

State of Hawaii
DEPARTMENT OF LAND AND NATURAL RESOURCES
Division of Aquatic
Resources Honolulu,
Hawaii 96813

April 23, 2021

Board of Land
and Natural Resources
Honolulu, Hawaii

Request for Authorization and Approval to Issue a Papahānaumokuākea Marine National
Monument Research Permit to Dr. Haunani H. Kane, Postdoctoral Research Fellow,
Department of Marine Science, University of Hawai'i at Hilo, for Access to State Waters
For the Research and Surveying of Sediment to Determine the Impacts of Extreme
Storms on Critical Habitat and Near Shore Marine Environments Activities

The Division of Aquatic Resources (DAR) hereby submits a request for your authorization and approval for issuance of a Papahānaumokuākea Marine National Monument Research permit to Dr. Haunani H. Kane, Postdoctoral Research Fellow, Department of Marine Science, University of Hawai'i at Hilo, pursuant to §187 A-6, Hawai 'i Revised Statutes (HRS), Chapter 13-60.5, Hawai 'i Administrative Rules (HAR), and all other applicable laws and regulations.

The Native Hawaiian practices permit, as described below, would allow entry and activities to occur in Papahānaumokuākea Marine National Monument, including the NWHI State Marine Refuge and the waters (0-3 nautical miles) surrounding the following sites:

- Nihoa
- French Frigate Shoals

The activities covered under this permit would be authorized to occur between May 2021 and May 2022.

INTENDED ACTIVITIES

The applicant, Dr. Haunani H. Kane, proposes to assess the impacts of Hurricane Walaka upon islands and the shallow marine environment at Lalo (French Frigate Shoals). Island and nearshore sediment data collection method will be used to understand shifts in dominant sediment types and sources from the nearshore reef to be properly identified. Additional surveys to collect high resolution imagery via ROV will also be used to document island sediment and shallow reef lost and subsequent recovery following Hurricane Walaka. The proposed activities will improve the understandings of the potential loss and timescales for recovery of critical habitat following extreme storm events.

The objective of this research is to assess the impacts of Hurricane Walaka upon islands and the shallow marine environment at French Frigate Shoals. The researcher's survey techniques will use a non-invasive method to collect high resolution imagery to document island sediment and shallow reef loss and subsequent recovery following Hurricane Walaka. The researcher's island and nearshore sediment data collection method will enable shifts in dominant sediment types and sources from the nearshore reef to be identified. This will enable estimates for future sediment production and replenishment to islands following environmental stressors. The proposed activities will improve the understandings of the potential loss and timescales for recovery of critical habitat following extreme storm events. The proposed activities will also improve understandings of how future sea level rise will impact essential habitats for priority species (e.g. sea turtles, monk seals, and various seabirds).

To accomplish this activity the researchers would 1) Use a remotely operated vehicle (ROV), to map and quantify the impacts of Hurricane Walaka upon 10 nearshore shallow reefs at Nihoa (2 reefs) and at FFS (8 reefs), 2) Collect GPS data and aerial imagery using an unmanned aerial system (UAS) at three islands within FFS (pending USFWS approval), and 3) Collect sediment samples (total: 200, $\frac{3}{4}$ cup volume) from the shallow marine environment (80, $\frac{3}{4}$ cup volume), and modern beach face (100, $\frac{3}{4}$ cup volume) at three islands within FFS. 3D digital reconstructions of the nearshore reef habitat, and island environments will be derived from ROV and UAS imagery (pending USFWS approval). These models will be compared to 3D models of island environments collected in 2018 by Dr. Fletcher's team (includes Dr. Kane, McDonald, and Dominique- Tavares listed on this permit), and supplement reef models collected at deeper depths by Dr. John Burns. Comparing 2018 & 2020 3D island models and sediment composition will enable sediment budgets for each island to be quantified by both sediment source, and sediment volume. 3D models of the shallow reef will enable dominant sediment sources (including but not limited to calcareous red algae, *Halimeda spp.* and coral) to be mapped and quantified. Ultimately the researchers/team will obtain detailed data on the impacts of extreme storm events, and the capacity of atoll islands to naturally recover from environmental stressors. This research will allow the researchers/team to decipher important characteristics of reduced resiliency affecting islands and critical island habitats across PMNM.

This activity would help the Monument by providing detailed analyses of island habitat and nearshore reefs is useful for determining the severity and prevalence of Hurricane Walaka impacts across FFS. By resurveying sites visited in 2018 (Gin and East Island) the researchers/team will provide visual representations of island recovery and loss. The 3D island reconstructions will provide useful data for assessing island elevation, and island sedimentary budgets. Both are useful metrics for predicting future time scales of vulnerability to storms and sea level rise. Furthermore analyses of island sediments will reveal the dependency of islands upon the adjacent nearshore reef for sediment replenishment following environmental stressors. The team's research will provide PMNM staff with guidance for responsive management of critical ecosystems and endangered species in a future of elevated sea-level.

Background

Obtaining a better understanding of the fate of reef islands is vital for understanding the future of

critical habitats at FFS and also for depicting what impacts the researchers/team may foresee for cultural, natural, and historic resources of the PMNM as a whole. The researchers island surveying methods have proved useful for determining the impacts of past and future sea level rise and storms. Combining a geologic sedimentary approach with cutting edge 3D reconstruction techniques will produce excellent data products that will enhance the researchers/team understandings of the bio-geological parameters that govern reef-island resiliency and vulnerability to climate related stressors. This research will ultimately provide useful information for managers such as the spatial and temporal dynamics of island evolution and recovery, keystone island sediment species that disproportionately contribute to island composition, and the ability to identify and map the source of keystone species upon adjacent reefs.

