially Particularly Sensitive Environment Will Not be Significant. Even where a categorical exemption appears to include a proposed action, the action cannot be declared exempt if "the cumulative impact of planned successive actions in the same place, over time, is significant, or when an action that is normally insignificant in its impact on the environment may be significant in a particularly sensitive environment." HAR § 11-200-8(b) To gauge whether a significant impact or effect is probable, an exempting agency must consider every phase of a proposed action, any expected primary and secondary consequences, the long-term and short-term effects of the action, the overall and cumulative effect of the action, and the sum effects of an action on the quality of the environment. HAR § 11-200-12.

Significant cumulative impacts are not anticipated as a result of this activity, and numerous safeguards further ensure that the potentially sensitive environment of the project area will not be significantly affected. All activities will be conducted in a manner that does not diminish marine resources, qualities, and ecological integrity, or have any indirect, secondary, cultural, or cumulative effects.

Since no significant cumulative impacts or significant impacts with respect to any particularly sensitive aspect of the project area are anticipated, the categorical exemptions identified above should remain applicable.

4. Overall Impacts will Probably have a Minimal or No Significant Effect on the Environment.

Any foreseeable impacts from the proposed activity will probably be minimal, and further mitigated by general and specific conditions attached to the permit. Specifically, all research activities covered by this permit will be carried out with strict safeguards for the natural, historic, and cultural resources, other applicable law and agency policies and standard operating procedures.

Conclusion. Upon consideration of the permit to be approved by the Board of Land and Natural Resources, the potential effects of the above listed project as provided by Chapter 343, HRS, and Chapter 11-200, HAR, have been determined to be of probable minimal or no significant effect on the environment and exempt from the preparation of an environmental assessment.

Suzanne D. Case,
Director, Department of Land and Natural Resources
and
Chairperson, Board of Land and Natural Resources

Date

State of Hawai'i
 Department of Land & Natural Resources
 Division of Aquatic Resources
 1151 Punchbowl Street, Room 330
 Honolulu, Hawai'i 96813

**SPECIAL ACTIVITY PERMIT
 (SAP) 2016-06**

Issued: September 25, 2015
 Expires: September 24, 2016

The State of Hawaii BOARD OF LAND AND NATURAL RESOURCES ("Board") through its DEPARTMENT OF LAND AND NATURAL RESOURCES ("Department") hereby grants and issues a SPECIAL ACTIVITY PERMIT (SAP) to:

MARK HIXON ("Permittee")
 University of Hawaii at Manoa
 Department of Biology
 2538 McCarthy Mall, Edmonson 216
 Honolulu, HI 96822

For placement of experimental artificial coral modules and settlement plates on State Submerged lands for a limited period of time, subject to the numbers and locations as listed in the table below; along with Special Conditions.

COMMON NAME	SPECIES	LIMITS see Special Conditions	LOCATIONS see Special Conditions
Artificial Coral modules	<i>n/a</i>	6 Modules Each Module = 48 Concrete Blocks Total = 288 (8" x 8" x 16") Concrete Blocks	Hanauma Bay Marine Life Conservation District (MLCD) in Sand Channel ONLY (List Specific GPS points)
Settlement Plates	<i>n/a</i>	48 (4" x 4") Ceramic Tiles (limestone or sanitized coral rock fragments)	Hanauma Bay Marine Life Conservation District (MLCD) – ONLY attached to Coral modules

Artificial Coral modules	<i>n/a</i>	6 Modules Each Module = 48 Concrete Blocks Total = 288 (8" x 8" x 16") Concrete Blocks	Waikiki (Apuakehau or Halekulani Sand Channel)
Settlement Plates	<i>n/a</i>	48 (4" x 4") Ceramic Tiles (limestone or sanitized coral rock fragments)	Waikiki (Apuakehau or Halekulani Sand Channel)
Benthic Organisms	<i>Various benthic organisms ATTACHED to deployed Settlement Plates ONLY (genus species will be inventoried after sampling settlement plate)</i>	Various sizes and amounts (size and amounts will be inventoried after sampling settlement plate)	Hanauma Bay Marine Life Conservation District Sand Channel (MLCD) ONLY attached to Coral modules
Benthic Organisms	<i>Various benthic organisms ATTACHED to deployed Settlement Plates ONLY (genus species will be inventoried after sampling settlement plate)</i>	Various sizes and amounts (size and amounts will be inventoried after sampling settlement plate)	Waikiki (Apuakehau or Halekulani Sand Channel)

This Permit authorizes the Permittee and assistants designated through this Permit to engage in activities otherwise prohibited by law, which TAKE, POSSESS, TRANSPORT, OR KILL certain aquatic life from waters of the State, but subject to the conditions stated here.

