

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: Randall Kosaki, Ph.D.

Affiliation: NOAA/NOS/ONMS/Papahānaumokuākea Marine National Monument

Permit Category: Research

Proposed Activity Dates: August 6-September 4, 2009

Proposed Method of Entry (Vessel/Plane): NOAA Ship HI'IALAKAI

Proposed Locations: Nihoa, Necker, French Frigate Shoals, Pearl and Hermes, Midway, Kure, others TBD

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

11

Estimated number of days in the Monument: 25

Description of proposed activities: (complete these sentences):

a.) The proposed activity would...

The proposed activities would use conventional and technical SCUBA diving technology to commence exploration and documentation of the biodiversity of the NWHI's deep coral reefs, as well as to document the presence or absence of alien/invasive species in these deep reef ecosystems. Of primary interest are surveys for the presence or absence of the invasive octocoral *Carijoa riisei*, and the invasive red alga *Hypnea musciformis*. These invasive species are spreading in the Main Hawaiian Islands, and are considered a serious threat to the southeastern end of the NWHI (Godwin et al. 2006, See 2007). An ancillary project to be opportunistically conducted while divers are at depth is to begin a characterization of the fish fauna of deep coral reefs in the NWHI.

Pacific coral reefs host greater macroscopic biodiversity than any other marine habitat (Pyle 1995, Reaka-Kudla 1997, Myers 1999). Photosynthetic corals have recently been documented to a depth of at least 165 m in the Pacific; yet only the upper 30 m is well studied (e.g., Pyle 1996, 1998). Like tropical rainforest canopies before 1970, deeper reefs are largely unexplored, and the biodiversity at depths of 30-200 m (more than 80% of the depth range of coral-reef habitat) remains almost completely unknown.

These "Mesophotic Coral Ecosystems" (MCEs) have recently been prioritized for study, due to a growing realization that the flora and fauna are both diverse and unique, and also face growing threats. Perhaps most ominously, these reefs occur at the lower limit of the aragonite saturation zone in much of the Pacific (Guinotte et al. 2006), and may be especially vulnerable to ocean acidification. The World Conservation Union (IUCN) has identified this ecosystem as a top conservation priority for reef fishes (Sadovy 2007). The biodiversity of these MCEs is threatened before its documentation has begun in earnest. We therefore propose to address both issues, and will for the first time characterize the MCE fish fauna of the NWHI while simultaneously conducting surveys for the invasive species most likely to impact these deep reef ecosystems.

b.) To accomplish this activity we would

To accomplish the primary activity, we would conduct technical trimix dives from small boats supported by NOAA ship *Hi'ialakai*. The barrier to exploring MCEs has been technological. The vast majority of research on shallow coral reefs in the NWHI and elsewhere has been conducted with conventional SCUBA, but safe and meaningful scientific research with this gear has been confined mostly to the shallowest 30 m of reef habitat. Likewise, remote sampling methods (traps and trawls) have proven ineffective for sampling this complex rocky coral-reef environment (Dennis & Aldhous 2004). Deep-sea submersibles have been used to examine marine life at depths of 30-200 m in the tropical Pacific (e.g., Hills-Colinvaux 1986, Thresher & Colin 1986, Kahng & Maragos 2006), but they typically cost \$20,000-\$60,000 per day, and are rarely deployed in remote tropical Pacific regions. Furthermore, submersibles are ill-suited to collect cryptic species typical of the reef environment. Low densities of *Hypnea* and *Carijoa* would most likely go undetected by submersible observers.

The depths of our proposed dives would range between 10-35m in depth (conventional SCUBA), and 35-90 m (trimix). Visual surveys for *Hypnea* and *Carijoa* will be conducted in areas of high-probability habitat as determined by habitat suitability modeling now being conducted by NOAA's National Centers for Coastal and Ocean Science (NCCOS) Bioecogeography team. If the invasive species in question are found, not more than three voucher specimens per dive site will be collected for taxonomic identification and genetic characterization by scientists at the University of Hawaii. Collections of *Carijoa* are also (redundantly) covered under a 2009 PMNM research permit application submitted simultaneously by Dr. Rob Toonen of the Hawaii Institute of Marine Biology. Analysis of these specimens will occur at HIMB.

To accomplish the secondary activity (fish biodiversity), divers will make presence/absence notes on fishes encountered during the invasive species survey dives. The ultimate goal of these checklists will be a published, island-by-island checklist of fishes known from the deep reefs of the NWHI. If fish species are encountered that are not readily identifiable, or may represent a new geographic record or new species, up to three voucher specimens per island/reef/atoll will be collected.

c.) This activity would help the Monument by ...

The primary activity would help the Monument by establishing a presence-or-absence baseline at the island groups intermediate in location between the Main Hawaiian Islands (presumed source of these invasive species) and the rest of the NWHI. Nihoa and Mokumanama are the two islands/banks that are the most likely gateway or stepping stones for invasive species from the MHI to the NWHI. *Carijoa* is abundant in the waters of Maui County and Oahu, and also occurs on Kauai (Godwin et al. 2006, See 2007). It is known to overgrow black coral colonies and associated substrata in the Auau Channel (and elsewhere in the MHI). It has not yet been detected in the NWHI, but small colonies have been seen at Kaula Rock, Five Fathom Pinnacle, and Niihau, all of which are geographically intermediate between the MHI and NWHI (Montgomery, personal communication). Although existing monitoring programs in the NWHI, e.g. RAMP (Reef Assessment and Monitoring Program) survey for all taxa and will record alien or invasive species when encountered, most of these surveys are conducted between 10 and 20 m depth. *Carijoa* is most abundant in 30-100 m depth, and in the NWHI, *Hypnea* is only known from depths exceeding 35 m at Mokumanamana. Thus, existing surveys are unlikely to encounter either species. If detected at an early stage of colonization and spread, eradication may be a possibility (e.g. pilot *Carijoa* eradication project in Nawiliwili Harbor on Kauai).

Other information or background: