State of Hawai'i
DEPARTMENT OF LAND AND NATURAL RESOURCES
Division of Aquatic Resources
Honolulu, Hawai'i 96813

June 12, 2015

Board of Land and Natural Resources
Honolulu, Hawai'i

Request for Authorization and Approval to Issue a Papahānaumokuākea Marine National Monument Research Permit to Dr. Christopher Bird, Texas A&M University – Corpus Christi, and Dr. Robert Toonen, Hawai'i Institute of Marine Biology, University of Hawai'i, for Access to State Waters to Conduct Intertidal Biodiversity Survey Activities

The Division of Aquatic Resources (DAR) hereby submits a request for your authorization and approval for issuance of a Papahānaumokuākea Marine National Monument research permit to applicants Dr. Christopher Bird, Assistant Professor, Texas A&M University – Corpus Christi, and Dr. Robert Toonen, Research Professor, Hawai'i Institute of Marine Biology, University of Hawai'i, pursuant to § 187A-6, Hawai'i Revised Statutes (HRS), Chapter 13-60.5, Hawai'i Administrative Rules (HAR), and all other applicable laws and regulations.

The research permit, as described below, would allow entry and management activities to occur in Papahānaumokuākea Marine National Monument, including the NWHI State Marine Refuge and the waters (0-3 nautical miles) surrounding the following sites:

- Nīhoa Island
- Mokumanamana (Necker)
- French Frigate Shoals
- Gardner Pinnacles

The activities covered under this permit would occur between June 15, 2015 and June 14, 2016.

The proposed activities are largely a continuation of work previously permitted and conducted in the Monument.

INTENDED ACTIVITIES

The purpose of the proposed project is to characterize yearly variation in 'opihi and other intertidal and shallow subtidal populations in the Monument.

The applicants proposed research aims to accomplish the following objectives:

1. Collect complementary data on the intertidal ecosystem with a suite of research scientists, cultural practitioners, and resource managers;

2. Establish a baseline survey of intertidal ecosystems, specifically focused on ‘opihi species associations, relative abundance, and reproductive characteristics to better understand the implications and consequences of human activities on these communities;
3. Characterize the biodiversity of the Hawaiian intertidal zone and their connectivity to one another across the archipelago;
4. To determine ‘opihi size at reproductive maturity and reproductive characteristics such as gonad index, and molecular composition of sperm-egg recognition proteins in the absence of human predation; and
5. Using ‘opihi as a model system, to elucidate the mechanisms by which divergent selection can lead to adaptive radiation of marine species.

To fulfill these objectives, the applicants propose to survey a maximum of thirty (30) intertidal transects at each island and collect sixteen (16) target invertebrate species and one (1) macroalgal (limu) species. Table 1 outlines the specimen collections where three (3) species would be non-lethally sampled and the remaining specimens would be lethally sampled. The applicants are also proposing to collect up to three (3) voucher specimens of species they cannot visually identify or may represent a new geographic record or new species, in accordance with the Monument *Voucher Specimen Guidelines*. Additionally, the team would snorkel within 0 to 20 m of the shoreline in teams of four to perform observational fish survey transects; no collections would be performed with these surveys.

The following collection activities are proposed:

1. Collection of forty-eight (48) per island of each invertebrate in Table 1, with the exception of twenty-five (25) individual *Cellana extarata* from French Frigate Shoals. Tissue from all invertebrates collected would be preserved for laboratory genetic analysis; and
2. Collected ‘opihi gonad tissue would be tested in the laboratory for gamete recognition proteins and these data would be correlated to human population densities nearby to test for human impacts.

Table 1: Proposed organisms collection list.

Common name	**Hawaiian name**	**Scientific name**	**Sampling**	**Island**			
				Nīho a	**Mokumana -mana**	**Mokupa-papa**	**Puhahonua**
Black purse shell	nahawele	*Isognomon californicum*	Lethal	48	48	48	48
Calyx bubble		*Smaragdinella calyculata*	Lethal	48	48	48	48
Thin shell rock crab	‘a‘ama	*Grapsus tenuicrustatus*	Non-lethal	48	48	48	48
Rock octopus	he‘e pali	*Octopus oliveri*	Non-lethal	48	48	48	48
Day octopus	he‘e mauli	*Octopus cyanea*	Non-lethal	48	48	48	48

Common name	Hawaiian name	Scientific name	Sampling	Island			
				Nīho a	Mokumana -mana	Mokupa-papa	Puhahonua
Spotted drupe	makaloa	*Drupa ricina*	Lethal	48	48	48	48
Hawaiian periwinkle		*Echinolittorina hawaiiensis*	Lethal	48	48	48	48
Spotted periwinkle	pipipi kōlea	*Littoraria pintado*	Lethal	48	48	48	48
Black nerite	pipipi	*Nerita picea*	Lethal	48	48	48	48
Rock shell		*Purpura (Thais) aperta*	Lethal	48	48	48	48
Rock shell		*Thais intermedia*	Lethal	48	48	48	48
False ʻopihi		*Siphonaria normalis*	Lethal	48	48	48	48
Yellowfoot ʻopihi	ʻopihi ʻalinalina	*Cellana exarata*	Lethal	144	144	Up to 25	Up to 144
Blackfoot ʻopihi	ʻopihi makaiauli	*Cellana sandwicensis*	Lethal	144	144	0	0
Shingle urchin	hāʻukeʻuke kaupali	*Colobocentrotus atratus*	Lethal	48	48	48	48
Oblong urchin	ʻina uli	*Echinometra oblonga*	Lethal	48	48	48	48
Rock-boring urchin	ʻina kea	*Echinometra mathaei*	Lethal	48	48	48	48
Crown-of-thorns seastar		*Acanthaster planci*	Lethal	48	48	48	48
Miscellaneous algae	limu		Non-lethal	1,000	1,000	1,000	1,000

The time period request, twelve (12) days, would coincide with proposed permit for Shauna Kēhaunani Springer (PMNM-2015-017). This project would be a collaboration of efforts from Na Mamo o Muoleʻa, The Nature Conservancy, Hawaiʻi Institute of Marine Biology, Na Maka o Papahānaumokuākea, Conservation International-Hawaii Fish Trust, Texas A&M and the NOAA Papahānaumokuākea Marine National Monument. This activity would benefit the management of the Monument as it facilitates cultural access, use, and understanding of the place.

The activities proposed by the applicants directly support the Monument Management Plan's priority management need 3.1 – Understanding and Interpreting the NWHI, 3.1.1 – Marine Science Action Plan, Activity MCS-1.5: Measure connectivity and genetic diversity of key species to enhance management decisions. This Activity emphasizes the importance of understanding connectivity and genetic diversity to effectively manage for changes in the environment.

The activities described above may require the following regulated activities to occur in State waters:

- ☒ Removing, moving, taking, harvesting, possessing, injuring, disturbing, or damaging any living or nonliving Monument resource
- ☒ Drilling into, dredging, or otherwise altering the submerged lands other than by anchoring a vessel; or constructing, placing, or abandoning any structure, material, or other matter on submerged lands
- ☒ Discharging or depositing any material or matter into the Monument
- ☒ Swimming, snorkeling, or closed or open circuit SCUBA diving within any Special Preservation Area or Midway Atoll Special Management Area

REVIEW PROCESS

The permit application was sent out for review and comment to the following scientific and cultural entities: Hawai'i Division of Aquatic Resources, Hawai'i Division of Forestry and Wildlife, Papahānaumokuākea Marine National Monument (NOAA/NOS), NOAA Pacific Islands Regional Office (NOAA-PIRO), United States Fish and Wildlife Service Hawaiian and Pacific Islands National Wildlife Refuge Complex Office, and the Office of Hawaiian Affairs (OHA). In addition, the permit application has been posted on the Monument Web site since March 27, 2015 giving the public an opportunity to comment. The application was posted within 40 days of its receipt, in accordance with the Monument's Public Notification Policy.

Comments received from the scientific community are summarized as follows:

QUESTIONS:

1. Please explain the anticipated cumulative impacts of having 3 groups (Springer, Toonen-Bird, &Thompson) at one site collecting intertidal zone species at Nihoa.

No more than 10 people would participate in intertidal monitoring activities on any one island, at any given time. This is the same footprint as has occurred in previous years (since 2009) and no known or identifiable negative impacts to the environment have occurred since this projects inception. The addition of the Thompson permit activities, onboard the Hikianalia, will not change the footprint in the intertidal zone. Collections of invertebrates and other specimens found in the intertidal zone will be limited to what has been requested via my permit application as well as Kehau Springer's application.

2. Application states there will be "Drilling" and "Discharging". How many survey pins will be drilled per island? What is being discharged?

Checking this box was a mistake. "Drilling into, dredging, or otherwise altering the submerged lands other than by anchoring a vessel; or constructing, ***placing****, or abandoning any structure, material, or other matter on the submerged lands"*
No drilling or discharging is required. I will be ***placing*** *a transect line and sash chain along the intertidal zone for purposes of demarcation during surveys. All demarcation lines will be removed once surveys in the defined area are complete.*

3. Is there any report from the previous years on what has been found to date?

For each permit I have received, I have submitted the required annual and summary permit reports to the PMNM office.

COMMENTS / RECOMMENDATIONS:

1. Hoku Johnson of NOAA is the resource monitor, if the application is approved, and she is included in the 10 people conducting these proposed surveys at selected sites.

Noted.

2. Currently the application lists 4 sites: Nihoa, Mokumanamana, FFS & Gardiner Pinnacles. If they accessed all four sites, their wildlife collections would be larger as indicated in their applications, however, they are only planning thus far for Nihoa and Mokumanamana, and realistically those listed number of collections would be much lower.

As stated in the application, all 4 locations have been requested. However, it is possible that not all locations will be accessed during the trip this Summer.

3. Both Springer and Toonen-Bird will share 10 individuals assisting with these proposals during the survey and collections, so there will be not more than 10 people on site of the intertidal zone.

Correct.

4. The group sizes are pretty large. Please take great care not to damage the reef during water and intertidal activities. Take extreme care with vessels and equipment to prevent being a vector for invasive species.

Noted.

5. Please follow PMNM BMPS to ensure that no chemicals enter the waters of the NWHI.

Noted.

Comments received from the Native Hawaiian community are summarized as follows:

Cultural reviews support the acceptance of this application. No concerns were raised.

Comments received from the public are summarized as follows:

No comments were received from the public on this application.