This Permit is authorized pursuant to Hawaii Revised Statutes, § §171-6, 171-7, 187A-2, 187A -6, 188-68, 190-1 and 190-4, other applicable laws, and the Hawaii Administrative Rules ("HAR") implementing these statutes.

This Permit is subject to the following terms and conditions.

CONDITIONS

Part I. GENERAL

- A. This Permit is effective when the following processes have been completed.
1. Each assistant must be listed at the end of this Permit.
 2. The Permittee and each assistant must read the Permit completely; acknowledge that he or she understands and agrees to abide by the conditions of the Permit, and sign both copies of the Permit as provided.
 3. The Permit becomes valid when signed by an authorized representative of the Department and the Department returns one validated copy to the Permittee.
 4. The Permittee agrees to notify the Division of Aquatic Resources ("Division") immediately of any change in assistants. Additional persons may be added as assistants in the manner provided in this Permit.
 5. The Permittee agrees to obtain the Division's prior written approval before conducting any activity which would be prohibited if not authorized under this Permit (i.e. request in advance changes to permit conditions).
 6. This Permit does not in any manner render the Department or the State of Hawai'i liable in any way for claims of personal injury or property damage which may arise or result from activity authorized by this Permit. The Permittee or all assistants agree to hold the Board and State harmless against any and all claims of injury, death or damage resulting from acts or omissions under this Permit.
 7. This Permit conveys authority ONLY of the Department's jurisdiction over aquatic resources: The Permittee is and remains responsible for obtaining all other permission from other applicable authorities, including owners of and tenants of private lands; other divisions of the Department; other local, State and Federal agencies. A right of entry permit is also required for use of state submerged lands from the Department's Land Division. This permit authorizes activities involving aquatic organisms protected by Federal law only with appropriate Federal authorization.

8. The Permittee and each assistant are individually responsible and accountable for his or her actions while performing activities authorized by this Permit. The Permittee is also responsible and accountable for the actions of each assistant.
9. This Permit is not transferrable and not assignable to another person.
10. The Permittee or assistant must carry a copy of this permit on location while performing activities authorized by this Permit.
11. Authority granted by this Permit ends on the "Expiration Date" on the first page of this permit; within one month of the expiration date, the Permittee agrees to return this permit to the Division with a Collecting Report completed for the full duration of this permit, reporting results of all activities under this permit in the form provided with this permit.
12. The Permittee and assistants agree to provide access to data obtained under this permit upon request of the Division, to provide the Division one copy of each report prepared with such data and published for distribution, and to allow Department staff to inspect on Permittee's premises organisms collected under this permit.
13. Violation of any condition of this permit by any person may be cause for immediate revocation of the permit; the person responsible may be subject to penalty as provided by law; violation may be cause also for denial of future permit applications.
14. The Permittee may request change of a condition or conditions of this permit by writing to the Division; if approved by the Department, the Division will issue an attachment ("Amendment") which shall become part of, and amend terms of, this permit. The Department may impose additional conditions to, or restrictions of, this permit by written notice to the Permittee.

Part II. SPECIAL CONDITIONS

- A. **General Statement:** This permit authorizes deployment of (12) experimental artificial coral modules with attached settlement plates and take of colonized settlement plates ONLY as listed in the table on page 1 and subject to the other conditions of this permit.

B. Locations: Deployment and collecting activities under this permit are limited to the sand channels in Hanauma Bay Marine Life Conservation District (MLCD) and Waikiki of the Island of Oahu as listed in the table on page 1.

C. Materials to be deployed:

1. Concrete will be Portland Type II with no additives. Concrete and stainless steel bands will not have been used prior to this project for other uses.

2. Modules and Settlement Plates will be documented as having been cured (i.e. soaked in freshwater) for a minimum of 2 weeks immediately prior to deployment with clean freshwater changes every four (4) days to remove leachate. All modules and settlement plates will be photo-documented after curing process in order to show they are clean of organisms or discolorations that might be indicative of chemical leaching prior to deployment.

3. Settlement plates will be mounted or attached only to the approved coral modules within Hanauma Bay and off Waikiki.

4. All modules deployed will have attached to each deployed unit a waterproof, permanent label listing the permit number, and a non-personal contact number or email.

D. Activities: Activities under this permit shall abide by the following conditions.

1. Modules shall be placed on bare sand where there is minimal evidence of infaunal burrows. A pre-deployment survey will be conducted and accepted by the Department prior to placement of any structure within the Bay. Survey will consist of bottom characterization of sand habitat including average density of burrows for within the target area and a coral/algae/fish survey of coral reef habitat to both sides of the sand channel adjacent to the project area to establish baseline. Infaunal characterization will include identification, density and biomass of infaunal organisms from number of sand core samples that can provide statistical rigor and that have minimal impact.

