

## **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:** Robert J. Toonen

**Affiliation:** Hawaii Institute of Marine Biology, University of Hawaii at Manoa

**Permit Category:** Research

**Proposed Activity Dates:** 05/15/10 through 11/15/10

**Proposed Method of Entry (Vessel/Plane):** R/V Hi'ialakai

**Proposed Locations:** Shallow water habitats (< 100 feet depth), focused on: 1) completing connectivity sampling in locations that were excluded due to weather conditions, cruise constraints or time in previous years, and 2) taxonomic studies of scleractinian corals of the genera Montipora and Pocillopora in collaboration with Maragos (USFWS). In addition to completing the last of the connectivity collections, we also propose to begin exploration of black corals at mesophotic depths (30 to 250m) which remain largely unexplored outside the MHI.

**Estimated number of individuals (including Applicant) to be covered under this permit:**

One berthing position for my research team on each of 2 different research cruises, plus available members of researchers from other permitted activities who can collect opportunistically on our behalf.

**Estimated number of days in the Monument:** Up to approximately 60 days spread across 2 research cruises

**Description of proposed activities:** (complete these sentences):

a.) The proposed activity would...  
collect non-lethal tissue biopsy samples of common reef invertebrates to conduct a population genetic survey. This survey is an attempt to complete the on-going effort to determine patterns of connectivity or isolation among each reef ecosystem throughout the Hawaiian Archipelago with a focus on specific species and locations of special interest that have been missed due to circumstances beyond our control in previous years. The primary goal of this work will be to: 1) complete collections of spiny lobsters, and 2) to determine the specific location of limited exchange detected between Papahānaumokuākea Marine National Monument and the Main Eight Hawaiian Islands. The sites of the NWHI between Kauai and French Frigate Shoals have been missed in collection efforts in previous years due to cruise constraints or weather, and I am unsure that they will be collected this year either, but we will continue to submit permit

applications until we are able to collect at these sites to determine the location of the barrier between the Main and NWHI.

Additionally we propose to begin taxonomic work on several groups of corals whose identity is a subject of debate. In particular, we propose to collaborate with Jim Maragos (USFWS) to collect voucher specimens and characterize the Hawaiian *Montipora* and *Pocillopora* species.

Finally, we also propose to study black corals at mesophotic depths in the Monument. This research will involve collection of vouchers for comparison with established type specimens to confirm or refute the morphological identification of the Hawaiian antipatharian (black coral) fauna. The black corals are already under revision because the species previously identified as *Antipathes dichotoma* from Hawaii do not match specimens from the type locality of *A. dichotoma* in the Mediterranean Sea; as a result, the Hawaiian “*A. dichotoma*” has now been assigned the new name of *Antipathes griggi* (Opresko 2009). Likewise, our study over the past year has resulted in the redescription of *Antipathes grandis* (Wagner et al., in review) from the Main Hawaiian Islands. Last year, during the first technical diving to the appropriate depths in the Monument, we discovered 4 species of black corals never before reported from the NWHI and now seek to obtain voucher collections of these animals to determine whether the species identity is correct (or a misidentification due as described for *A. dichotoma* above). In addition to technical diving to collect samples, we request permission to 1) deploy an ROV for exploration and video surveys of appropriate habitats to estimate the distribution and abundance of each species within the Monument, and 2) deploy temperature loggers at technical dive sites in order to check whether differences in faunal composition across sites correspond to latitudinal differences in temperature. The temperature loggers will be recovered on a subsequent cruise in the 2011.

b.) To accomplish this activity we would .... collect target invertebrates by hand. Connectivity studies require only a tiny tissue biopsy sample be collected prior to release of the live animals back to the environment. These samples are identified in a sample database and tissues are preserved for future DNA analyses to determine patterns of genetic structure among locations and infer the level and magnitude of exchange among those populations. Coral samples for taxonomic study require high resolution photographs of the colony prior to sampling, and then collection of small portions of colonies for subsequent DNA and morphological study as well as museum archiving. Likewise, black coral samples from mesophotic depths will be preserved for DNA, morphological, histological and electron microscopic work to identify the species and sex of the sampled colonies in addition to subsequent archiving in appropriate museums (we propose the Bishop and Smithsonian museums as the obvious choices). Finally, we hope to use an ROV at depth to perform video transects of appropriate habitat to estimate the abundance and distribution of the antipatharian species within the Monument.