Additional reviews and permit history:

Are there other relevant/necessary permits or environmental reviews that have or will be issued with regard to this project? (e.g., MMPA, ESA, EA) Yes ☒ No ☐
If so, please list or explain:

- The proposed activities are incompliance with the National Environmental Policy Act.
- The proposed activities are in compliance with the National Historic Preservation Act.
- An ESA section 7 consultation was completed July 8, 2011 and remains valid through 2015. On July 3, 2012, consultation was re-initiated to account for the presence of hawksbill turtles, update BMPs, and highlight new aspects of the joint Toonen/Bird permit application and S. Kēhaunani Springer's permit application. A NMFS letter of concurrence was issued on August 27, 2012, to remain valid through 2015.
- The Department has made an exemption determination for this permit in accordance chapter 343, HRS, and Chapter 11-200, HAR. See Attachment ("DECLARATION OF EXEMPTION FROM THE PREPARATION OF AN ENVIRONMENTAL ASSESSMENT UNDER THE AUTHORITY OF CHAPTER 343, HRS AND CHAPTER 11-200 HAR, FOR PAPAHĀNAUMOKUĀKEA MARINE NATIONAL MONUMENT RESEARCH PERMIT TO DR. CHRISTOPHER BIRD, TEXAS A&M UNIVERSITY – CORPUS CHRISTI, AND DR. ROBERT TOONEN, HAWAI'I INSTITUTE OF MARINE BIOLOGY, UNIVERSITY OF HAWAI'I, FOR ACCESS TO STATE WATERS TO CONDUCT INTERTIDAL BIODIVERSITY SURVEY ACTIVITIES UNDER PERMIT PMNM-2015-026."

Has Applicant been granted a permit from the State in the past? Yes ☒ No ☐
If so, please summarize past permits:

- The applicant was granted permit PMNM-2011-041, PMNM-2012-049, PMNM-2014-026, in 2011, 2012 and 2014 respectively, for similar work.

Have there been any a) violations: Yes ☐ No ☒
b) Late/incomplete post-activity reports: Yes ☐ No ☒

Are there any other relevant concerns from previous permits? Yes ☐ No ☒

STAFF OPINION

PMNM staff is of the opinion that the applicants have properly demonstrated valid justification for their application and should be allowed to enter the NWHI State waters and conduct the

activities therein as specified in the application with certain special instructions and conditions, which are in addition to the Papahānaumokuākea Marine National Monument Research Permit General Conditions. All suggested special conditions have been vetted through the legal counsel of the Co-Trustee agencies (see Recommendation section).

MONUMENT MANAGEMENT BOARD OPINION

The MMB is of the opinion that the applicants have met the findings of Presidential Proclamation 8031 and this activity may be conducted subject to completion of all compliance requirements. The MMB concurs with the special conditions recommended by PMNM staff.

RECOMMENDATION:

That the Board authorize and approve a Research Permit to Dr. Christopher Bird, Texas A&M University-Corpus Christi, and Dr. Robert Toonen, Hawai'i Institute of Marine Biology, University of Hawai'i, with the following special conditions:

1. This permit is not to be used for nor does it authorize the sale of collected organisms. Under this permit, the authorized activities must be for noncommercial purposes not involving the use or sale of any organism, by-products, or materials collected within the Monument for obtaining patent or intellectual property rights.

2. The permittee may not convey, transfer, or distribute, in any fashion (including, but not limited to, selling, trading, giving, or loaning) any coral, live rock, or organism collected under this permit without the express written permission of the Co-Trustees.

3. To prevent introduction of disease or the unintended transport of live organisms, the permittee must comply with the disease and transport protocols attached to this permit.

4. Tenders and small vessels must be equipped with engines that meet EPA emissions requirements.

5. Refueling of tenders and all small vessels must be done at the support ships and outside the confines of lagoons or near-shore waters in the State NWHI Marine Refuge.

Respectfully submitted,

Maria Carnevale
Papahānaumokuākea Marine National Monument
Administrator

APPROVED FOR SUBMITTAL

SUZANNE CASE
Chairperson

Papahānaumokuākea Marine National Monument

RESEARCH Permit Application

NOTE: ***This Permit Application (and associated Instructions) are to propose activities to be conducted in the Papahānaumokuākea Marine National Monument. The Co-Trustees are required to determine that issuing the requested permit is compatible with the findings of Presidential Proclamation 8031. Within this Application, provide all information that you believe will assist the Co-Trustees in determining how your proposed activities are compatible with the conservation and management of the natural, historic, and cultural resources of the Papahānaumokuākea Marine National Monument (Monument).***

ADDITIONAL IMPORTANT INFORMATION:

- Any or all of the information within this application may be posted to the Monument website informing the public on projects proposed to occur in the Monument.

- In addition to the permit application, the Applicant must either download the Monument Compliance Information Sheet from the Monument website OR request a hard copy from the Monument Permit Coordinator (contact information below). The Monument Compliance Information Sheet must be submitted to the Monument Permit Coordinator after initial application consultation.

- Issuance of a Monument permit is dependent upon the completion and review of the application and Compliance Information Sheet.

INCOMPLETE APPLICATIONS WILL NOT BE CONSIDERED

Send Permit Applications to:
Papahānaumokuākea Marine National Monument Permit Coordinator
6600 Kalaniana'ole Hwy. # 300
Honolulu, HI 96825
nwhipermit@noaa.gov
PHONE: (808) 397-2660 FAX: (808) 397-2662

SUBMITTAL VIA ELECTRONIC MAIL IS PREFERRED BUT NOT REQUIRED. FOR ADDITIONAL SUBMITTAL INSTRUCTIONS, SEE THE LAST PAGE.

Papahānaumokuākea Marine National Monument
Permit Application Cover Sheet

This Permit Application Cover Sheet is intended to provide summary information and status to the public on permit applications for activities proposed to be conducted in the Papahānaumokuākea Marine National Monument. While a permit application has been received, it has not been fully reviewed nor approved by the Monument Management Board to date. The Monument permit process also ensures that all environmental reviews are conducted prior to the issuance of a Monument permit.

Summary Information

Applicant Name: Christopher E. Bird[1,2] & Robert J. Toonen[2]
Affiliation:
[1]Department of Life Sciences, Texas A&M University – Corpus Christi
[2]Hawai'i Institute of Marine Biology, University of Hawai'i at Mānoa

Permit Category: Research
Proposed Activity Dates: July 2015, targeting July 1-20
Proposed Method of Entry (Vessel/Plane): Vessel
Proposed Locations: Intertidal and shallow water habitats around basaltic islands on which 'opihi occur. Specifically, Nihoa Island, Mokumanamana Island, Mokupapapa (French Frigate Shoals, La Perouse Pinnacles,), and Puhahonu (Gardner Pinnacles)

Estimated number of individuals (including Applicant) to be covered under this permit: 27 total people will be covered to conduct activities under this permit, co-listed under the Native Hawaiian Practices applications submitted by Shauna Kehaunani Springer and Nainoa Thompson/PVS.

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Estimated number of days in the Monument: approximately 12 days

Description of proposed activities: (complete these sentences):

a.) The proposed activity would…

aim to examine the biodiversity of the Hawaiian intertidal and shallow subtidal ecosystem, and study the basic ecology of 'opihi populations within the NWHI. We propose to continue conducting the first comprehensive biodiversity mapping survey of the intertidal zone in the NWHI and quantify species presence/absence and relative abundances within and among sites across the basaltic emergent islands. We also seek to examine population connectivity of intertidal species in comparison to the broad survey of coral reef organisms sampled to date. We find different patterns of larval exchange among the 'opihi which suggests that intertidal species may differ from the average seen in subtidal taxa, and that has important management implications that need to be confirmed. We propose to examine the reproductive status 'opihi populations across the NWHI to better understand natural population dynamics and potential mechanisms of speciation in these economically, ecologically and culturally important limpets.

This work will be tightly linked with the Native Hawaiian cultural practice application and is a joint collaborative study among Na Mamo o Muole'a, the Nature Conservancy, the Hawai'i Institute of Marine Biology, Nā Maka o Papahānaumokuākea, and the NOAA Papahānaumokuākea Marine National Monument. We will perform the standardized 'opihi monitoring protocol developed through this collaboration, which is inclusive of Hawaiian methods of monitoring, has was specifically developed (and is continuously being refined) to monitor intertidal populations associated with 'opihi across the Main and Northwestern Hawaiian Islands. To date, communities on every island, save Ni'ihau, have been involved and through these efforts the NWHI have been surveyed for intertidal species composition, population size and age structure of organisms associated with 'opihi. Here we request a permit to conduct the sixth year of surveys and monitoring within the NWHI, with a primary focus on mapping opihi population sizes.

b.) To accomplish this activity we would ....
conduct standardized transect and rapid mapping surveys developed collaboratively among the partners listed above to integrate quantitative scientific data collection with Native Hawaiian observational data. Specifically, we will lay a minimum of 15 belt transects per island to assess size distribution, population density, community structure, species range, distribution, and rugosity for all identifiable organisms within the intertidal zone. Rapid mapping surveys will be conducted where the number of opihi (separate counts for *Cellana exarata* and *Cellana sandwicensis*) and presence/absence for other invert species are recorded in two meter wide belt transects at 10s-100s of georeferenced points around each island. Using this method, we were able to census all 'opihi residing on Mokupapapa in 2013 and 2014.

We will collect 'opihi and ha'uke'uke to examine reproductive state and patterns of population connectivity in the intertidal zone and compare that directly to the patterns found in subtidal species. The size and state of 'opihi and ha'uke'uke gonads will be determined in the laboratory after the cruise. Genomic DNA isolated from inverteberate muscle tissues will be sequenced in order to assess connectivity and stock structure. Messenger RNA, the products of gene expression, will be isolated from gonad tissue in order to identify and compare the sperm-egg recognition proteins (methods described below), and in the accompanying Native Hawaiian Practices Permit Application filed by Kehau Springer. When the ship leaves the island, no supplies will be left behind. The samples we request to be collected for this work are summarized in Appendix 1. All data will be stored and analyzed at Texas A&M University Corpus Christi and the Hawaii Institute of Marine Biology by Chris Bird and Rob Toonen, respectively. Tissue samples, DNA and RNA sampled from animals will need to be additionally processed at specialized laboratories at Texas A&M University – College Station, ARQ Genomics in Austin, TX, and Simon Frasier University in Vancouver, BC. These data will be useful to both the Monument, as well as to local and governmental resource managers in the Main Hawaiian Islands to make effective decisions on managing the resources.

c.) This activity would help the Monument by ...

providing baseline knowledge of one of the least studied ecosystems which is potentially most threatened by climate change. Sea level rise is underway, and the first community to feel the effects of climate change will be the one that lives at the interface of land and sea and experiences the greatest extremes of both environments: the intertidal. Limited knowledge of this ecosystem restricts our understanding of climate change impacts and suitable responses. Further, knowing which species occur and where they live is fundamental to the management of natural resources in any ecosystem, and the Hawaiian intertidal zone is poorly characterized in general. We will also confirm whether or not the intertidal species show a distinct pattern of population connectivity across the archipelago than do the subtidal ones surveyed to date. These data will provide quantitative data on the species present in these ecosystems, their biodiversity, population dynamics and connectivity and also contribute to the ongoing debate about how new species arise in the sea. The tight collaboration of the team comprised of cultural practitioners, research scientists, and resource managers will ensure that the findings are of relevance to a broad group of stakeholders and of direct relevance to the people of Hawai'i.

