

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: 7/1/12 - 10/31/12

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:

7

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, plus 8 mesophotic reef fishes, 6 mesophotic 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 Papahānaumokuākea Marine National Monument.

Specimens will be collected on deep 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 2009 - 2010 were used to select species for genetic analysis (ones that are abundant and feasible to collect). In addition, we wish to collect specimens of any 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 5+ per hour) to sustain collections without adverse impact.

b.) To accomplish this activity we would
survey 20 fishes, 6 invertebrate, and one plant species at locations across the entire archipelago, using polespears and narcotics 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.

This permit application differs from last year in that we have removed three invertebrate species and added one fish species that was previously collected across the archipelago, the invasive Bluestriped Snapper (*Lutjanus kasmira*). Our previous investigations revealed that this fish, deliberately introduced to Hawaii 55 years ago, brought an intestinal fish parasite (*Spirocamallanus istiblenni*) that has spread to native fishes. While the original host has colonized all the way from Oahu to Midway and Kure, the parasite has spread no further than Pearl and Hermes Reef, where it occurs at low frequency (M. Gaither, G. Aeby et al. In prep). Therefore we would like to monitor Pearl & Hermes, Midway and Kure for the presence of this parasite (N = 15 *L. kasmira* at each location), to determine whether it is spreading and posing a health threat to Monument living resources.

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, the most 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 is arises (Bowen & Roman 2005). While the main objective is to assess genetic connectivity among shallow 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), and so we have added four damselfish species to this investigation.