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: Bowen, Brian W.
Affiliation: Hawaii Institute of Marine Biology

Permit Category: Research
Proposed Activity Dates: 9/1/15 - 8/31/16
Proposed Method of Entry (Vessel/Plane): RV Hi'ialakai
Proposed Locations: Shallow reefs and mesophotic reef habitats (1 - 450 feet depth), focused on Kure, Midway, Pearl & Hermes, Lisianski, Laysan, Maro Reef, Gardner Pinnacles, French Frigate Shoals, Mokumanmana, and Nihoa. However, we request latitude to sample other regions as weather and opportunity dictate.

Estimated number of individuals (including Applicant) to be covered under this permit: 23 people are listed in section A.4, although only 2 - 8 will participate in a single cruise.
Estimated number of days in the Monument: 55

Description of proposed activities: (complete these sentences):

a.) The proposed activity would…

be a genetic survey of 12 shallow reef fishes, 14 mesophotic reef fishes, 8 invertebrates, and one mesophotic plant species, designed to address the level of isolation between shallow and deep reef ecosystems across the Hawaiian Archipelago, and especially throughout the Papahanaumokuakea Marine National Monument.

Specimens will be collected on deep and shallow reefs to evaluate the hypothesis that these mesophotic reefs can serve as refugia to replenish shallow reefs. Genetic studies can validate or refute this hypothesis, which has clear implications for management and conservation of biological resources. Deep dives during the permit periods in 2012 - 2013 were used to select species for genetic analysis (ones that are abundant and feasible to collect). Since then we have refined our list to include those species that we are continuously observing on our dives and are the most practical candidates for these studies. Due to logistic constraints on the 2014 cruise, limited collections were accomplished (N<30), so we request only a few changes this year. Our preliminary genetic data suggests that the surge zone specialists may be currently experiencing

population bottlenecks resulting from different patterns of habitat loss and gain during sea level changes.
In addition, we wish to collect specimens of any suspected new species encountered at depths greater than 130 feet, for genetic characterization, description, and vouchering in the Bishop Museum (see Appendix 1, opportunistic collections). This is an essential activity to characterize the biodiversity of the Monument, and will only be invoked in cases where species are sufficiently abundant (encounter rate of 10+ per hour) to sustain collections without adverse impact.

b.) To accomplish this activity we would ….
survey 26 fishes, 8 invertebrate, and one plant species at locations across the entire archipelago, using polespears and nets when possible to collect fish, nonlethal tissue biopsies for invertebrates (except the oysters which are collected whole) and small biopsies from a plant, and using DNA sequencing technology to resolve novel evolutionary lineages, genetic diversity and connectivity among reef habitats.

c.) This activity would help the Monument by …
determining whether the Monument is a series of relatively fragile (isolated) ecosystems, or whether individual reef habitats are connected in a larger and more robust ecosystem. There is also a concern about whether the NWHI serves as a source of larvae to replenish depleted fisheries in the main Hawaiian Islands. The assays of population connectivity outlined here will address these issues in a format that has statistical power and scientific credibility.

For example, recent findings from this research indicate that the Yellow Tang (Zebrasoma flavescens) is divided into 4-7 isolated populations within the Hawaiian Archipelago, including three populations in the PMNM (Eble et al. 2011). This fish is heavily harvested for the ornamental fish trade, and so findings will realign management units for this species. Findings also indicate some connectivity between the Main Hawaiian Islands and the lower NWHI.

Other information or background: To preserve biodiversity, it is important to know how it arises (Bowen & Roman 2005). While the main objective is to assess genetic connectivity among shallow and deep reef habitats, a "value added" component is that we can assess the age and origin of Hawaiian fauna as well as the age and origins of populations on each island. A genealogical approach to relationships among mtDNA haplotypes will indicate whether the closest relatives to the Hawaiian fauna lie predominantly to the West (Ogasawara Arch, Wake Island, or Marshall Islands) or to the South (Johnston Atoll, Line Islands; Gosline 1955; Maragos & Jokiel 1986; Maragos et al. 2004). In these cases, populations of the widespread Indo-Pacific species will be compared to the Hawaiian endemic. The geographic source of the Hawaiian form (especially Hawaiian endemics) will be resolved with parsimony networks and phylogenetic tools (see Methods), and the age of colonization events will be estimated with the mtDNA molecular clock.

Reef fauna typically have a pelagic phase (eggs and larvae), which lasts 20-60 days, followed by settlement onto a reef where they remain through juvenile and adults stages. Long distance dispersal is accomplished almost exclusively during the pelagic larval phase. However, the geographic limits of such dispersal are uncertain (Bowen et al. 2006a; 2006b; Weersing & Toonen 2009). Recent research shows that effective dispersal of marine larvae can fall short of their potential (Swearer et al. 2002). This may be particularly true of the damselfishes, as recent evidence indicates (Ramon et al. 2008). We continue to collect damselfish to test this hypothesis.

NEW PROGRESS FOR THE 2014 - 2015 YEAR
In the previous year, despite few specimen collections (N < 30) we made substantial progress on four fronts, by processing previous specimens.
1) Coleman et al. (2014) has demonstrated that the the Indo-Pacific damselfish Abudefduf vaigiensis has invaded the Hawaiian Archipelago in large numbers over the last 40 years, by hitchhiking on marine debris. It is hybridizing with the endemic Hawaiian damselfish Abudefduf abdominalis. The recent invader may be hybridizing the native species into extinction. While hybrids are now detected throughout the archipelago, they are less common in the Monument, which may serve as the last refugia of the endemic Hawaiian species. This illustrates how invaders can enter the Hawaiian Archipelago via marine debris, reinforcing the justification for efforts to limit marine debris in the Monument.

2) Gaither et al. (2015) has demonstrated that the orangestripe surgeonfish (Acanthurus olivaceus, widespread in the Pacific Ocean) has a genetically unique population in Hawai`i. This study adds to the evolutionary distinctiveness of Hawaiian fauna.

3) Selkoe et al. (2014) usaed a meta-analysis of all species surveyed to date in this project to show that the length of the pelagic (ocean drifting) larval period explained up to half of genetic connectivity. Feeding specialists disperse less than generalists, and invertebrates disperse less than fishes. This study adds to our understanding of how gene flow (especially through pelagic larvae) will allow replenishment of depleted reef resources.

4) Tenggardjaja et al. (2014) has shown that populations of the damselfish Chromis verator are highly connected between shallow reef and the mesophotic reefs below 60 meters. This is the first publication from our research program on mesophotic reef fishes, and the finding of high connectivity confirms that deep cohorts of fishes can reseed depleted shallow reefs. However, findings from additional species are needed to evaluate the generality of this conclusion.