Other information or background: Littoral habitats, those lying between the low-tide line and the upper limit of aquatic species on the shore, are among the most studied and well-known aquatic habitats on the planet. A primary exception to that generalization is that this zone is one of the least studied in Hawai'i despite seven (7) consecutive years of surveying in the Hawaiian Islands by members of the 'Opihi Partnership. The effects of tides on littoral marine habitats are so ubiquitous that shorelines are commonly described as 'intertidal', whereas waves are considered a secondary factor that simply modifies the intertidal habitat. However in Hawai'i, mean significant wave height exceeds tidal range most of the time, and may be a primary structuring force for littoral communities as outlined in Bird (2006) and Bird et al (2013). The patterns of distribution and abundance of organisms on rocky shores, in particular the upper and lower limits of species, along vertical gradients of exposure have been studied extensively in other regions of the globe. Hypotheses addressing the causes of biotic zonation and community structure have evolved from strictly physical to an inseparable combination of physical and biological factors, including physiological tolerance (Connell 1961a b), species interactions (Bruno & Bertness 2001, Menge & Branch 2001), and all other forms of biotic factors.

A fundamental advance in the understanding of biotic zonation on rocky shores was the demonstration that species interactions also affected zonation patterns, where biotic factors generally affect the lower limit of distribution and physical factors affect the upper limit of distribution (Connell 1961a b, Paine 1967). A number of exceptions to this generalization have been demonstrated, many of which highlight the more general effect of biological interactions on the realized distribution of a species. Ultimately, the inseparable interaction between physical and biological factors define the realized limits of species (Denny & Wethey 2001), and intertidal communities are unique in that organisms must cope with some of the most severe extremes of both marine and terrestrial environments. This has led to debate about whether these species are so hardy that they are resistant to change, or whether they live in such extreme environments that climate change will impact them more (e.g., Stillman 2003). Available data from long-term surveys of the intertidal community in California suggest the latter: intertidal communities are one of the first to show ecosystem impacts of climate change that can already

be documented and are expected to accelerate given future climate change scenarios (e.g., Barry et al 1995; Sagarin et al. 1999).

Section A - Applicant Information

1. Applicant

Name (last, first, middle initial):

Bird, Christopher E.
Assistant Professor, Texas A&M University - Corpus Christi

Toonen, Robert J.
Research Professor, HIMB, University of Hawai'i at Mānoa

1a. Intended field Principal Investigator (See instructions for more information):
Chris Bird

2. Mailing address (street/P.O. box, city, state, country, zip):

Chris Bird
Texas A&M University - Corpus Christi
Center for the Sciences, Unit 5802
[redacted]

Rob Toonen
Hawai'i Institute of Marine Biology
[redacted]

3. Affiliation (institution/agency/organization directly related to the proposed project):
Life Sciences, Texas A&M University - Corpus Christi
HIMB, University of Hawai'i at Mānoa

4. Additional persons to be covered by permit. List all personnel roles and names (if known at time of application) here (e.g. John Doe, Research Diver; Jane Doe, Field Technician):
We expect that the final list of cruise personnel will be available soon, but has not yet been finalized. We seek a crew of 11 people drawn from across the partners listed above and these are the same participants as those on the Native Hawaiian Practices Permit Application filed by

Kehau Springer. In addition, a crew of 16 onboard Hikianalia will participate in monitoring activities at Nihoa Island and therefore, will be reflected on my CIS form when provided, closer to our departure date.

We expect that the scientific crew will likely consist of 3 to 4 members, likely drawn from the following list or their equivalent expertise:

Amended List for July 2015 Searcher Cruise Dates

Chris Bird (Ph.D., Asst Professor, TAMUCC),
Patricia Cockett (Master's Student)
Rob Toonen (Ph.D., Research Professor, HIMB),
Eric Tong (Ph.D. Candidate , HIMB)
Hoku Johnson (PMNM, Resource manager)
Matt Ramsey (former DAR Resource manager, NOAA Fisheries manager)
Makani Gregg
Bert Hispanola (Cultural Practitioner)
James Hispanola (Cultural Practitioner)
Russell Amimoto (Nature Conservancy)
Nakoa Goo (NOAA)
TBD Kaua'i Cultural Practitioner

Additional crew members will be selected from Native Hawaiian communities as outlined in the Springer permit application and be included here as co-listed permittees for a maximum of 12 people in total.

Section B: Project Information

5a. Project location(s):

		Ocean Based	
☒ Nihoa Island	☒ Land-based	☒ Shallow water	☐ Deep water
☒ Necker Island (Mokumanamana)	☒ Land-based	☒ Shallow water	☐ Deep water
☒ French Frigate Shoals	☒ Land-based	☒ Shallow water	☐ Deep water
☒ Gardner Pinnacles	☒ Land-based	☒ Shallow water	☐ Deep water
☐ Maro Reef			
☐ Laysan Island	☐ Land-based	☐ Shallow water	☐ Deep water
☐ Lisianski Island, Neva Shoal	☐ Land-based	☐ Shallow water	☐ Deep water
☐ Pearl and Hermes Atoll	☐ Land-based	☐ Shallow water	☐ Deep water
☐ Midway Atoll	☐ Land-based	☐ Shallow water	☐ Deep water
☐ Kure Atoll	☐ Land-based	☐ Shallow water	☐ Deep water
☐ Other			

NOTE: There is a fee schedule for people visiting Midway Atoll National Wildlife Refuge via vessel and aircraft.

Location Description:
As outlined above, our survey and collection efforts will be concentrated in the intertidal zone, surrounding each emergent basaltic land mass on which 'opihi occur. Although we include this within the land-based category above, the monitoring team would not access any sites beyond the splash zone on any island.

5b. Check all applicable regulated activities proposed to be conducted in the Monument:

☒ Removing, moving, taking, harvesting, possessing, injuring, disturbing, or damaging any living or nonliving Monument resource
☒ Drilling into, dredging, or otherwise altering the submerged lands other than by anchoring a vessel; or constructing, placing, or abandoning any structure, material, or other matter on the submerged lands
☐ Anchoring a vessel
☐ Deserting a vessel aground, at anchor, or adrift
☒ Discharging or depositing any material or matter into the Monument
☐ Touching coral, living or dead
☐ Possessing fishing gear except when stowed and not available for immediate use during passage without interruption through the Monument
☐ Attracting any living Monument resource
☐ Sustenance fishing (Federal waters only, outside of Special Preservation Areas, Ecological Reserves and Special Management Areas)
☐ Subsistence fishing (State waters only)
☒ Swimming, snorkeling, or closed or open circuit SCUBA diving within any Special Preservation Area or Midway Atoll Special Management Area

6 Purpose/Need/Scope ***State purpose of proposed activities:***
We wish to characterize yearly variation in opihi and other intertidal and shallow subtidal populations in PMNM. Further, new genetic techniques that allow us to more fully sequence the genomes of individuals require more stringent sample preservation protocols than were used in the past collections of specimens from PMNM. Using these newer population genomic techniques, we can ascertain a more highly resolved image of connectivity and self recruitment on the islands of PMNM, that include the assessment of unique selective pressures driving local adaptation on the inhabitants of each island.
The primary objectives of this research expedition are to: (1) collect complementary data on the intertidal ecosystem with a suite of research scientists, cultural practitioners, and resource managers; (2) establish a baseline survey of intertidal ecosystems, specifically focused on 'opihi species associations, relative abundance, reproductive cycles, and identity to better understand the implications and consequences of human activities on these communities; (3) determine the species present to characterize the biodiversity of the Hawaiian intertidal zone and their connectivity to one another across the archipelago; (4) to determine ʻopihi size at reproductive maturity and reproductive characteristics such as gonad index, and molecular composition of sperm-egg recognition proteins in the absence of human predation, (5) begin to explore the genomic signatures of adaptation to human activities and natural processes using ʻopihi as a model system to elucidate the mechanisms by which divergent selection can lead to adaptive radiation of marine species.

Along these same lines we request permission to collect up to 3 voucher specimens of an individual organism that cannot be identified as a known species and/or may represent new geographic records or new species from the taxonomic groups under study as laid forth in the voucher specimen guidelines of the Monument. Voucher specimen(s) would be used for taxonomic study to determine the species identity and would be accessioned in an approved repository such as the Bishop and/or Smithsonian museum permanent collections as recommended.

7. Answer the Findings below by providing information that you believe will assist the Co-Trustees in determining how your proposed activities are compatible with the conservation and management of the natural, historic, and cultural resources of the Monument:

The Findings are as follows:

a. How can the activity be conducted with adequate safeguards for the cultural, natural and historic resources and ecological integrity of the Monument?
Most activities in this permit application were previously permitted and have demonstrated no impact on the Monument's cultural, natural and historic resources. The one change is that two species (*Purpura* or *Thais aperta* and *Thais intermedia*) have been added to the collection list because they have been identified as species for consumption on the sister permit of Kehau Springer. Our research team consists of conservation biologists who are both teaching and studying the science of how best to manage and conserve biological diversity in the sea. As such, minimizing our impact to the ecosystem we are trying to conserve is naturally and inherently a top priority for any research we conduct, especially within the boundaries of the

Monument. We believe that we have implemented every reasonable safeguard for the natural resources and ecological integrity of the Monument in our research, and we do not conduct research that could have a detectable impact on the ecosystem. We have an established track record of management-relevant research in this area and have not been able to detect any cumulative impacts of scientific collections to date (Selkoe et al. 2009). As outlined in greater detail below, our sample size, choice of species, and methodologies have all been selected to provide robust and scientifically rigorous information to managers with the least possible impact to the natural resources of the Monument. We will adhere to all rules, regulations and best practices established by the co-trustees for the Monument, including all quarantine requirements, wildlife viewing guidelines, and entry/exit notification procedures where applicable.

Additionally, our team has always tried and will continue to ensure that we have minimal impact on the cultural resources of Papahānaumokuākea. We rely on our colleagues who are cultural practitioners to take the lead on proper protocols for our voyage, and these are outlined in detail in the accompanying permit application by Springer. Each member of our team is aware of the unique ecological and cultural status of the Monument, and our on-going collaboration with the cultural practitioners continues to expand our understanding of Hawaiian protocol in conducting research within Papahānaumokuākea Marine National Monument.

In addition to following the lead of our cultural practitioner team-mates, we ask that each researcher take responsibility to prepare an appropriate offering in advance to ensure that they reflect on why they are on this trip, what is the purpose of the trip, and enter the Monument with the proper intent. It is respectful to provide an offering and to not go forth to take from the place with empty hands. However, given concerns regarding transport of materials into the Monument, it is also difficult to present a proper offering in the form of a gift. In previous years, we have used pure rainwater collected by hand to ensure a personal connection with the offering, and we believe that this is the best option for research scientists unfamiliar with the proper cultural protocols. This fresh-caught rainwater can be poured out as a personal offering in return for the privilege of collecting samples in the Monument by each member of our team. In addition we will follow the lead and participate to the best of our ability in protocols undertaken by our cultural colleagues in whatever preparation is appropriate for the voyage.

b. How will the activity be conducted in a manner compatible with the management direction of this proclamation, considering the extent to which the conduct of the activity may diminish or enhance Monument cultural, natural and historic resources, qualities, and ecological integrity, any indirect, secondary, or cumulative effects of the activity, and the duration of such effects?