This information will provide guidance for PMNM managers tasked with developing responsive management plans. Atoll reef islands within the PMNM, provide critical nesting habitat for 96% of the population of the threatened Hawaiian green sea turtle (*Chelonia mydas*), one-third of the population of endangered Hawaiian monk seal (*Monachus schauinslandi*), and the largest colony of tropical seabirds in the world (Baker et al., 2006; Reynolds, et al., 2012). These critical species require stable island habitats that are becoming increasingly threatened by sea level rise (Anderson et al., 2018; Romine et al., 2013) and more frequent tropical cyclone activity (Murakami et al., 2013). In 2018, FFS received international attention after East Island was removed in its entirety following a direct hit from Walaka, a category three tropical cyclone. Since 2018 reefs and islands have both accreted and eroded by bio-geological processes that are still not fully understood.

The researchers/team activities bridge this gap in knowledge by employing non-invasive interdisciplinary approaches to address management and conservation questions during a time when impacts related to environmental change are accelerating. The researchers propose to do the following: 1) Use a remotely operated vehicle (ROV), to map and quantify the impacts of Hurricane Walaka upon 10 nearshore shallow reefs at Nihoa (2 reefs) and at FFS (8 reefs), 2) Collect GPS data and aerial imagery using an unmanned aerial system (UAS) at three islands within FFS (pending approval), 3) Collect sediment samples (total: 200, ¾ cup volume) from the shallow marine environment (80, ¾ cup volume), and modern beach face (100, ¾ cup volume) at three islands within FFS. In addition at Tern Island two shallow trenches will be sampled (not to exceed a total of 20 samples, ¾ cup volume) to compare pre and post-Walaka derived sediments. The research activities of this project build upon a 2018 data collection effort focused on assessing the impacts of sea level rise upon FFS. Pre (July 2018) and post (July 2020) Walaka UAS derived datasets will be compared to quantify island-specific volumes of sediment gains and losses. Furthermore pre and post-Walaka sediment analyses will elucidate shifts in island sediment composition and identification of island sediment sources from the nearshore reef. The resulting data of the activities proposed in this study will be critically valuable to better understandings of the timescales and spatial extent of island vulnerability and the potential for natural recovery following environmental stressors. The application and relevance of the products produced by the proposed activities extend beyond FFS and are applicable both across PMNM and to other low-lying island ecosystems such as the Maldives (Indian Ocean), Tuvalu, Kiribati and the Marshall Islands (Pacific).

Locations

At Nihoa, and French Frigate Shoals (East Island, Gin Island, La Perouse Pinnacle, and Tern Island) the researchers/team propose to collect video and photos of the shallow reef using a Trident Underwater drone (<https://www.sofarocan.com/products/trident>). At East island, Gin island, La Perouse Pinnacle, and Tern Island the researchers/team propose to collect imagery of the island and surrounding shallow nearshore environment using a unmanned aerial system (UAS) (pending USFWS approval).

At East island, Gin island, and Tern Island the researchers propose to survey, and collect sediment samples (3/4 cup) from the beach face, and the nearshore environment. At Tern Island the researchers propose to excavate two shallow trenches and collect sediment samples. The researchers will follow best management practices for moving between islands, boat operations and diving activities, and unmanned aerial systems (UAS) (pending USFWS approval).

All survey and sample locations will be conducted at sites determined by the Dr. Kane, under the guidance of PMNM resource monitors that accompany this project. The exact locations are still to be decided. Additional photos and video collected by the researchers/team documenter will document research methods and the recovery of each island following Hurricane Walaka. Images and video will be used only for educational outreach and research purposes.

Minimization of Impact

The researchers acknowledge that there are concerns with disturbing sediment from the islands and nearshore. The researchers welcome discussion with PMNM staff including cultural experts to ensure that the researchers/team research is conducted in a manner that is respectful of the place, and its cultural, natural, and historical resources. All survey and sample locations will be conducted at sites determined by the Dr. Kane, under the guidance of PMNM resource monitors that accompany this project. For sediment sample collection at Tern Island the researchers will consult USFWS contaminants biologist. Collection equipment will be inspected and disinfected between sampling different areas to mitigate for the spread of aquatic invasive species, coral disease or other pathogens or parasitic organisms. Best efforts will be made to ensure that the collection of samples is conducted in such a manner as the process does not result in any additional harm to surrounding marine or terrestrial organisms. Efforts will be made to distribute collection activities across shoreline/reef flat/benthic areas, so as not to consolidate the impacts of data collection in one location.