2. Deployment, collection and transport activities under authority of this permit must be supervised directly, on site, by either the permittee or their appointed representative (who must be a signatory of this permit). Deployment of modules and settlement plates will be photo-documented (including pre-installation benthic installation, and post-installation time-stamped photos along with GPS points). Follow-on monitoring and

removal activities will include confirmation time-stamped photography of all in-place units and associated benthic habitats. Photo-documentation will be made prior to and immediately after collection or servicing of materials. These records will be made available to the Division upon request at any time and listed in the annual report.

3. Logistics for deployment and transportation of individual concrete blocks into designated sand channels (table on page 1) must be clearly outlined in a written Reef Module Deployment Plan that is prior approved in writing by DAR. Deployment (along with monitoring, maintenance and removal) will occur in a manner that does not disrupt or affect public use of the area. All vessels and equipment to be used for deployment must be pre-approved by the Division.
4. Logistics for construction of individual coral modules in designated sand channels (table on page 1) must be clearly outlined in a Reef Module Construction Plan that is approved in writing by DAR. Coral modules must be secured (bound) into consolidated units via 0.75" high-grade stainless steel bands to form small (1.4m x 0.8m x 0.8m = 0.9m²) habitat for marine organisms. Total number consolidated units allowed: 6 in Hanauma Bay and 6 in Waikiki
5. Logistics for emergency removal of individual coral modules out of designated sand channels (table on page 1) must be clearly outlined in a Reef Module Emergency Removal Plan that is approved in writing by DAR. Plan will include evidence of resources and capability to immediately remove all artificial coral modules and mitigate damage to natural resources if invasive algae or other organisms are detected or observed on the modules (in Hanauma Bay ONLY) or in the immediate vicinity, if significant ecological change is detected or observed, if public or environmental health or safety is at risk or if the Division or Department determines for any reason that this continued activity is not desired within the MLCD.
6. Permittee (Dr. Mark Hixon, Professor and Endowed Chair, Marine Biology, UH Manoa) is liable and financially responsible for all components of deployment, installation, modification, repair and maintenance or removal processes of artificial coral modules and any cost bearing incidences associated with research activity and additionally subject to the Memorandum of Agreement (MOA) between the Division of Aquatic Resources of the Department of Land and Natural Resources, and the University of Hawaii, Office of Research Services. All actions involving the artificial coral modules and settlement plates will be directly supervised by the Permittee or his assigned representative who must be a signatory to this permit.

7. Settlement plates may be transported to labs of Dr. Mark Hixon at University of Hawaii, Department Dr. Megan Donahue at Hawaii Institute of Marine Biology (HIMB) and Dr. Celia Smith at UH) at UH Manoa, Hawaii Institute of other in-State institutions designated by permittee for analysis after written approval from DAR.
8. An Aquatic Invasive Species (AIS) Mitigation Plan will be filed with the Division and approved by DAR prior to conducting any deployment or collection under this permit. The Plan will include methods and protocols to minimize AIS or disease movement through gear, supplies, vessels and activities of the permittee. **If sampling and transporting live benthic organisms on settlement plates**, permittee must take actions to sample organisms without visible disease if possible, organisms that exhibit non-invasive potential and take precautions to sterilize sampling equipment between collection periods. If necessary to sample all organisms on settlement plates, permittee must set up quarantine tanks that restrict any movement of disease or invasive organisms to other regions of the island. Permittee may possess bleach on vessel ONLY to disinfect collection gear and dive gear during or after sampling.
9. No extractive or impact-causing activities will be done on (or immediately adjacent to) any intact, attached coral colony measuring larger than 1 m longest diameter. Specific efforts will be made to avoid damage to any large (> 0.5 m) colonies of living coral. Coral modules will NOT be placed within 20 m of any live coral.
10. No coral species other than those directly colonized on approved settlement plates will be collected or impacted by any activities conducted under this permit.
11. The permittee will create a visual notification that can be posted both physically and electronically at the Hanauma Bay Visitor Center explaining the project, showing what the units look like, rough description of location, and explaining that this is being done for a limited period under permit from the State (list the permit number). These materials will be approved by DAR before being released to the public or Hanauma Bay.
12. The Division may require the Permittee to accommodate the presence of an observer specified by the Division during permitted activities.

D. Notice:

1. Collecting generally - the Permittee must give notice, in form specified by the Department, to DAR Oahu (808-587-2270 or 808-587-0100) and to the Department's Division of Conservation and Resources Enforcement (DOCARE Oahu, 808-643-3567), at least 2 hours prior to initial commencement of any series of collection activities (including servicing of the Settlement Plates) and deployment or extraction of the Coral modules taken place under this permit.
2. Mass mortality - the Permittee must notify DAR Oahu (587-0100) within one day (24 hours) of
 - a. Any instance of damage caused to coral or other marine natural resources as a result of any activities conducted under this permit.
 - b. **Fragmentation - This permit does not authorize any fragmentation of live coral.**
 - c. Rare Species - The following *Porites* species require special permission from the Division prior to collection under this permit: *Porites pukoensis*, *Porites duerdeni*, *Porites studeri*. The following *Montipora* species require special permission from DAR prior to collection under this permit: *Montipora dilitata*. The following *Pocillopora* species require special permission from DAR prior to collection under this permit: *Pocillopora ligulata*, *Pocillopora molokensis*.
3. Gear and Methods: Use of any chemical substances pursuant to Section 188-23, Hawai'i Revised Statutes, electrical shocking devices, or explosives remains expressly prohibited. No chemicals will be brought into the MLCD for any purpose.
4. Use of Organisms: Organisms collected under authority of this permit may not be used for personal consumption or sale; organisms collected under this permit may not be traded, bartered or loaned to other individuals, institutions or entities;
 - a. Written approval must be obtained from the Division prior to
 - i. Purchasing or any other acquisition of regulated organisms (regardless of origin) alive from any other party,
 - ii. Transporting any live organism (regulated or not) between islands.
 - iii. Exchanging or donating any organisms collected under this permit to any other person, party or organization;

- iv. Movement of any live or dead material collected from Hanauma Bay, or movement of any live or dead coral, out-of-State for any reason.
 - b. The permittee may not convey in any fashion (including, but not limited to, selling, trading, or giving) any regulated coral (live or dead) to any person or party in Hawai'i that does not already have a permit from the Department authorizing possession of same and without direct, written approval from the Division;
5. **Annual Report:** Upon expiration, the permittee must provide to the Division a final written report summarizing results of collecting activity carried out under this permit and the analysis of the data:
- a. The annual report should provide a written explanation as to how the collection (and other activities) of a fully-protected marine species is benefiting the State of Hawai'i in general and specifically, the improved management of the species.
 - b. The final report must describe, in form specified by the Department,
 - i. Species name and total numbers/quantities of all regulated and non-regulated specimens collected under this permit.
 - ii. Results of **chemical, biochemical, genetic, physiological, histological, pathological or statistical analysis of data** analysis data (if conducted).
 - iii. **GPS coordinates/documentation** of location of each sample or action conducted
 - iv. **Photo-documentation** of deployment, construction and removal process and of representative samples of organisms from settlement plates.
 - a. Photo-documentation sets of photos must include **5 representative photos of deployment, construction and removal process**. Photo-documentation sets of photos must include **representative photos of a sub-sample of settlement plates collected from each module and representative photos of each species of coral and dominant macro-algae observed colonizing on settlement plates**. Documentation sets must also include

5 representative photos per artificial reef module (each side) and any representative photos that display successful colonization by benthic organisms and resident fish.

- b. An inventory of organisms (dead or alive) present at the facility or with the permittee the end of the report period, in form acceptable to the Division, must accompany the annual report;
- c. The annual report is due at the Division's Honolulu office within three months (90 days) after expiration of the permit or as otherwise instructed by the Division, and is required prior to any renewal of this permit.

6. Ownership of Biogenetic Resources. The State holds legal title to the natural resources and biogenetic resources gathered from state lands, including submerged lands. See Haw. Op.Atty.Gen. Opinion No. 03-03 (April 11, 2003). Biogenetic resources refers to the genetic material or composition of the natural resources and other things connected to, or gathered from public lands. See Davis v. Green, 2 Haw. 327 (1861); United States v. Gerber, 999F.2d 1112 (7th Cir. 1993).

7. Use of Tissue Samples and Biogenetic Resources. The permittee may not convey in any fashion (including, but not limited to, selling, trading, or giving) any tissue samples to any person or party in Hawai'i that does not already have a permit from the Department authorizing possession of same and without written approval from DAR.

VALIDATING SIGNATURE

SUZANNE D. CASE, Chairperson
Board of Land and Natural Resources

cc: DLNR Division of Conservation and Resources Enforcement
(X) DAR Oahu

ACKNOWLEDGING SIGNATURES

By signature below, I attest that I have read and understand the General and Special Conditions of Special Activity Permit SAP 2016-12 and that, further, I agree to comply with all of these conditions when collecting under authority of this permit.

MARK HIXON
Primary Permittee

Designated Assistants

Sign	Sign

Additional Assistants

Sign	Sign