As mentioned above, activities proposed herein have been permitted previously, with the exception of the collection of two additional species that are being collected for consumption under the permit of Kehau Springer, and furthermore was conducted without detectable impact in the past. Our expansion of the scope of the initial surveys to include biodiversity surveys and connectivity work in the intertidal is similar to the work that we have done previously for subtidal reef-associated organisms, and has been done without detectable cumulative impact to date. Our proposed survey of the reproductive status, spawning timing, and larval behavior of 'opihi is likewise expected to have no detectable impact, but will provide valuable scientific and

management information for the entire Hawaiian Archipelago. This type of research is directly mandated by the Proclamation, and is necessary to both maintain ecosystem integrity and provide for adaptive ecosystem management in the face of natural or anthropogenic disasters and global climate change. As outlined above and below, our activities have no detectable effect to diminish Monument resources, nor have any known indirect, secondary or cumulative effects on the ecosystem or resources therein. Because we are conservation biologists who are concerned about exactly these sort of impacts, we have voluntarily conducted a threat assessment of the activities in the Monument (Selkoe et al. 2008) and compiled a cumulative impact threat map of the Monument (Selkoe et al. 2009) which has been provided to the co-trustees for use in future management decisions.

c. Is there a practicable alternative to conducting the activity within the Monument? If not, explain why your activities must be conducted in the Monument.

We expect it is self-evident that there is no practical alternative to sampling within the Monument when the goal of the research is to understand the baseline ecosystem state of the intertidal populations within the Monument. Likewise, surveys of biodiversity within understudied habitats of the Monument which seek to determine the species present, their abundance and distribution are only possible within the bounds of the region of interest. Finally, these studies will be of both direct benefit to the resource management within the Monument itself, and to the remainder of the Hawaiian Archipelago for ecologically, economically and culturally important species such as 'opihi.

The exceptions that may not seem quite so self-evident is the examination of gonad index and gamete recognition proteins. The reproductive work is needed to examine the baseline state of the populations in the absence of human harvest and will provide important information about spawning capacity, timing, ability of larvae to return to their source island, and adaptation of the gamete recognition system to the high natural densities of ʻopihi in PMNM. We humans use our senses to select our mate, but ʻopihi release their gametes into the water column and proteins coating the sperm and eggs mediate mate choice. If eggs can be permissive or selective to fertilization by sperm. If eggs are too permissive, the are fertilized by multiple sperm and the embryo perishes. If the eggs are too restrictive, then the eggs remain unfertilized. In our most recent surveys, we observe upwards of 100 fold higher ʻopihi densities in PMNM relative to Oahu, and we expect that harvesting pressure will leave a distinct signature in the gamete recognition proteins. Females on Oahu are either mostly permissive or else they do not produce offspring. Gamete recognition proteins are also under strong positive selection and the previously discovered levels of gene flow predict that each island might have particular strains of males and females that are more compatible with each other than individuals from other locations. In 2011 -13 we found differences in the reproductive state of ʻopihi between islands and species that could have important implications for the connectivity of populations among islands. Our surveys of genomic and gamete recognition protein diversity can be used to assess the ability of ʻopihi to adapt to human activities.

d. How does the end value of the activity outweigh its adverse impacts on Monument cultural, natural and historic resources, qualities, and ecological integrity?

Given that we can detect no adverse effects of our activities on the resources of the Monument, we believe that the end value of this research clearly outweighs whatever imperceptible impact exists. We have an established track record of communicating our findings to the resource managers and making sure that all research conducted within the Monument meets the bar of management relevance. The proposed research will provide the first quantitative baseline survey of intertidal ecosystems across the Hawaiian Archipelago and address questions of vulnerability to climate change. Additionally, the reproductive work proposed herein will benefit both population studies and resource management of 'opihi stocks in Hawai'i, but also contribute to our understanding of how new species can arise in the sea. Finally, the intertidal zone is a greatly understudied ecosystem that is likely to be one of the most directly and immediately impacted by climate change because it experiences the extremes of both terrestrial and marine environments daily. An understanding of the intertidal communities across this region will identify potentially vulnerable locations and species, and (as outlined above) greatly increase the decision-making capacity of the co-trustees in dealing with the reality of future climate change within the Monument and the Hawaiian Archipelago in general.

e. Explain how the duration of the activity is no longer than necessary to achieve its stated purpose.

The expedition length is determined by limited funding, which makes it shorter than ideal, and is certainly no longer than is necessary to accomplish the research goals outlined in this permit application.

f. Provide information demonstrating that you are qualified to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.

Chris Bird has a PhD in Ecology, Evolution, and Conservation Biology through the Botany Department at the University of Hawaii, was a Post Doctoral Fellow at the Hawaii Institute of Marine Biology from 2007-2012 working on the exact type of work entailed in this application, is an Assistant Professor at Texas A&M and has published ~20 research papers in peer-reviewed journals dealing specifically with the subject of conservation and management of Hawaiian natural resources, rocky shores in particular. Rob Toonen has a PhD in Population Biology, is a Research Professor at HIMB, and has published ~200 research papers in peer-reviewed journals dealing specifically with the subject of conservation and management of Hawaiian natural resources. With Rob Toonen and Celia Smith, Chris has been studying 'opihi and Hawaiian intertidal communities since 1999, before to the establishment of the Monument. This research has been of considerable interest to both the science and management community of Hawai'i and has begun to receive international recognition for the insights we are gaining to understand divergent selection leading to speciation in the sea. This on-going project should be well known to the Monument co-trustees, and our research accomplishments are presented in regular meetings with the management community and semi-annual meetings. Our accomplishments and qualifications to perform this research are further documented in the included CVs. We will be responsible for the conduct of the scientific team and work closely with the cultural practitioner team to ensure a successful mission.

g. Provide information demonstrating that you have adequate financial resources available to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.

This mission requires no specific funding beyond the cost of mounting the expedition to complete the research goals. The proposed field activities are funded in full by NOAA for the Papahānaumokuākea Marine National Monument. The data analysis and storage will be supported by the Monument as necessary, the Hawai'i Institute of Marine Biology, and Texas A&M University. As a new faculty at Texas A&M, Chris Bird's startup package includes funds for three graduate students, as well as ~$500,000 in equipment and supplies required to conduct research. The success of the unfunded 'opihi partnership demonstrates our collective commitment to this effort and our ability to complete this sort of work voluntarily even in the absence of funding. We are able to leverage the existence of samples to obtain federal funding from a variety of sources, and have an established track record of doing exactly that. We also have a clearly established track record of completing and publishing the research conducted in the Papahānaumokuākea Marine National Monument on a reasonable time frame, and have every intention to continue that tradition. Finally, we provide regular individual research updates to the management community and will also continue that effort in the future.

h. Explain how your methods and procedures are appropriate to achieve the proposed activity's goals in relation to their impacts to Monument cultural, natural and historic resources, qualities, and ecological integrity.

Our choice of sites are guided by personal safety and natural resource concerns within the Monument, but are constrained by the fact that intertidal communities that support 'opihi populations are limited to basaltic emergent islands. Minimizing our impact on the natural resources of the Monument is critical to us because they are the focus of the study for purposes of conservation, and we absolutely do not want to detract from that system we are seeking to conserve. The methods and procedures we propose to use are widely accepted and are among the few that directly incorporate Native Hawaiian marine practitioners, resource managers and research scientists in collaborative study that is co-designed and jointly implemented. Our success in obtaining extramural funding, our rate of publication in high quality scientific journals, and the frequency with which those studies are cited all show that the work being performed is accepted, valued and endorsed by the global scientific community. Belt transects do not require any specialized equipment and are simple enough to be employed by community members without scientific training across the inhabited Main eight Hawaiian islands. All our work takes full account the unique value and seeks to minimize any potential for impact to the Monument resources.

i. Has your vessel has been outfitted with a mobile transceiver unit approved by OLE and complies with the requirements of Presidential Proclamation 8031?

We will be chartering the Searcher and the partner NOAA PMNM staff will ensure it meets the VMS type-approval requirement as stated in Monument regulations.

j. Demonstrate that there are no other factors that would make the issuance of a permit for the activity inappropriate.

There are no other factors that would make the issuance of the permit inappropriate. The activity is non-commercial. The end-value of the activity is informational and is intended solely to provide local and governmental managers with information critical to the conservation of natural resources.

8. Procedures/Methods:

The primary objectives of this research expedition are to: (1) collect complementary data on the intertidal ecosystem with a suite of research scientists, cultural practitioners, and resource managers; (2) establish a baseline survey of intertidal and shallow subtidal ecosystems, specifically focused on 'opihi species associations, relative abundance, and reproductive characteristics to better understand the implications and consequences of human impacts and natural processes on these communities; (3) characterize the biodiversity of the Hawaiian intertidal zone and their connectivity to one another across the archipelago; (4) to determine ‘opihi size at reproductive maturity and reproductive characteristics such as gonad index, and molecular composition of sperm-egg recognition proteins in the absence of human predation, (5) begin to explore the genomic signatures of adaptation to human activities and natural processes using ‘opihi as a model system to elucidate the mechanisms by which divergent selection can lead to adaptive radiation of marine species.

Objectives 1& 2: To accomplish these goals, we conduct 15-30 belt transects per island located randomly at sites selected based on access, safety and weather conditions. We also map ‘opihi density and species presence/absence at 10s to 100s of georeferenced locations on each island. The transect methodology and data collection sheets come from a series of joint retreats between the resource management agency, NGO, research scientist and cultural practitioner partners to develop the collaborative protocol we implement. The data sheet and collaborative protocol, are described in more detail in Kehau Springer's permit application. In brief, we survey a series of belt transects per island, in which teams mark the start of the transect by recording the GPS waypoints. We then lay a transect sash chain perpendicular to the shoreline (mauka to makai), from the highest marine animal on the shore to 15 ft deep. We attach colored cable ties to the sash chain to divide the transect into zones, and count all ‘opihi by size class within each zone. We count all other visually identifiable intertidal organisms associated with the ‘opihi and record the species present and the abundance of each along the transect lines. Next we estimate the percent cover of each algae species and collect a voucher specimen from each type of algae to confirm algal id later in the laboratory under a microscope. If algal turfs are present, we collect a 1cm2 voucher sample of each visually distinct turf type because turfs are typically composed of 10's of species and are not identifiable in the field. We then measure the x,y,z spatial coordinates of each zone boundary along the transect before measuring the “rugose” length of the transect laid to contour the exact surface distance of each zone. Each data sheet is double-checked and photographed in the field, and matched with a photograph of the entire transect and the conditions are recorded along with anything else noteworthy along the transect line. An additional photograph is taken every 25cm along the transect chain o capture each zone

boundary. For the mapping, six individuals survey while 2 individuals watch waves, and 2 individuals collect data. All ʻopihi are identified by species and counted, presence/absence data for invertebrates and edible limu are recorded, and a GPS coordinate is recorded and associated with the survey number in 2 m wide transects of shoreline (mauka to makai). Consecutive two meter transects are surveyed, unit by unit, until the entire accessible portion of the island is surveyed. At Mokupapapa, all opihi are counted. At Mokumanamana and Nihoa, if all sides of the island are mappable, then we survey all accessible shoreline at a boat access before moving to a new area. In 2013, we mapped all areas that the waves permitted us to survey.

We have begun conducting the first very near shore fish surveys conducted in PMNM. In order to survey shallow very near shore fish populations, we employ a system involving 4 snorkelers that swim parallel to the shore within 0-20 m of the shore line that was surveyed with transects. Each snorkeler has a different task. Snorkeler 1 surveys benthic fish. Snorkeler 2 surveys silver fish. Snorkeler 3 surveys colorful fish. Each surveying snorkeler records the number of fish of each species that they see on the swimming transect and is equipped with a camera to photograph unknown species. In 2011-12 we developed lists of the most common fish observed in the very near shore habitat that we have used to develop data sheets for data recording. Snorkeler 4 video tapes the fish along the transect to serve as visual documentation of the different species present. The snorkelers are paired and swim side by side with a boat escort for safety. The length of the swimming transect is recorded from the boat using a gps and a stopwatch to give an idea of catch per unit effort, but our primary goal at this point is to record the species present. This approach covers both objective (1) and (2).

In order to track 'opihi reproductive cycles, we will continue to determine the gonad index of all ʻopihi and haʻukeʻuke collected in collaboration with Kehau Springer. The 2015 cruise will begin shortly after the full moon and end shortly after the new moon, when opihi spawn. We plan to collect 24 individuals per 1 cm size class (<1, 1-2 ,2-3 ,3-4 , 4-5, >5cm) per species of ʻopihi and haʻukeʻuke on Nihoa and Mokumanamana, and transport them to the boat for immediate processing. On Mokupapapa, after confirming the census population size to be 2900 (see methods two paragraphs above), as we determined in 2013, only 5 individuals per size class will be collected (25 total) thereby ensuring that we collect fewer than 1% of the limpets present. On Puhahonu, if visited, we will use the mapping protocol to census the ʻopihi population, which is inhabited solely by *Cellana exarata*, according to previous DNA analysis. The result of the census will determine whether our ʻopihi sampling is conducted as outlined for Mokumanamana and Nihoa (>>12,000 ʻopihi on island, <<1% of population sampled), or Mokupapapa (<3000 ʻopihi on island, <1% of population sampled). RNAlater, a RNA and DNA tissue preservative, will be stored in plastic unbreakable tubes inside of plastic containment containers (5gal buckets). On the ship, we will dissect the 'opihi to separate the gonad, the non-gonadal tissue, and the shell for subsequent weighing at HIMB on O'ahu. The wet weight of the gonad and somatic tissue will be weighed and compared to assess reproductive state for males and females allowing us to estimate reproductive state. Tissues will be preserved by freezing in liquid nitrogen and storage in RNA later reagent (a solution designed for and proven to be the best method of preventing the degradation of DNA and RNA in marine invertebrate samples).

The combination of size class sampling and genomic DNA sequencing will allow us to conduct a survey of connectivity and self recruitment on an unprecedentedly fine scale in PMNM. We are still processing genetic samples from 2012 and 2013 that were collected and processed in this vein, and we are finding genetic patterns on the scale of centimeters. One

technician, four graduate students and six undergraduate students are working on processing the samples and survey data in Chris Bird's laboratory at Texas A&M.

Non-lethal sampling of crabs (*Grapsus tenuicrustatus*) and octopi (*Octopus oliveri* and *O. cyanea*) will be conducted by removing a leg, or an 1 inch section of arm tip, respectively.

In 2012, we detected a difference in the onset of reproductive maturity on Mokupapapa. Often when fishery species are managed with a size limit, the size at reproductive maturity decreases due to selective pressure for younger maturation. We are going to test this hypothesis by comparing the size at reproductive maturity for 'opihi inside and outside of PMNM. To do this, the 'opihi listed above will be preserved and analyzed for gonad index in the laboratory with the other 'opihi.

When possible, we will extract the DNA from live invertebrate tissues on the ship at the conclusion of each day in order to avoid sample degradation that interferes with genome-wide genetic surveys. All waste will be retained on the ship, and kept in primary and secondary containment vessels. Waste will be disposed of at the University of Hawai'i on O'ahu. DNA extraction involves chaotropic salts, guanidine, SDS, sodium azides, and ethanol.

Objective 3, connectivity:
As stated above, the previously employed technique of preserving tissue samples in ethanol for DNA analysis has resulted in samples that cannot be genomically analyzed. In 2012, we employed a new sample preservation method with opihi, preservation in liquid nitrogen, that was much more successful. Since then, we have found that either preservation in RNAlater reagent or extracting and stabilizing DNA from live tissue is the best method to preserve the high quality DNA required for genomic analysis, and we successfully used a field DNA extraction kit to do so. With this proven stategy, we plan to resample the other animal species that we originally collected, in 2011 and 2012 (along with the addition of *Octopus oliveri, Octopus cyanea, Actinopyga mauritiana, Heterocentrotus mammilatus, Echinothrix diadema, and Tripneustes gratilla, Thais intermedia, Purpura aperta,* some of which are being harvested for Hawaiian consumption) for the first multispecies population genomic study in the Hawaiian Islands, and most likely the world. PIs Chris Bird and Rob Toonen have optimized genomic survey protocols. Kelly Pennoyer, Luz Angela Lopez de Mesa, and Lauren Gurski, PhD students in Chris Bird's lab, are working on this project in the main Hawaiian Islands for their dissertation and would also process the PMNM samples. A total of 48 specimens per species per island would be collected between 2014 and 2015.

The target species we have identified for genetic assessment are ones which are abundant and common on every island surveyed to date, and for which the estimated population sizes are so large that collection of 48 individuals per island will have no detectable impact. Our cut off is that we will not sample more than 1% of the population at any island, and preliminary abundance surveys from previous years indicate that populations are well in excess of 4800 individuals per island for each of the species that we have included on this permit application (with the exception of *Cellana exarata* on Mokupapapa, of which we will only collect 25 individuals). We will examine connectivity of the intertidal species to compare with the subtidal organisms scored to date and determined whether coral reef species are a good predictor of intertidal species connectivity. DNA samples will be analyzed using standard techniques well–established in the field and in use daily in our lab (see attached CV).

Objectives 4&5, ʻopihi reproductive characteristics and human impacts and adaptation of ʻopihi

The sampling scheme outlined above will allow us to calculate the gonad index for different size classes of opihi by determining the mass of gonads and somatic tissues. This data will allow us to determine the size at reproductive maturity and the reproductive state of opihi on different islands.

It is not very surprising that we are starting to see a strong relationship between human population size and ʻopihi population size, given the ʻopihi are actively harvested by humans. We will continue to develop a model that best describes the impact of human harvesting on ʻopihi and we will relate these results with the genetic data that we've been processing.

In our surveys of genomic variation, we can test for genetic loci that are related to human population and land use statistics. Patricia Cockett, a master's student in Chris Bird's lab is explicitly sampling opihi with respect to sources of pollution and the PMNM ʻopihi samples stand as a fantastic control group, where there is little pollution from humans.

The expressed gamete recognition protein genes will be discovered through whole transcriptome RNA sequencing of gonad tissue will be conducted on three males and three females per opihi species from Mokupapapa, Mokumanamana, and Nihoa (30 opihi sampled from the above detailed collections). DNA oligonucleotide primers will be developed to amplify these genes from the ʻopihi DNA collections developed over the past 10 years from the entire archipelago. We will test for a correlation between allele frequency and ʻopihi population density from mapping and transect surveys conducted in both PMNM and the MHI in order to identify alleles that likely confer an advantage at high or low population densities. We will also test for population structure in gamete recognition proteins among samples. A test for human impacts will be conducted by correlating gamete-recognition genes with the ratio human population size to linear coastline distance of ʻopihi habitat.

NOTE: If land or marine archeological activities are involved, contact the Monument Permit Coordinator at the address on the general application form before proceeding, as a customized application will be needed. For more information, contact the Monument office on the first page of this application

9a. Collection of specimens - collecting activities (would apply to any activity): organisms or objects (List of species, if applicable, attach additional sheets if necessary):

Common name:

Yellowfoot ʻopihi (ʻopihi ʻalinalina)
Blackfoot ʻopihi (ʻopihi makaiauli)
Shingle urchin (hāʻukeʻuke kaupali)
Black nerite (pipipi)
Spotted periwinkle (pipipi kōlea)
Spotted drupe (makaloa)
Pupu awa

Pupu
Black purse shell (nahawele)
Thin shell rock crab ('a'ama)
Rock-boring urchin ('ina kea)
Oblong urchin ('ina uli)
Turf algae (limu)
Octopus
Crown-of-thorns seastar
(see Appendix 1 for detailed list of samples.
Scientific name:
Cellana exarata
Cellana sandwicensis
Isognomon californicum
Smaragdinella calyculata
Grapsus tenuicrustatus
Drupa ricina
Purpura aperta
Thais intermedia
Echinolittorina hawaiiensis
Littoraria pintado
Nerita picea
Siphonaria normalis
Colobocentrotus atratus
Echinometra oblonga
Echinometra mathaei
Octopus oliveri
Octopus cyanea
Acanthaster planci

& size of specimens:

Following above, see Appendix 1 for detailed list of maximum sample sizes

Collection location:

Following above, see Appendix 1 for detailed list of collection sites

☒ Whole Organism ☒ Partial Organism

9b. What will be done with the specimens after the project has ended?

Preserved samples remain the property of the Monument, and will maintained with population preserved connectivity biopsy tissue samples collected to date at HIMB, Texas A&M, and

Scripps until they are used up by the study or such time as the Monument co-trustees request that they be returned to them. Taxonomic voucher specimens will be submitted for permanent inclusion in museum collections as per the voucher specimen guidelines. Specimens will be centrally housed at Texas A&M where Chris Bird can ensure their safe storage, preservation and care. Algae samples will be shipped to Scripps for identification and then will be housed at Texas A&M. Specimens may also be shipped to HIMB for processing. DNA and RNA samples will be processed at HIMB, Texas A&M, ARQ Genomics (Austin, TX), and Simon Frasier University. Voucher specimens will be subsampled for genetic analysis and stored frozen or in preservative prior to study.

Details of contact information for specimen transfer and analysis listed below:

a. For post processing and storage: Dr. Christopher Bird [redacted]

b. For algal identification: Dr. Jennifer Smith [redacted]

c. For post processing of DNA and RNA samples:

   i. Dr. Christopher Bird [redacted]

   ii. Rob Toonen, Ph.D. [redacted]

   iii. ARQ Genetics, [redacted]

   iv. Michael Hart, Ph.D. [redacted]

9c. Will the organisms be kept alive after collection? ☒ No

• General site/location for collections:
0-20m at Puhahonu, Mokupapapa, Mokumanamana, and Nihoa

• Will organisms be released?

No.

10. If applicable, how will the collected samples or specimens be transported out of the Monument?

Preserved samples (frozen in RNAlater saturated salt buffer) will be transported back to Oahu aboard the vessel. Specimens will be centrally housed at Texas A&M where Chris Bird can ensure their safe storage, preservation and care. Algae samples will be shipped to Scripps for identification and then will be housed at Texas A&M. Specimens may also be shipped to HIMB for processing. DNA and RNA samples will be processed at HIMB, Texas A&M, ARQ Genomics (Austin, TX), and Simon Frasier University. Voucher specimens will be subsampled for genetic analysis and stored frozen or in preservative prior to study.

11. Describe collaborative activities to share samples, reduce duplicative sampling, or duplicative research:

All researchers working on this project have coordinated to share samples and avoid duplicate sampling. Specifically, the samples listed here and those in the accompanying permit application by Kehau Springer are explicitly the same samples and not duplicative or in addition to one another.

12a. List all specialized gear and materials to be used in this activity:

We will collect samples by hand using no specialized gear or materials beyond snorkeling gear, transect lines, data sheets, and butter knives.

12b. List all Hazardous Materials you propose to take to and use within the Monument:

Tissue preservative solution for DNA and RNA analyses is RNALater, MSDS attached.. DNA extraction involves chaotropic salts, guanidine, SDS, sodium azides, and ethanol. RNAlater will be double contained (plastic bottles inside of sealed buckets), we be used within Rubbermaid containment basins, and all waste will be double contained and disposed of at the University of Hawaii.

13. Describe any fixed installations and instrumentation proposed to be set in the Monument:

None

14. Provide a time line for sample analysis, data analysis, write-up and publication of information:

Surveys will be completed in the field during the expedition. Data analysis and write-up will depends on the availability of specific support for researchers post-cruise. With current levels of partial support and volunteer activities, we expect it will take roughly 1.5 years to complete the

post-cruise analysis of survey data. Time to publication can be considerably longer since the turn-around time for some journals now exceeds 800 days, but results will be reported as soon as possible among the partners and to the resource management community.

Regardless of the time to publication, the results from these studies are made available to Monument managers as quickly as possible through the brown-bag luncheons, semi-annual reports, and semi-annual mini symposium during which all researchers involved in this project present the most current findings from their ongoing research to the broader management community. Findings are always provided to the Monument co-trustees almost as quickly as they become available, and made available to the greater management community within no more than 6 months of the data being collected. Finally, given the specific partnership of Hawaiian cultural practitioners, NGO community, State and Federal resource managers, and research scientists, we are confident that research results will be communicated widely.

Additionally this permit application is a partner to the Native Hawaiian Practices permit application of Kehau Springer. All samples and methodologies discussed in this permit application are directly related to both permit applications and are the same samples, not in addition to one another. This project and its group of dedicated participants will continue to bridge the gap between cultural and western research in Papahānaumokuākea Marine National Monument, and community participants will communicate our collective findings to their respective communities (Hana, Kalapana, etc.) as outlined in Kahau Springer's permit application.

Tentative Cruise Itinerary

DATE	PORT / Island	Departure Time	Distance	Activities
06/25/15	Depart Kewalo for French Frigate Shoals (MPP)	0900		
06/26/15	Transit			
06/27/15	Transit			
06/28/15	Arrive MPP	Full day operations at MPP		Map, Collect
06/29/15	MPP	Full day operations at MPP		Transect, Collect
06/30/15	MPP/Transit	½ day operations MPP, depart for MMM	155nm @ 8 knots = 20 hrs	Fish
007/01/15	Transit/MMM	Arrive MMM, ½ day operations @ MMM		Map
07/02/15	MMM	Full day operations @ MMM		Transect, Collect

07/03/15	MMM/ Transit	boat Full day operations @ MMM depart for NIH around 1600	122nm @ 8 knots = 16 hrs	Map, Fish
07/04/15	NIH	SEARCHER anchor in pm – scout coastline via small boat		Collect
07/05/15	NIH	Full day operations @ NIH		Map, Collect
07/06/15	NIH-Transit	Full day operations @ NIH, depart at 1600 to HNL	245nm @ 8 knots = 31 hrs	Transect, Fish
07/07/15	Transit	Transit – arrive 11pm-ish		
07/08/15	Transit-offload			

15. List all Applicants' publications directly related to the proposed project:

21 Simion, P, CE Bird, and RJ Toonen (in prep) Comparative phylogeography of *Octopus cyanea* and *O. oliveri* in the Hawaiian Archipelago.

20 Bird, CE, BH Holland, P Samallow, BW Bowen, and RJ Toonen (in prep) Shell game: spatially variable morphological convergence revealed by DNA analysis in sibling limpets.

19 Bird, CE, M Iacchei, and RJ Toonen (in prep) Isolation, disruptive selection, and divergence within a population of broadcast-spawning limpets.

18 Bird, CE and RJ Toonen (in prep) Patterns of recent divergence and gene flow between budding lineages and species boundaries in the sibling Hawaiian limpets (*Cellana* spp.)

17 Bird, CE, MA Timmers, PE Smouse and RJ Toonen (in review) Inferring dispersal patterns with F_{ST} and $\boxed{\text{ST}}$: when is genetic distance is too much information? Integrative and Comparative Biology. *Invited*

16 Bird, CE, E Franklin, RJ Toonen, & CM Smith (in review) Between wave and tide marks: a unified model of water level and vertical zonation on littoral shores.

15 Bird, CE, M Stat, RD Gates, & RJ Toonen (in review) Complex analysis of molecular variance with PERMANOVA+.

14 Bird, CE, D Skillings, I Fernandez, and RJ Toonen (in press) Sympatric speciation in the post Modern Synthesis era of evolutionary biology. Evolutionary Biology. *Invited* Special issue on speciation.

13 Padilla-Gamino, JL, X Pochon, CE Bird, G Concepcion, RD Gates (in press) From parent to gamete: vertical transmission of *Symbiodinium* (Dinophyceae) in the scleractinian coral Montipora capitata.

12 Forsman, Z, B Kimokeo, CE Bird, CL Hunter & RJ Toonen (2012) Coral farming: species-specific effects of light, water motion and artificial foods. Journal of the Marine Biological Association of the UK.

11 Timmers, MA, CE Bird, DJ Skillings, PE Smouse, and RJ Toonen (2012) There's no place like home: crown-of-thorns outbreaks in the central Pacific are locally derived and independent events. PLoS ONE.

10 Bird, CE, PE Smouse, SA Karl & RJ Toonen (2011) Detecting and measuring genetic differentiation. In: S. Koenemann, C. Schubart & C. Held (eds.) Crustacean Issues: Phylogeography and Population Genetics in Crustacea. 31-73.*Invited*

9 Bird, CE (2011) Morphological and behavioral evidence for adaptive diversification of sympatric Hawaiian limpets. Journal of Integrative and Comparative Biology. 51:466-473.

8 Bird, CE, B Holland, BW Bowen & RJ Toonen (2011) Diversification of sympatric broadcast-spawning limpets (*Cellana* spp.) within the Hawaiian archipelago. Molecular Ecology. 20:2128-2141.

7 Gaither, MR , Z Szabo, M Crepeau, CE Bird & RJ Toonen (2011) Preservation of corals in salt-saturated DMSO buffer is superior to ethanol for PCR experiments. Coral Reefs. 30: 329-333.

6 Toonen, RJ, K Andrews, I Baums, CE Bird, G Concepcion, T Daly-Engel, J Eble, A Faucci, M Gaither, M Iacchei, J Puritz, J Schultz, D Skillings, M Timmers & B Bowen (2011) Defining boundaries for ecosystem-based management: a multispecies case study of marine connectivity across the Hawaiian archipelago. Journal of Marine Biology Article ID 460173, 15pp. doi:10.1155/2011/460173

5 Stat, M, CE Bird, X Pochon, L Chasqui, LJ Chauka, GT Concepcion, D Logan, M Takabayashi, RJ Toonen & RD Gates (2011) Variation in *Symbiodinium* ITS2 sequence assemblages among coral colonies. PLoS ONE 6(1): e15854. doi:10.1371/journal.pone.0015854

4 Skillings, D, CE Bird & RJ Toonen (2011) Gateways to Hawai'i – genetic population structure of the tropical sea cucumber *Holothuria atra*. Journal of Marine Biology. Article ID 783030, 16 pp

3 Timmers, MA, K Andrews, CE Bird, MJ deMaintenon, RE Brainard & RJ Toonen (2011) Widespread dispersal of the crown-of-thorns sea star, *Acanthaster planci*, across the Hawaiian Archipelago and Johnston Atoll. Journal of Marine Biology. Article ID 934269, 10 pp. doi:10.1155/2011/934269

2 Rodgers, KS, PL Jokiel, CE Bird, & EK Brown (2009) Quantifying the condition of Hawaiian coral reefs. Aquatic Conservation. 20:93-105.

1 Bird, CE, BS Holland, BW Bowen & RJ Toonen (2007) Contrasting phylogeography in three endemic Hawaiian limpets (*Cellana* spp.) with similar life histories. Molecular Ecology. 16:3173-3187.

With knowledge of the penalties for false or incomplete statements, as provided by 18 U.S.C. 1001, and for perjury, as provided by 18 U.S.C. 1621, I hereby certify to the best of my abilities under penalty of perjury of that the information I have provided on this application form is true and correct. I agree that the Co-Trustees may post this application in its entirety on the Internet. I understand that the Co-Trustees will consider deleting all information that I have identified as "confidential" prior to posting the application.

_____

Signature Date

SEND ONE SIGNED APPLICATION VIA MAIL TO THE MONUMENT OFFICE BELOW:

Papahānaumokuākea Marine National Monument Permit Coordinator
6600 Kalaniana'ole Hwy. # 300
Honolulu, HI 96825
FAX: (808) 397-2662

DID YOU INCLUDE THESE?

☒ Applicant CV/Resume/Biography
☒ Intended field Principal Investigator CV/Resume/Biography
☒ Electronic and Hard Copy of Application with Signature
☒ Statement of information you wish to be kept confidential
☒ Material Safety Data Sheets for Hazardous Materials

Appendix 1. Maximum total collection numbers.