As a means to ensure that the researchers/team research aligns with PMNM the researchers will follow best management practices for moving between islands, boat operations and diving activities, and unmanned aerial systems. The researchers will be operating a drone to collect high-resolution imagery of FFS islands (pending USFWS approval). In July 2018 the researchers/team drone pilot Kristian McDonald successfully collected drone imagery and constructed 3D, Digital Elevation Models (DEMs) of East Island, and Gin Island. This baseline data will be compared to 2020 3D DEMs to quantify changes in the volume of sediment loss and gain following Hurricane Walaka. Kristian is a DOT/FAA certified remote pilot and has experience piloting UAS in FFS and working with PMNM resource monitors to assure that the

researchers make every effort to follow established drone protocols and best management practices. The researchers will also seek guidance from the PMNM before any UAS derived data is made publicly available. Additional photos and video collected by the researchers/team documenter will document research methods and the recovery of each island following Hurricane Walaka. Images and video will be used only for educational outreach and research purposes.

Cultural Protocol

The researchers/team research group will pay respect and conduct culturally appropriate protocols at each island visited as well as throughout the research to continue to connect to place and stay grounded as a group. As a part of researcher's cultural plan, the team's research cruise will be conducted in partnership with the Office of Hawaiian Affairs and Nā Maka Onaona. The team will have group discussions centered around huli 'ia, a tool developed by Nā Maka Onaona, to document environmental observations experienced through all of the researchers/team senses while in Papahānaumokuākea. Researchers will participate in discussions contributing their observations sharing noticeable dominant characteristics of lanī (sky), honua (earth), and kai (ocean) as a way to characterize that time (season) and space (Papahānaumokuākea). This broader holistic view will support the researchers/team research team in intimately understanding moods and characteristics of Papahānaumokuākea and through this documentation process, supports the development of best practices enabling communities to adjust and adapt their activities to assist in mālama 'āina (care for the land). In addition as a part of the researchers/team cultural plan, the researchers will provide data and information to assist the Cultural Working Group's effort to develop Hawaiian names and descriptions for new processes and spaces that may be encountered in the island and in the shallow nearshore environment. Finally, in an effort to create intergenerational capacity building, native Hawaiian students and early scholars will be included in the research team, and be mentored in all aspects from research development, fieldwork, and post-cruise data analysis.

Importance of Research in the PMNM

There is no practicable alternative to conducting activities in the Monument. The researchers are addressing questions that are directly relevant to the very existence of critical habitat within the Monument in a future of increased impacts related to more prevalent and intense hurricanes and elevated sea level. Hence the study must be carried out within the Monument. The researchers are limiting the study site to Nihoa and four islands at FFS. Lessons learned from FFS are applicable to low lying sandy islands throughout the PMNM. An important implication of this work is relevant to endangered species management plans. As sandy habitat in PMNM becomes unstable as a result of increased storminess and sea level rise the main Hawaiian Islands may be considered as future replacement habitat. Therefore, it is the specific location of PMNM that is necessary for this research.

The management value of data produced by the team's research activities outweighs the impacts upon Monument resources. FFS has already experienced island lost at Disappearing island, Trig Island, and most recently East Island following Hurricane Walaka in 2018. Devastating impacts on reefs at FFS have also documented. Furthermore, a preliminary study by the USGS predicts that under 2 m of sea level rise five of the nine islands at FFS will be completely submerged assuming a passive inundation model. Here the researchers propose to improve upon previous

studies by characterizing Hurricane Walaka impacts and recovery of the critical island and shallow reef habitats.

This project will contribute to the formulation of monitoring and management action for reefs and island habitats at French Frigate Shoals. The researcher's project will increase conservation and management capacity for mitigating the impacts of hurricane damage and sea level rise thus contributing to the decision making ability for stewardship of PMNM. Research products produced at FFS are applicable across the PMNM. In addition, the researchers will do their best to ensure that the team's methods have minimal impact on monument resources. Finally, the researchers will work with PMNM staff, including the OHA, to return samples in a culturally appropriate manner.

Procedures/Methods

1.) Map shallow reefs using an ROV.

The researchers/team propose to use a remotely operated vehicle (ROV), to map and quantify the impacts of Hurricane Walaka upon 10 nearshore shallow reefs at Nihoa (2 reefs) and at FFS (8 reefs). ROV derived imagery will be post-processed at the University of Hawai'i using Structure-from-Motion. 3D models and orthophotos of the shallow reef habitat will be created for each surveyed site. The researchers anticipate surveying at most 2 sites at Nihoa, and approximately 2 sites at each island at FFS (La Perouse, Gin, East, and Tern Islands). Surveyed sites will be approximately 100 m² in size. The ROV used by the team is a Trident Underwater drone (<https://www.sofarocan.com/products/trident>).

The researchers ROV is compact (7.5 lbs. and 16.1in x 8.1in x 3.4in) and is tethered to the surface where real-time video enables the pilot to navigate the ROV. The ROV will be deployed from a small boat operated by the SSV Makani Olu crew. The team is experienced in operating the ROV in numerous coastal and nearshore settings. The researchers will follow the protocols from the PMNM Boating and Diving BMP. The researchers will avoid contact with live corals and take great care when navigating around islands so that corals are not impacted by the team's work.

2.) UAS island surveys (pending USFWS approval)

Topographic or island elevations will be acquired from UAS imagery. The researchers/team propose to collect high resolution imagery of 3 islands (Gin, East, and Tern Islands) and the surrounding nearshore environment using a UAS equipped with an internal GPS and a camera (pending USFWS approval). Canvas targets (1 m x 1 m) will be laid out on the island at the time that imagery is collected and later surveyed with an RTK-GPS for ground control. The RTKGPS includes a fixed base station that will sit on a tripod during the duration of the survey. The rover system is attached to a pole, and the surveyor will transport the rover to each survey site (corners of trenches, GPS control points, and geological features). UAS imagery and GPS control points will be post-processed at the University of Hawai'i. A topographic DEM of each island will be derived from UAS imagery using Structure-from-Motion.