c.) This activity would help the Monument by ... identifying the location of the reduced connectivity between the Main and Northwestern Hawaiian Islands to determine whether the location corresponds to the border of the Monument or not. Results from this study to date indicate that there are regions of both high exchange and

of strong isolation within the Archipelago that need to be considered in management strategies. In particular, there is a barrier to dispersal between the Main and Northwestern Hawaiian Islands (particularly between Kauai and French Frigate Shoals) that is poorly understood because of mechanical failure, limited field opportunities, and poor weather in previous years. We seek to complete the sampling of a few remaining species and identify the specific location of the Main to NWHI barrier.

Knowing which species occur and where is fundamental to the management of the resources, and the first dives to mesophotic depths in the NWHI have already extended the ranges of black coral in Hawaii throughout large areas of the Monument. Studies in the MHI have called the taxonomy of the antipatharians into question, and we propose to survey the habitats by ROV to estimate the extent of these valuable resources within Monument boundaries, and collect voucher specimens to confirm which species are present in which areas. Likewise, there is debate among coral taxonomists regarding the species designations of *Montipora* and *Pocillopora* under Monument jurisdiction, and we propose to begin taxonomic collections for detailed study of the morphospecies of contention.

**Other information or background:** There appear to be 4 primary areas of restricted larval exchange across the Hawaiian Archipelago, resulting in 5 areas of moderate connectivity. The findings of our connectivity research have been presented at numerous public meetings and to all the co-trustee agency partners. One of the primary remaining questions from the work to date is the specific location of the Main to NWHI barrier, which we have not been able to address due to the difficulty of collecting samples at the near NWHI sites. We hope to solve that last remaining question this year. We have also been asked to complete work on the spiny lobster connectivity, and propose to collect the samples necessary to address that question as well.

In addition to hopefully completing the connectivity collections, we propose to survey the species diversity and reproductive status of black corals found at mesophotic depths. This area was explored for the first time in the Monument last year, and we discovered four species of black coral never before reported from the NWHI. These include *Antipathes griggi* (formerly *A. dichotoma*) off the islands of Necker and Laysan in 59-70 m, *Myriopathes ulex* off Necker Island and Pearl & Hermes Atoll in 58-69 m, *Cirripathes cf. anguina* off the island of Necker and Laysan in 59-69 m, and *Cirripathes sp.* off Necker Island in 58 m. We request permission to collect vouchers of each so that we can examine these samples in comparison to the museum collections and in consultation with the world taxonomic experts to confirm whether the species identifications are correct or whether these are potential new species. Whenever possible, use of an ROV for video transects will help to estimate the distribution and abundance of these species among sites throughout the Monument waters.

We also propose to begin taxonomic work on scleractinian corals whose identity is a subject of debate. In particular, we propose to collaborate with Jim Maragos (USFWS) to collect voucher specimens and characterize the Hawaiian *Montipora* and *Pocillopora* species. Our current work in the MHI to examine the Species of Concern, *Montipora dilatata*, shows 3 distinct genetic groups: I) *M. patula*/*M. verilli*, II) *M. dilatata*/*M. turgescens*/*M. flabellata* and III) *M. capitata*. Alternate explanations for these results

could include either: 1) these genetic groups represent closely related but distinct species with occasional hybridization, and 2) there are only three morphologically plastic species which have been split into 6 different named taxa. Validation of these initial findings and determination of which alternate is true requires collection of a few voucher specimens of all known species of *Montipora* across the Hawaiian Archipelago to establish the taxonomy of these species (Forsman et al. in prep). Likewise, initial testing of the coral *Pocillopora meandrina* suggests that the Hawaiian form is genetically distinct from *P. meandrina* from other locations throughout the Pacific, and may be an unrecognized species restricted to Hawaii. If this were true, that would greatly alter its priority for management. We propose to collaborate on voucher specimen collections with Maragos to identify and sample a few colonies of all known morphospecies of *Montipora* and *Pocillopora* corals (some of which are restricted to the NWHI) across the Hawaiian Archipelago for taxonomic studies.

Finally, we are developing a new DNA-based technology for the detection of alien invasive species (the ReefChip), and we request permission to collect samples of any alien invasive species located within the Monument while performing these other activities to ensure that those species are included on our detection chip.