2015 Collection List

Species	Type	Distribution	Sampling	Nihoa	Mokumanamana	Mokupāpapa (French Frigate Shoals)	Pūhāhonu (Gardner Pinnacles0	Preserve Tissue For Genetic Analysis
Isognomon californicum	Bivalve	Hawaii	Lethal	48	48	48	48	Y
Smaragdinella calyculata	Bubble Shell	Indo-Pac	Lethal	48	48	48	48	Y
Grapsus tenuicrustatus	Crab	Indo-Pac	Non-lethal	48	48	48	48	Y
Octopus oliveri	Octopus	Indo-Pac	Non-Lethal	48	48	48	48	Y
Octopus cyanea	Octopus	Indo Pac	Non-Lethal	48	48	48	48	Y
Drupa ricina	Snail	Indo-Pac	Lethal	48	48	48	48	Y
Echinolittorina hawaiiensis	Snail	Hawaii	Lethal	48	48	48	48	Y
Littoraria pintado	Snail	Indo-Pac	Lethal	48	48	48	48	Y
Nerita picea	Snail	Hawaii	Lethal	48	48	48	48	Y
Purpura (Thais) aperta	Snail		Lethal	48	48	48	48	Y
Thais intermedia	Snail		Lethal	48	48	48	48	Y
Siphonaria normalis	Limpet	Indo-Pac	Lethal	48	48	48	48	Y
Cellana exarata	Limpet	Hawaii	Lethal	144	144	< 1% of pop, up to 25	<1% of pop, up to 144	Y
Cellana sandwicensis	Limpet	Hawaii	Lethal	144	144	0	0	Y
Colobocentrotus atratus	Urchin	Indo-Pac	Lethal	48	48	48	48	Y
Echinometra oblonga	Urchin	Indo-Pac	Lethal	48	48	48	48	Y
Echinometra mathaei	Urchin	Indo-Pac	Lethal	48	48	48	48	Y
Acanthaster planci	Sea star	Indo-Pac	Lethal	48	48	48	48	Y
Misc Algae	algae	various	Non-lethal	1000 pinches	1000 pinches	1000 pinches	1000 pinches	Y

Note: no more than 1000 pinches (using no more than the thumb, pointer and middle fingers, an area < $4cm^2$, i.e. 2 x 2 cm) of turf algae will be collected at each site.

Papahānaumokuākea Marine National Monument
Compliance Information Sheet

1. Updated list of personnel to be covered by permit. List all personnel names and their roles here (e.g. John Doe, Diver; Jane Doe, Field Technician, Jerry Doe, Medical Assistant):

Chris Bird	Scientist
Hoku Johnson –	PMNM Representative
Tia Brown –	PMNM Representative
Misaki Takabayashi -	Scientist
Kim Kanoe Morishige –	Field Technician
Patricia Cockett	Field Technician

Pending Invitations:
Kipahulu (researcher)
Hana (researcher)
Kauai (EMT)
Makani Greig (potential backup)
Albert Espaniola (potential backup)
VanNicholas Velasco (potential backup, Educator)

2. Specific Site Location(s): (Attach copies of specific collection locations):
Gardner Pinnacles
La Perouse Pinnacles at Mokupapapa (French Frigate Shoals)
Shark Cove, Mokumanamana
West Ledge, Adams Bay, Nihoa
Ka'ula Rock
Lehua Rock
Niihau (exploring possibilities)

3. Other permits (list and attach documentation of all other related Federal or State permits):
Kehau Springer's Hawaiian Cultural Permit (PMNM-2015-017)
Nainoa Thompson's Traditional Navigation Permit (PMNM-2015-021)

3a. For each of the permits listed, identify any permit violations or any permit that was suspended, amended, modified or revoked for cause. Explain the circumstances surrounding the violation or permit suspension, amendment, modification or revocation.

na

4. Funding sources (Attach copies of your budget, specific to proposed activities under this permit and include funding sources. See instructions for more information):
The scientific aspects of this trip are funding by Bird's startup package from Texas A&M. $20,000 is allocated to processing genetic samples. Other funding provided by NOAA/NOS/ONMS/PMNM and OHA.

5. Time frame:
Activity start: June 25
Activity completion: July 7

Dates actively inside the Monument:
From: June 27
To: July 6

Describe any limiting factors in declaring specific dates of the proposed activity at the time of application: we are exploring the possibility of conducting surveys on Niihau. This would reduce the time in the monument.

Personnel schedule in the Monument: A complete itinerary is forthcoming, project is aiming to spend 1-2 days at Mokumanamana, 2-3 days at Nihoa and 1 days at Lehua, depending on weather conditions and sail plan logistics.

6. Indicate (with attached documentation) what insurance policies, bonding coverage, and/or financial resources are in place to pay for or reimburse the Monument trustees for the necessary search and rescue, evacuation, and/or removal of any or all persons covered by the permit from the Monument: The project is fully supported by the Monument. The federal government is self-insured. In addition, the cruise participants will carry emergency evacuation insurance (e.g., DAN insurance or something comparable).

7. Check the appropriate box to indicate how personnel will enter the Monument:

☒ Vessel
☐ Aircraft

Provide Vessel and Aircraft information: RV Searcher, Captain: Jon Littenberg

8. The certifications/inspections (below) must be completed prior to departure for vessels (and associated tenders) entering the Monument. Fill in scheduled date (attach documentation):

☒ Rodent free, Date:
☒ Tender vessel, Date:
☒ Ballast water, Date:
☒ Gear/equipment, Date:
☒ Hull inspection, Date:

9. Vessel information (NOTE: if you are traveling aboard a National Oceanic and Atmospheric Administration vessel, skip this question):
Vessel name: RV Searcher
Vessel owner: Dr. Littenberg
Captain's name: Jon Littenberg
IMO#:8981884
Vessel ID#:1103056
Flag: USA
Vessel type: STEEL TRAWLER
Call sign: WDA6100
Embarkation port: HONOLULU
Last port vessel will have been at prior to this embarkation: Kewalo Basin, Honolulu, HI
Length: 96 FT
Gross tonnage: 105
Total ballast water capacity volume (m3): NA
Total number of ballast water tanks on ship: 0
Total fuel capacity: 9600 GALLONS
Total number of fuel tanks on ship: 6
Marine Sanitation Device: YES, HEADHUNTER MARINE
Type: TYPE II

Explain in detail how you will comply with the regulations regarding discharge in the Monument. Describe in detail. If applicable, attach schematics of the vessel's discharge and treatment systems: No discharge will take place in the Monument according to the PMNM permits being supported. All black and grey waters shall be stored in storage tanks until our departure from the PMNM. All rubbish and recycling materials shall be securely stored aboard for proper disposal upon our return to Honolulu.

Other fuel/hazardous materials to be carried on board and amounts: Small amounts of gasoline for the outboards on the skiffs, approximately 30 gallons.

Provide proof of a National Oceanic and Atmospheric Administration (NOAA) Office of Law Enforcement-approved Vessel Monitoring System (VMS). Provide the name and contact information of the contractor responsible for installing the VMS system. Also describe VMS unit name and type: Thrane and Thrane Sailor

VMS Email: 436998398@c.xantic.net
Inmarsat ID#:4tto92e62b15

* Individuals MUST ENSURE that a type-approved VMS unit is installed and that its automatic position reports are being properly received by the NOAA OLE system prior to the issuance of a permit. To make sure your VMS is properly configured for the NOAA OLE system, please contact NOAA OLE at (808) 203-2503 or (808) 203-2500.

* PERMITS WILL NOT BE ISSUED TO INDIVIDUALS ENTERING THE MONUMENT VIA VESSEL UNTIL NOAA OLE HAS CONTACTED THE MONUMENT PERMIT COORDINATOR WITH A 'POSITIVE CHECK' READING.

10. Tender information:

On what workboats (tenders) will personnel, gear and materials be transported within the Monument? List the number of tenders/skiffs aboard and specific types of motors:

There are two inflatable workboats. Only one is intended to be used. Each boat has a 4 stroke outboard engine.

Additional Information for Land Based Operations

11. Proposed movement of personnel, gear, materials, and, if applicable, samples:

12. Room and board requirements on island:

13. Work space needs:

DID YOU INCLUDE THESE?

- ☐ Map(s) or GPS point(s) of Project Location(s), if applicable
- ☐ Funding Proposal(s)
- ☐ Funding and Award Documentation, if already received
- ☐ Documentation of Insurance, if already received
- ☐ Documentation of Inspections
- ☐ Documentation of all required Federal and State Permits or applications for permits

DAVID Y. IGE
GOVERNOR OF HAWAI I

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

KEKOA KALUHIWA
FIRST DEPUTY

W. ROY HARDY
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 HAWAI'I
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAI'I 96809

June 12, 2015

TO: Division of Aquatic Resources File

THROUGH: Suzanne Case, Chairperson

FROM: Maria Carnevale
Papahānaumokuākea Marine National Monument

DECLARATION OF EXEMPTION FROM THE PREPARATION OF AN ENVIRONMENTAL ASSESSMENT UNDER THE AUTHORITY OF CHAPTER 343, HRS AND CHAPTER 11-200 HAR, FOR PAPAHĀNAUMOKUĀKEA MARINE NATIONAL MONUMENT RESEARCH PERMIT TO DR. CHRISTOPHER BIRD, TEXAS A&M UNIVERSITY – CORPUS CHRISTI, AND DR. ROBERT TOONEN, HAWAI'I INSTITUTE OF MARINE BIOLOGY, UNIVERSITY OF HAWAI'I, FOR ACCESS TO STATE WATERS TO CONDUCT INTERTIDAL BIODIVERSITY ACTIVITIES UNDER PERMIT PMNM-2015-026

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:
Papahānaumokuākea Marine National Monument Research Permit to Dr. Christopher Bird, Assistant Professor, Texas A&M University – Corpus Christi, and Dr. Robert Toonen, Research Professor, Hawai'i Institute of Marine Biology, University of Hawai'i, for Access to State Waters to Conduct Intertidal Biodiversity Activities.

Permit Number: PMNM-2015-026

Project Description:
The research permit, as described below, would allow entry and activities to occur in Papahānaumokuākea Marine National Monument, including the NWHI State waters from June 15, 2015 – June 14, 2016.

The purpose of the proposed project would be to examine the biodiversity of the Hawaiian intertidal and subtidal ecosystem and to study the basic ecology of 'opihi populations within the Northwestern Hawaiian Islands. The Applicants propose to collect samples of common intertidal invertebrates and macroalgae (limu) in order to establish an intertidal baseline survey of the NWHI, that would characterize the biodiversity, population dynamics and connectivity, and contribute to the understanding of the Hawaiian intertidal and shallow subtidal ecosystem and basic ecology of

'opihi populations within the NWHI. This project would be a continuation of the first comprehensive biodiversity mapping survey of the intertidal zone in the NWHI which quantifies species presence/absence and relative abundances within and among sites across the basaltic emergent islands.

The Applicants proposed research aims to accomplish five objectives laid out in the submittal. In order to accomplish the objectives, the following measures will be taken:

Objectives 1 and 2:
Fifteen to thirty (15-30) belt transects will be established per island located randomly at sites selected based on access, safety and weather conditions. A transect sash chain will be laid perpendicular to the shoreline (mauka to makai), from the highest marine animal on the shore to 15 ft deep into the ocean. Colored cable ties will be attached to the sash chain to divide the transect into zones. If algal turfs are present, 1cm^2 voucher sample of each visually distinct turf type will be collected. In order to survey nearshore fish populations, four snorkelers will conduct surveys between 0-20m of the shoreline swimming parallel to the shoreline that was surveyed with transects.