3.) Sediment collection.

The researchers propose to collect no more than 200 sediment samples (not to exceed ¾ cup volume) from the shallow marine environment (80, ¾ cup volume), and modern beach face (100,

¾ cup volume). Sampling the shallow seafloor will involve a small team (at least 2 people) deploying a benthic sediment sampler from a small boat operated by the crew of the SSV Makani Olu. The benthic sediment sampler will be tethered to the boat. Sediment will be sampled adjacent to ROV survey sites (at least 2 samples per survey site) and additional sandy sites surrounding each island. If necessary, the team may also enter the nearshore marine environment with snorkel gear to recover sediment. The researchers will follow the protocols from the PMNM Boating and Diving BMP. The researchers will avoid contact with live corals and take great care when navigating around islands so that corals are not impacted by the team's work. No more than 100 sediment samples will be collected from the beach face at Gin, East, and Tern island. At Tern Island, two shallow trenches will be sampled (not to exceed a total of 20 samples, ¾ cup volume) to compare pre and post Walaka derived sediments. The researchers anticipate trenching along the beach side of the runway as this site was noted in 2019 to have Walaka lagoon sediments deposited upon the Pre Walaka soil and subsurface sand layer. Trenches will not exceed 1 m x 1 m x 1 m in size. Trenches will be opened only long enough to be described, sampled (no more than 20 samples total), and photographed. Each trench will be backfilled with preexisting sediment. The researchers don't anticipate any trenches being left unattended or opened overnight. The researchers hope these measures will limit the potential for a listed species (turtle or monk seal) from entering the trench. Furthermore, the researchers will consult with the resource monitor that accompanies them on the proposed project and the USFWS contaminants biologist to determine the safest place to excavate at Tern island. Sediment samples will be taken back to the University of Hawai'i for compositional analysis under the microscope, and radiocarbon dating. Upon completion of analyses, samples will be returned to PMNM under the guidance of PMNM staff including the OHA. The researchers will not collect any living specimens however they do anticipate collecting skeletal reef derived material in the beach and nearshore sediment samples. Anticipated organisms include sand-sized fragments of unidentified coral species, red calcareous algae, green calcareous algae (*Halimeda* spp.), mollusks, and foraminifera (e.g. *Amphistigena*). Samples will not exceed 200 samples (each approximately ¾ cup in size). Sediment and fossil reef samples will be stored in sample bags and transported out of the monument on the chartered vessel. Specimens will be returned to PMNM staff under the guidance of PMNM. The Office of Hawaiian Affairs will be consulted for cultural guidance.

Gear. The following specialized gear and materials to be used in this activity: Shovel, Elevation survey equipment (total station, tripod, survey rod, survey ribbon, survey prism, canvas targets, brunton compass, RTK GPS base station and rover, etc.), Phantom drone – ONLY after approval (lithium batteries, ipad) Trident Underwater drone and ipad, Miscellaneous tools (handheld GPS, notebooks, walkie talkies, cameras, measuring, tape, etc.), Snorkeling gear (mask, fins) and Sample bags and vials

The purpose of the researchers/team proposed activities is to collect imagery and sediment samples to assess the impacts of Hurricane Walaka upon islands and the shallow marine environment. This work is needed in order to monitor and track changes in island erosion and accretion, and future island sediment availability. The researchers/team activities will improve understandings of potential loss and recovery of essential habitats for priority species.

The actual fieldwork component of this research involves the minimum time required to obtain the desired data necessary to assess the impacts and recovery of critical habitat following

Hurricane Walaka. Because SSV Makani Olu is largely powered by wind, the researchers/team anticipate the majority of the 15 days will be for transiting from O‘ahu, with a maximum of 5 days allotted for research at FFS and Nihoa. Weather permitting, the researchers/team propose to visit 4 islands at FFS (Gin, East, Tern, La Perouse), and Nihoa during the 15 day period. The researchers surveying methods and procedures are designed to be as un-invasive and thorough as possible. The researchers will utilize a unique approach to assessing the impacts and recovery of the island and shallow reef environments to decipher the dynamics between sediment production at reefs and sediment delivery to adjacent islands. The researchers have successfully implemented these methodologies in similar studies at ‘Upolu Island, Sāmoa, the Republic of the Marshall Islands, and at FFS in July of 2018. The researchers island and shallow reef surveys will enable 3D reconstructions of shallow coral habitats and island environments. These methods are non-invasive and provide high-resolution data pertaining to reef and island topography that cannot be acquired from remotely sensed satellite imagery. Sediment sampling will enable island sediment sources and availability from the shallow marine environment to be quantified. Comparisons to data collected in 2018 provide baselines for detecting changes in island and reef sediment sources following Hurricane Walaka.

Ultimately this work will provide the PMNM with a comprehensive and robust dataset pertaining to the vulnerability and or resiliency of atoll reef islands systems to environmental stressors such as storms and sea level rise. Islands and corals are cultural and ecological resources that provide critical habitat to a multitude of marine and terrestrial species.

To safeguard Monument resources, there will be at least two Papahānaumokuākea trained Resource Monitors on the expedition which the applicant has agreed to consult with on any activities. Additionally, the applicant would abide by the following PMNM Best Management Practices (BMPs) while conducting the aforementioned activities within the PMNM: Best Management Practices for Boat Operations and Diving Activities (BMP #004); Human Hazards to Seabirds (BMP#003); Special Conditions and Rules for Moving Between Islands/Atolls and Packing for Field Camps (BMP#007); Best Practices for Minimizing the Impact of Artificial Light on Sea Turtles (BMP#009); Marine Wildlife Viewing Guidelines (BMP #010); Disease and Introduced Species Prevention Protocol for Permitted Activities in the Marine Environment (BMP #011) and Best Management Practices for Maritime Heritage Sites (BMP#017).

The activity would provide manager’s insight into how sea-level rise and perturbations to the island’s shape and nearshore bathymetry at Lalo will affect the convergence or divergence of wave-driven sand transport, causing the islands to accrete or erode, respectively in the Monument. The research will provide Papahānaumokuākea Marine National Monument (PMNM) staff with guidance for responsive management of critical ecosystems and endangered species in a future of elevated sea-level. Lessons learned at Lalo will be applicable throughout the rest of Papahānaumokuākea.

The applicant’s proposed activities directly support the Monument Management Plan (MMP) Marine Conservation Science (MCS) Action Plan Strategy MCS-1: *Continue and enhance research, characterization and monitoring of marine ecosystems* (PMNM MMP Vol. I, p. 122, 2008).

MMB Agency Reviewer Questions and Applicant Responses:**QUESTIONS:**

1. What are the exact goals at Nihoa? The application mentions surveys on the impacts of Hurricane Walaka but were there actual hurricane impacts at Nihoa? If so, could the applicant expand on that?

The goal of research conducted at Nihoa will be to collect ROV derived video from 1-3 reefs depending upon time constraints. Prior reef surveys following Hurricane Walaka did not record hurricane Impacts at Nihoa. Rather our surveys will be conducted to document the current status of the reefs themselves and to collect high quality video for research and educational purposes.

2. What would be the roles of the 10th, 11th and 12th TBD people listed in the application? A science party of 12 seems more than necessary to conduct the proposed activities.

Researcher number 10 will be Kainalu Steward, a Coastal Geologist from UH Hilo. Kainalu will assist with sediment collection and surveying the islands. Researcher 11 and 12 have yet to be determined. Everyone on the ship is being counted under my permitted activities in the instance that I need certain persons help. This does not mean that all 12 will be on an islet at a given time.

3. Has the applicant successfully made DEMs from ROV video before? It would be good to ensure that the method is worked out before collecting data in PMNM.

Yes, our team has successfully made DEMs and photomosaics from ROV video. This process involves using a computer code to splice video into individual frames or photographs. These photographs are then rendered into orthophotomosaics and digital elevation models using photogrammetry software such as Structure-From-Motion. In addition a snorkeler will deploy and recover 1-5 small (approximate size of a standard ruler) survey markers within the surveyed area. The survey markers will be used to scale the final DEMs and orthophotos.

At least two individuals will be trained in all aspects of piloting, deploying survey markers, and creating DEMs prior to the trip to ensure that all methods are worked out before collecting data in PMNM.

4. What is the sediment sampler? Can the applicant describe or illustrate its configuration? What kind of controls will there be on its operation to ensure that hard bottom or live coral amongst the target sediment will not be damaged? Will the ROV or snorkelers ensure that the contact is made directly with the bottom to ensure it is sediment?

An image of the sediment sampler is provided below.



The metal cylinder is open on one end and attached to a rope. It is deployed from the small boat. This instrument was successfully used in 2018 by participants on this permit application to collect nearshore sediment surrounding East Island and the Gins. Prior to deployment either a snorkeler, the ROV, or in shallow waters a researcher will observe from the small boat to ensure that no contact is made with hard bottom or live coral. In areas with hard bottom or coral we will rely upon the snorkeler to retrieve sediment instead of the sediment sampler.

5. Given the potential for monk seals and sea turtles to be hauled out on East and Gin islands, and considering the relatively small size of these islands, access to conduct activities on East and Gin islands shall be determined in consultation with the designated resource monitor based on local conditions.

We will work with resource monitors prior to conducting activities at East and Gin Islands to ensure that we have limited impact upon wildlife.

6. NMFS requests that land access to Tern Island be limited to the minimum number of people necessary for the activities to be conducted, and that landing on the island be done at the boat ramp or pier on the west side of the island.

We will work with resource monitors to ensure that land access is made at the boat ramp or pier on the west side of the island. Land access will be limited to necessary personnel to conduct the activities outlined in our permit.

7. While accessing the land portions of Tern Island, all permitted individuals must be accompanied by the resource monitor, unattended individuals should not be allowed.

We will work with the resource monitor to ensure that he/she accompanies our team while accessing land portions of Tern Island.

8. The applicant must be aware of and abide by the minimum viewing distance in the Marine Life Viewing Guidelines for protected species while in the Monument.

We have referenced the Marine Life Viewing Guidelines best management practices and will follow guidance provided for the Hawaiian monk seal, other marine mammals, turtles, etc.

9. It is recommended prior to departure, that the applicant and designated resource monitor contact the Hawaiian Monk Seal Research Program (Michelle Barbieri at Michelle.Barbieri@noaa.gov) and Marine Turtle Biology and Assessment Program (Yonat Swimmer at Yonat.Swimmer@noaa.gov) to discuss protected species concerns in

preparation for conducting the proposed activities.

The Office of Hawaiian Affairs, as the trip sponsor, is already discussing with the Hawaiian Monk Seal Research Program about ways to coordinate agency needs and concerns.

COMMENTS / RECOMMENDATIONS:

1. A PMNM designated Resource Monitor will be required to accompany this expedition. The USFWS thanks you for having Resource Monitors as part of your planned crew.

We look forward to working and learning alongside the Resource Monitor(s).

2. Due to DOI Secretarial Order, drone (UAS) use will not be permitted over USFWS managed lands or waters unless the order is reversed prior to conducting activities.

We understand this mandate and will not fly our drone over USFWS managed lands unless the ruling is overturned.

3. For trenching on islands with native vegetation, removed sand should be placed onto a tarp while digging and collecting is conducted in order to minimize disturbance. This was done on East Island under the Fletcher permit.

As was done in 2018, removed sand will be placed on a tarp while digging and collecting to minimize disturbance. All shallow trenches will be infilled immediately after sampling is completed.

4. Trenching locations must first be coordinated with LeeAnn Woodward (USFWS) to avoid contaminated areas of Tern Island.

We will coordinate with LeeAnn Woodward regarding trenching locations at Tern Island.

5. Trenching activities must first be coordinated with NOAAs Marine Turtle Biology and Assessment Program to mitigate risk to sea turtle nesting sites.

We will consult NOAAs Marine Turtle Biology and Assessment Program, and work with our resource manager to mitigate risk to turtle nesting sites.

6. The USFWS recommends approval of this permit.

Thank you.

7. If sediment is returned after analysis in the MHI, it should be sterilized before bringing it back to the PMNM.

Sediment will be sterilized before return to PMNM. In addition will consult PMNM management and resource monitors to determine the best way to carry out the return of materials

prior to doing so.

8. DAR requests the following condition to be included in the permit (if this is not already stated in the permit conditions or BMPs): *No direct interaction with, disturbance of, impact to or placement of benthic sediment sampler, remotely operated vehicle (ROV), or other gear or equipment on coral or live rock (defined as any natural hard substrate to which marine life is visibly attached or affixed).*

Understood!

Environmental Compliance:

NEPA / HEPA: (check-one)

Categorical Exclusion / Exempt Class _____

EA _____

EIS _____

Other Consultations: (ESA/MMPA Section 7; NHPA Section 106, etc.)

- A request to the National Marine Fisheries Service (NMFS) for Section 7 informal consultation coverage pursuant to the Endangered Species Act of 1973 is underway to have the proposed activities considered under PMNM's programmatic Section 7 informal consultation. The outcome of this request may require the applicant to adhere to other NMFS-prescribed conditions. Such conditions would be reflected in the PMNM permit, prior to issuance.
- An informal review of all aforementioned activities following section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA; 16 U.S.C. 1855(b)) was completed on March 25, 2021 by NOAA National Marine Fisheries Service (NMFS) Pacific Islands Regional Office (PIRO) for the Habitat Conservation Division. NMFS is concerned that there is the potential for the unavoidable loss of EFH from physical damage, and degradation of the quality of EFH from exposure to chemical contaminants, pollution, and waste and discharge. NMFS expects that many potential adverse effects from the proposed activity will be reduced due to implementation of the Monument-imposed BMPs. However, to further avoid and minimize the risk to EFH in the project area, NMFS offers the conservation recommendations to be added as Special Conditions below:
 - *Conservation Recommendation 1:* To avoid physical damage to corals during transit to and from Nihoa and FFS, a spotter should be placed in the bow of the dingy to watch for exposed or near surface coral heads.

- *Conservation Recommendation 2:* Measures should be implemented to prevent detergents and other cleaners from being washed overboard.

The Department has made an exemption determination for this permit in accordance chapter 343, HRS, and Chapter 11-200, HAR. See Attachment (“DECLARATION OF EXEMPTION FROM THE PREPARATION OF AN ENVIRONMENTAL ASSESSMENT UNDER THE AUTHORITY OF CHAPTER 343, HRS AND CHAPTER 11-200 HAR, FOR PAPA HĀNAUMOKUĀKEA MARINE NATIONAL MONUMENT RESEARCH PERMIT TO DR. HAUNANI H. KANE, POSTDOCTORAL RESEARCH FELLOW, DEPARTMENT OF MARINE SCIENCE, UNIVERSITY OF HAWAI‘I AT HILO, FOR ACCESS TO STATE WATERS FOR THE RESEARCH AND SURVEYING OF SEDIMENT TO DETERMINE THE IMPACTS OF EXTREME STORMS ON CRITICAL HABITAT AND NEAR SHORE MARINE ENVIRONMENTS ACTIVITIES UNDER PERMIT PMNM-2021-008”)

Has Applicant been granted a permit from the State in the past? Yes No

If so, please summarize past permits:

Have there been any a) violations: Yes No

 b) Late/incomplete post-activity reports: Yes No

Are there any other relevant concerns from previous permits? Yes No

STAFF OPINION:

DAR staff is of the opinion that Applicant has properly demonstrated valid justifications for his application and should be allowed to enter the NWHI State waters and to conduct the activities therein as specified in the application with certain special instructions and conditions, which are in addition to the Papahānaumokuākea Marine National Monument Research Permit General Conditions. All suggested special conditions have been vetted through the legal counsel of the Co-Trustee agencies (see Recommendation section).

