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:
NOAA/Inouye Regional Center
NOS/ONMS/PMNM/Attn: Permit Coordinator
1845 Wasp Blvd, Building 176
Honolulu, HI 96818
nwhipermit@noaa.gov
PHONE: (808) 725-5800 FAX: (808) 455-3093

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

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: Chris Bird; Rob Toonen
Affiliation: Department of Life Sciences, Texas A&M University – Corpus Christi; Hawai‘i Institute of Marine Biology, University of Hawai‘i at Mānoa

Permit Category: Research
Proposed Activity Dates: August 1, 2017 – July 31, 2018
Proposed Method of Entry (Vessel/Plane): Vessel
Proposed Locations: Nihoa, Mokumanamana, FFS (La Perouse Pinnacle), Gardner Pinnacle

Estimated number of individuals (including Applicant) to be covered under this permit: 15 total people will be covered to conduct activities under this permit, co-listed under the Native Hawaiian Practices applications submitted by Kim Morishige

Estimated number of days in the Monument: 15

Description of proposed activities: (complete these sentences):

a.) The proposed activity would…
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 each survey year.

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 Kim Morishige. 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 eight (8) 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).

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