In order to track 'opihi reproductive cycles, the Applicants will collect 24 individuals per 1 cm size class (1 to 5cm) per species of 'opihi and ha'uke'uke on Nīhoa and Mokumanamana. On Mokupāpapa (Kure Atoll), only 5 individuals per size class will be collected (25 total) thereby ensuring that we collect less than 1% of the limpets present. On Pūhāhonu (Gardner Pinnacles), if visited, mapping protocol will be used to census the 'opihi population, which is inhabited solely by *Cellana exarata*. Less than 1% of the population will be sampled on each island visited. RNA and DNA tissue preservative will be stored in plastic unbreakable tubes inside of plastic containment containers (5 gallon buckets). 'Opihi will be dissected on the ship to separate the gonad, the non-gonadal tissue, and the shell for subsequent weighing at HIMB on O'ahu. Tissues will be preserved by freezing in liquid nitrogen. Non-lethal sampling of crabs (*Grapsus tenuicrustatus*) and octopi (*Octopus oliveri* and *O. cyanea*) will be conducted by removing a leg or a 1 inch section of arm tip.

All waste will be retained on the ship, and kept in primary and secondary containment vessels. Waste will be disposed of at the University of Hawai'i on O'ahu. DNA extraction involves chaotropic salts, guanidine, SDS, sodium azides, and ethanol.

Objective 3:
The Applicants plan to resample the animal species that were originally collected in 2011 and 2012 (along with the addition of *Octopus oliveri, Octopus cyanea, Actinopyga mauritiana, Heterocentrotus mammilatus, Echinothrix diadema, and Tripneustes gratilla, Thais intermedia, Purpura aperta,* some of which are being harvested for Hawaiian consumption) for the first multispecies population genomic study in the Hawaiian Islands. A total of 48 specimens per species per island would be collected between 2014 and 2015.

Objectives 4 and 5:

The sampling scheme outlined above will allow the Applicants to calculate the gonad index for different size classes of 'opihi by determining the mass of gonads and other tissues. Mapping and transect surveys conducted in both PMNM and the Main Hawaiian Islands will help identify alleles that likely confer an advantage at high or low population densities. Additionally, a test for human impacts will be conducted by correlating gamete-recognition genes with the ratio human population size to linear coastline distance of 'opihi habitat.

Two new activities would focus on intertidal biodiversity and 'opihi reproduction:

1. The Applicants would collect forty-eight (48) individuals per island of each of the invertebrates, including three (3) invertebrate species that have not been previously permitted to collect. Except, twenty-five (25) individual specimens of *Cellana extarata* would be collected from French Frigate Shoals. Tissue from all invertebrates listed would be preserved for genetic analysis.
2. The Applicants would conduct further laboratory analysis of gonad tissue (sampling described previously). Once the gonad tissue is transported to Dr. Bird's laboratory at Texas A&M, the Applicants would test the tissue for a correlation between allele frequency and 'opihi population density obtained from the transect surveys performed in both the Monument and Main Hawaiian Islands. The tissue would also be tested for gamete recognition proteins and correlated to human population densities nearby to test for human impacts.

Activities associated with this project would continue work previously permitted in the Monument. This project would be a collaboration of efforts from Na Mamo o Muole'a, The Nature Conservancy, Hawai'i Institute of Marine Biology, Na Maka o Papahānaumokuākea, Conservation International-Hawaii Fish Trust, Texas A&M and the NOAA Papahānaumokuākea Marine National Monument.

The proposed activities are in direct support of the Monument Management Plan's priority management needs 3.1 – Understanding and Interpreting the NWHI (through action plan 3.1.1 Marine Conservation Science). This action plan specifies to "measure connectivity and genetic diversity of key species to enhance management decisions" (Activity MCS-1.5, PMNM MMP Vol 1, p. 123). Activities to support marine conservation science, including biodiversity and genetic diversity surveys such as those to be carried out by the permittee, are also addressed in the Monument Management Plan (MMP) Environmental Assessment (EA) (Finding of No Significant Impact (FONSI), December 2008). This EA summarizes that connectivity and genetic studies of key species would be helpful in forecasting, preparing, and mediating potential threats to populations (PMNM MMP Vol 2, p. 171). Identification of biodiversity and genetic diversity of invertebrates in the NWHI, such as those proposed, would enhance this understanding.

Consulted Parties:

The permit application was sent out for review and comment to the following scientific and cultural entities: Hawai'i Division of Aquatic Resources, Hawai'i Division of Forestry and Wildlife, Papahānaumokuākea Marine National Monument (NOAA/NOS), NOAA Pacific Islands Regional Office (NOAA-PIRO), United States Fish and Wildlife Service Hawaiian and Pacific Islands

National Wildlife Refuge Complex Office, and the Office of Hawaiian on March 27, 2015 giving the public an opportunity to comment. The application was posted within 40 days of its receipt, in accordance with the Monument's Public Notification Policy.

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; including transect monitoring in intertidal and near-shore regions, tissue biopsy sampling, and subsequent genetic and taxonomic study of invertebrates and macroalgae; have been evaluated as a single action. As a preliminary matter, multiple or phased actions, such as when a group of actions are part of a larger undertaking, or when an individual project is precedent to or represents a commitment to a larger project, must be grouped together and evaluated as a single action. HAR § 11-200-7. This permit may involve an activity that is precedent to a later planned activity, i.e. the continuation of near-shore biodiversity monitoring, sampling, and associated genetic studies; the categorical exemption determination here will treat all planned activities as a single action.

2. The Exemption Class for Experimental Management with no Serious or Major Environmental Disturbance Appears to Apply. Chapter 343, HRS, and § 11-200-8, HAR, provide for a list of classes of actions exempt from environmental assessment requirements. 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." The proposed removal activities here appear to fall squarely under the exemption class #5, exempt item #5 as described under the Division of Forestry and Wildlife exemption list published on June 12, 2008. This exemption class has been interpreted to include "wildlife surveys, new transect lines, photographing, recording, and sampling", such as those being proposed. As discussed below, no significant disturbance to any environmental resource is anticipated in the monitoring and removal of a limited number of sharks. Thus, so long as the below considerations are met, an exemption class should include the action now contemplated.

These invertebrates are abundant and common on every island surveyed. The population sizes have been estimated and a collection of forty-eight (48) individuals would have no detectable impact because less than 1 percent of their population would be sampled. The Applicants would follow Monument Best Management Practice (BMP) 016 – Activities on Nīhoa and BMP 006 – General Storage and Transport to minimize any impacts from activities.

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. Examples of actions which commonly have a significant effect on the environment are listed under HAR § 11-200-12.

The proposed project would be supported by the NOAA contracted vessel, R/V SEARCHER (PMNM-2015-001. Proposed activities would be a continuation of a proposed project in its sixth year. Similar near-shore biodiversity monitoring activities have also been permitted and performed within the NWHI. Past permitted projects including similar collections and techniques have shown no adverse impacts. The cumulative impacts of this permit, in conjunction another proposed Native Hawaiian practices permits (permit application currently in review for Springer, PMNM-2015-017) are also considered. Springer proposes to conduct Native Hawaiian environmental monitoring of ʻopihi and intertidal ecosystems. The proposed activities, while differing in their approach to understanding this habitat, are the result of collaborations with the same goal of adding to the total knowledge base for this region. As such, there would be no duplicative sampling of resources or organisms. No associated cumulative impacts are anticipated between activities from the SEARCHER and other vessels in the area. The activities conducted under this permit are not anticipated to have significant cumulative impacts. See Tables 1-6 for concurrent activities in the Monument:

Table 1. Concurrent projects aboard NOAA Ship SEARCHER

Permit	**Purpose and scope**	**Location**
PMNM-2015-017 Springer (proposed)	The permit would allow cultural intertidal studies of ʻopihi and hāʻukeʻuke to occur in the Monument	Nīhoa, Mokumanamana, French Frigate Shoals, Gardner Pinnacles

Table 2: Concurrent projects aboard NOAA Ship OKEANOS

Permit	**Purpose and scope**	**Location**
PMNM-2015-025 Wetzler OKEANOS	The permit would allow NOAA Ship OKEANOS into the Monument to support separately permitted activities	All locations
PMNM-2015-018 Elliott (proposed)	The proposed action would conduct bathymetric mapping activities to characterize deepwater areas and coral communities	Nīhoa, Mokumanamana, French Frigate Shoals, Gardner Pinnacles, Maro Reef, Laysan, Lisianski and Neva Shoal, Pearl and Hermes

Table 3: Concurrent projects aboard SSV MAKANIʻOLU

Permit	**Purpose and scope**	**Location**
PMNM-2015-014 Kikiloi	The proposed action would conduct archaeological research activities with an	Nīhoa, Mokumanamana

(proposed)	emphasis on agricultural lands	

Table 4: Concurrent projects aboard HIKIANALIA

Permit	Purpose and scope	Location
PMNM-2015-021 Thompson (proposed)	The proposed action would involve traditional wayfinding activities for young navigators	Nīhoa, Mokumanamana

Table 5: Concurrent projects aboard NOAA Ship HI'IALAKAI.

Permit	Purpose and scope	Location
PMNM-2015-006 Simon HI'IALAKAI (approved)	This permit allows the NOAA Ship HI'IALAKAI entry into the Monument. Personnel aboard the vessel would be permitted under separate permits	All locations
PMNM-2015-001 Co-Trustee (approved)	This permit allows monk seal field camp operations	Kure Atoll, Midway Atoll, French Frigate Shoals
PMNM-2014-009 Parrish-Garrett (proposed)	The proposed action would involve the selective removal of up to 20 Galapagos sharks from French Frigate Shoals to mitigate predation on Hawaiian monk seals	French Frigate Shoals
PMNM-2015-013 Couch (proposed)	This proposed action would be to assess health and community structure of corals on shallow-water reefs	All locations
PMNM-2015-012 Godwin (proposed)	This proposed action would be conduct to Pacific Reef Assessment and Monitoring Program	All locations
PMNM-2015-016 Wall (proposed)	This proposed action would be to document the coral bleaching of shallow-water reefs	All locations
PMNM-2015-015 Gleason (proposed)	This proposed action would conduct maritime heritage monitoring and surveying activities	All locations
PMNM-2015-019 Littnan (proposed)	This proposed action would be to conduct monitors and surveys of various areas using an Unmanned Aerial System (UAS)	Laysan, Lisianski, Pearl and Hermes, Midway Atoll
PMNM-2015-020 Meyer (proposed	This permit would allow research activities regarding top predator feeding and movement	All locations

Table 6: Concurrent projects about NOAA ship SETTE.

Permit	Purpose and scope	Location
PMNM-2015-004 Koes SETTE (approved)	This permit allows the NOAA SETTE entry into the Monument. Personnel aboard the vessel would be permitted under separate permits	All locations
PMNM-2015-001	This permit allows monk seal field camp	French Frigate Shoals,

Co-Trustee (approved)	operations	Lisianski Island, Pearl and Hermes Atoll, Midway Atoll, Kure Atoll

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 be Minimal and Insignificant 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 conservation and management activities covered by this permit will be carried out with strict safeguards for the natural, historic, and cultural resources of the Monument as required by Presidential Proclamation 8031, 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 Case
Board of Land and Natural Resources

Date