MONUMENT MANAGEMENT BOARD OPINION:

The MMB is of the opinion that the Applicant has met the findings of Presidential Proclamation 8031 and this activity may be conducted subject to completion of all compliance requirements. The MMB concurs with the special conditions recommended by NOAA, USFWS, ONMS, DAR, DOFAW and OHA staff.


RECOMMENDATION:

Based on the attached proposed declaration of exemption prepared by the department after consultation with and advice of those having jurisdiction and expertise for the proposed permit actions:

1. That the Board declare that the actions which are anticipated to be undertaken under this permit will have little or no significant effect on the environment and is therefore exempt from the preparation of an environmental assessment.
2. Upon the finding and adoption of the department's analysis by the Board, that the Board delegate and authorize the Chairperson to sign the declaration of exemption for purposes of recordkeeping requirements of chapter 343, HRS, and chapter 11-200, HAR.
3. That the Board authorize and approve a Research Permit to Dr. Haunani H. Kane, Postdoctoral Research Fellow, Department of Marine Science, University of Hawai'i at Hilo, for Access to State Waters For the Research and Surveying of Sediment to Determine the Impacts of Extreme Storms on Critical Habitat and Near Shore Marine Environments, with the following special conditions:
 - a. This permit is not to be used for nor does it authorize the sale of collected organisms. Under this permit, the authorized research activities must be for noncommercial purposes not involving the use or sale of any organism, by-products, or materials collected within the Monument for obtaining patent or intellectual property rights.
 - b. The permittee may not convey, transfer, or distribute, in any fashion (including, but not limited to, selling, trading, giving, or loaning) any coral, live rock, or organism collected under this permit without the express written permission of the Co-Trustees.
 - c. To prevent introduction of disease or the unintended transport of live organisms, the permittee must comply with the disease and transport protocol attached to this permit.
 - d. Tenders and small vessels must be equipped with engines that meet EPA emissions requirements.
 - e. Refueling of tenders and all small vessels must be done at the support ships and outside the confines of lagoons or near-shore waters in the State Marine Refuge.
 - f. No fishing is allowed in State Waters except as authorized under state law for subsistence, traditional, and customary practices by Native Hawaiians.
 - g. If there is any Hawaiian monk seal or any other protected species in the area when performing any permitted activity shall cease until the animal(s) depart the area, except as permitted for specific management of that species.

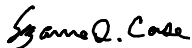
- h. For all activities requiring landing on uninhabited islands an authorized staff escort trained for each particular inhabited island will be included on the landing team.
- i. The permittee is required to follow all applicable Federal, State, and County laws with respect to the COVID-19 emergency response that apply at the time of departure and return. In issuance of this permit, the State of Hawaii is not otherwise monitoring or regulating permittee's compliance with COVID-19 laws and is not responsible for the health and safety of crew members, researchers or other occupants of the vessel associated with this permit.

Respectfully submitted,



Brian J. Neilson, Administrator
Division of Aquatic Resources

APPROVED FOR SUBMITTAL

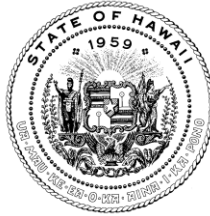


Suzanne D. Case, Chairperson
Board of Land and Natural Resources

Attachments:

- 1) Declaration of Exemption ("DE") from the Preparation of an Environmental Assessment under the Authority of Chapter 343, HRS & Chapter 11-200 HAR
- 2) PMNM Application
- 3) PMNM Compliance Information Sheet ("CIS Form")

DAVID Y. IGE
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
FIRST DEPUTY

M. KALEO MANUEL
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

April 23, 2021

TO: Division of Aquatic Resources File

THROUGH: Suzanne D. Case, Chairperson

FROM: Brian J. Neilson, Administrator
Division of Aquatic Resources

A handwritten signature in black ink, appearing to read "Brian J. Neilson".

SUBJECT:

DECLARATION OF EXEMPTION FROM THE PREPARATION OF AN ENVIRONMENTAL ASSESSMENT UNDER THE AUTHORITY OF CHAPTER 343, HRS AND CHAPTER 11-200 HAR, FOR A PAPAĀNAUMOKUĀKEA MARINE NATIONAL MONUMENT RESEARCH PERMIT TO DR. HAUNANI H. KANE, POSTDOCTORAL RESEARCH FELLOW, DEPARTMENT OF MARINE SCIENCE, UNIVERSITY OF HAWAI‘I AT HILO, FOR ACCESS TO STATE WATERS FOR THE RESEARCH AND SURVEYING OF SEDIMENT TO DETERMINE THE IMPACTS OF EXTREME STORMS ON CRITICAL HABITAT AND NEAR SHORE MARINE ENVIRONMENTS ACTIVITIES UNDER PERMIT PMNM-2021-008.

The following permitted activities are found to be exempted from preparation of an environmental assessment under the authority of Chapter 343, HRS and Chapter 11-200, HAR:

Project Title: Papahānaumokuākea Marine National Monument Research Permit to Dr. Haunani H. Kane, Postdoctoral Research Fellow, Department of Marine Science, University of Hawai‘i at Hilo, for Access to State Waters For the Research and Surveying of Sediment to Determine the Impacts of Extreme Storms on Critical Habitat and Near Shore Marine Environments Activities.

