

## **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:** Megan Donahue

**Affiliation:** Hawaii Institute of Marine Biology

**Permit Category:** Research

**Proposed Activity Dates:** 06/01/12-11/15/12

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

**Proposed Locations:** Shallow water reef (<100 ft depth) focused on bioeroder communities in forereef and lagoon habitats. Specific locations for the study will depend on cruise logistics but will include forereef sites at FFS, LIS, PHR, and KUR and lagoon sites at MID.

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

4

**Estimated number of days in the Monument:** 50

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

a.) The proposed activity would...

measure bioerosion rates and bioeroder community composition on reefs in the NWHI to evaluate whether internal bioeroders can serve as indicators of community response to ocean acidification on coral reefs. Taking advantage of variation in pH at large and small spatial scales, we will test whether the total bioerosion rate and/or the community composition of internal bioeroders responds to natural spatial variation in pH or other environmental drivers along the Archipelago. Bioerosion rates will be measured using microCT scans of coral blocks to get a 3D image of the eroded material; this method gives a better estimate of bioerosion rate than the traditional buoyant weight technique and allows characterization of distinct bioeroder groups. Community composition will be measured using a ReefChip, a molecular microarray that will be customized to detect and quantify the bioeroder community. If effective, this method would be an efficient and inexpensive way to detect community level effects of ocean acidification in remote areas.

b.) To accomplish this activity we would ....

(i) measure bioerosion rates by installing small calcium carbonate blocks (5x5x2cm) on reef substrate at each site. Five calcium carbonate blocks were deployed at 15 forereef sites (5 sites each at FFS, LIS, PHR) and 20 blocks were deployed at one lagoon site (MID) during the July-August 2011 cruise to the PMNM (a site is a 20m x 20m area of reef). If cruise logistics allow, we will deploy additional blocks this year at 5 forereef sites at Kure. These blocks act as a settling substrate for bioeroding organisms. Prior to deployment, each block is scanned by microCT (to create a 3D image of the block) and autoclaved. On the upcoming cruise, we will retrieve these calcium carbonate blocks, rescan with microCT, calculate bioerosion rates, and assess the bioeroder community composition at each site. At each forereef site, blocks were attached to calcification acidification units (CAUs) previously deployed by NOAA's Coral Reef Ecosystem Division (CRED). At the lagoon site, blocks were affixed to dead reef substrate.

(ii) measure variation in the bioeroder community by collecting thirty small pieces (5x5x5cm) of dead coral skeleton at each site. These pieces of reef substrate will be sampled for bioeroding fauna using both traditional taxonomic identification and the ReefChip microarray.

(iii) relate bioerosion rates to environmental data collected by NOAA CRED (including, pH, nitrate, dissolved inorganic carbon, temperature, salinity, and chlorophyll)

c.) This activity would help the Monument by ... evaluating whether internal bioeroders can serve as indicators of community response to ocean acidification on coral reefs. The community structure and function of bioeroding organisms may have a major effect on coral reef resilience: the sponges, polychaete worms, and tiny mollusks that comprise bioeroder communities control the strength and complexity of the coral reef framework, which is the habitat for more charismatic coral reef organisms. Shifts in the composition and functioning of these out-of-sight, but fundamental members of coral reef ecosystems may change the accretion-erosion balance of coral reefs. The methods developed here will help managers anticipate the likely effects of ocean acidification on bioeroder communities and bioerosion rates. If effective, this method would be an inexpensive way to detect community level effects of ocean acidification in remote areas.

**Other information or background:** All forereef sites are co-located with NOAA-CRED permanent sites. This minimizes the impact to the reefs and facilitates sharing of information.