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: Amy Baco-Taylor
Affiliation: Florida State University

Permit Category: Research
Proposed Activity Dates: Sept 28, 2020 -Nov 11, 2020
Proposed Method of Entry (Vessel/Plane): RV Kilo Moana
Proposed Locations:
Monument sites: Southeast Hancock Seamount, Acadmician Berg, Ladd, Bank 9, and Pioneer Bank.
High seas sites: Koko Seamount, Yuryaku Seamount, Kammu Seamount, Colahan Seamount.
Sites do not include any state waters.

Estimated number of individuals (including Applicant) to be covered under this permit: 25

Estimated number of days in the Monument: 45

Description of proposed activities: (complete these sentences):

a.) The proposed activity would…

Despite expectations that deep-sea scleractinian reefs could not exist under the harsh carbonate chemistry conditions of the N Pacific, reefs were recently discovered in the Northwestern Hawaiian Islands (NWHI) and the Emperor Seamount Chain (ESC), with 4 of 7 sites in waters undersaturated with respect to aragonite (aragonite saturation state (Ωar) range 0.71–1.33; $\Omega ar<1$ indicates undersaturation). Building on this discovery, the overarching question we will test with this work is: How is it that deep-sea scleractinian coral reefs can occur in undersaturated water, well below the hypothesized reef development limit of $\Omega ar = 0.9$? Although individual corals may be capable of calcifying in undersaturated water, it is unlikely that a three-dimensional reef structure could develop since deep-sea calcification rates are slow and most of the reef matrix is dead skeleton susceptible to dissolution. Therefore the hypotheses are: 1) These deep-sea reefs developed in saturated water and are now in undersaturated water because the aragonite saturation horizon (ASH) has shoaled over the last two centuries due to anthropogenic ocean

acidification; 2) The reefs in undersaturated water are now net dissolving; and 3) Environmental parameters other than Ωar are driving reef distribution.

b.) To accomplish this activity we would ….

To test these 3 hypotheses, 2 research cruises have been funded by NSF to characterize the reefs and environmental parameters of 9 seamounts across an Ωar gradient where reefs exist above and below the ASH. Coral and water samples will be collected, the ROV will conduct video transect surveys, and experimental dissolution blocks and in situ instrumentation will be deployed at the reef sites to investigate carbonate chemistry variability on diel (in situ instruments) to centennial (skeletal boron isotopes as a pH proxy) scales; calcification and dissolution rates; and reef ecology. Further, species distribution modeling will be used to examine the environmental factors that determine the distribution of these deep-sea reefs.

c.) This activity would help the Monument by …

This project will both substantially increase our knowledge of the deep-water communities within the monument as well as provide critical insights into deep-sea reef formation, persistence, distribution, and the effects of changing Ωar due to ocean acidification. Additionally, two key deep-sea reefs sites, SE and NW Hancock, fall into the 2016 expansion area of the PMNM which means they have not been extensively explored. So far in the entire North Pacific, deep-sea reefs are limited to only 7 known locations, 3 of which fall into the PMNM and 4 of which fall into high seas areas. Because of active trawling at all 4 high seas locations, and shoaling aragonite saturation horizons due to ocean acidification, the PMNM sites will be critical for survival of these reefs.

Other information or background:

This work builds on discoveries from the work permitted under PMNM-2014-028, and PMNM-2016-021.