Permit Number: PMNM-2021-008

Project Description: The applicant, Dr. Haunani H. Kane, proposes to assess the impacts of Hurricane Walaka upon islands and the shallow marine environment at Lalo (French Frigate Shoals), during expeditions planned between May 2021 and May 2022. Island and nearshore sediment data collection method will be used to understand shifts in dominant sediment types and sources from the nearshore reef to be properly identified. Additional surveys to collect high resolution imagery via ROV will also be used to document island sediment and shallow reef lost and subsequent recovery following Hurricane Walaka.

The proposed activities will improve the understandings of the potential loss and timescales for recovery of critical habitat following extreme storm events.

The objective of this research is to assess the impacts of Hurricane Walaka upon islands and the shallow marine environment at French Frigate Shoals. The researcher's survey techniques will use a non-invasive method to collect high resolution imagery to document island sediment and shallow reef lost and subsequent recovery following Hurricane Walaka. The researcher's island and nearshore sediment data collection method will enable shifts in dominant sediment types and sources from the nearshore reef to be identified. This will enable estimates for future sediment production and replenishment to islands following environmental stressors. The proposed activities will improve the understandings of the potential loss and timescales for recovery of critical habitat following extreme storm events. The proposed activities will also improve understandings of how future sea level rise will impact essential habitats for priority species (e.g. sea turtles, monk seals, and various seabirds).

To accomplish this activity the researchers would 1) Use a remotely operated vehicle (ROV), to map and quantify the impacts of Hurricane Walaka upon 10 nearshore shallow reefs at Nihoa (2 reefs) and at FFS (8 reefs), 2) Collect GPS data and aerial imagery using an unmanned aerial system (UAS) at three islands within FFS (pending USFWS approval), and 3) Collect sediment samples (total: 200, ¾ cup volume) from the shallow marine environment (80, ¾ cup volume), and modern beach face (100, ¾ cup volume) at three islands within FFS. 3D digital reconstructions of the nearshore reef habitat, and island environments will be derived from ROV and UAS imagery (pending USFWS approval). These models will be compared to 3D models of island environments collected in 2018 by Dr. Fletcher's team (includes Dr. Kane, McDonald, and Dominique- Tavares listed on this permit), and supplement reef models collected at deeper depths by Dr. John Burns. Comparing 2018 & 2020 3D island models and sediment composition will enable sediment budgets for each island to be quantified by both sediment source, and sediment volume. 3D models of the shallow reef will enable dominant sediment sources (including but not limited to calcareous red algae, *Halimeda spp.* and coral) to be mapped and quantified. Ultimately the researchers/team will obtain detailed data on the impacts of extreme storm events, and the capacity of atoll islands to naturally recover from environmental stressors. This research will allow the researchers/team to decipher important characteristics of reduced resiliency affecting islands and critical island habitats across PMNM.

This activity would help the Monument by providing detailed analyses of island habitat and nearshore reefs is useful for determining the severity and prevalence of Hurricane Walaka impacts across FFS. By resurveying sites visited in 2018 (Gin and East Island) the researchers/team will provide visual representations of island recovery and loss. The 3D island reconstructions will provide useful data for assessing island elevation, and island sedimentary budgets. Both are useful metrics for predicting future time scales of vulnerability to storms and sea level rise. Furthermore analyses of island sediments will reveal the dependency of islands upon the adjacent nearshore reef for sediment replenishment following environmental stressors. The team's research will provide PMNM staff with guidance for responsive management of critical ecosystems and endangered species in a future of elevated sea-level.

Background

Obtaining a better understanding of the fate of reef islands is vital for understanding the future of critical habitats at FFS and also for depicting what impacts the researchers/team may foresee for cultural, natural, and historic resources of the PMNM as a whole. The researchers island surveying methods have proved

useful for determining the impacts of past and future sea level rise and storms. Combining a geologic sedimentary approach with cutting edge 3D reconstruction techniques will produce excellent data products that will enhance the researchers/team understandings of the bio-geological parameters that govern reef-island resiliency and vulnerability to climate related stressors. This research will ultimately provide useful information for managers such as the spatial and temporal dynamics of island evolution and recovery, keystone island sediment species that disproportionally contribute to island composition, and the ability to identify and map the source of keystone species upon adjacent reefs.

This information will provide guidance for PMNM managers tasked with developing responsive management plans. Atoll reef islands within the PMNM, provide critical nesting habitat for 96% of the population of the threatened Hawaiian green sea turtle (*Chelonia mydas*), one-third of the population of endangered Hawaiian monk seal (*Monachus schauinslandi*), and the largest colony of tropical seabirds in the world (Baker et al., 2006; Reynolds, et al., 2012). These critical species require stable island habitats that are becoming increasingly threatened by sea level rise (Anderson et al., 2018; Romine et al., 2013) and more frequent tropical cyclone activity (Murakami et al., 2013). In 2018, FFS received international attention after East Island was removed in its entirety following a direct hit from Walaka, a category three tropical cyclone. Since 2018 reefs and islands have both accreted and eroded by bio-geological processes that are still not fully understood.

The researchers/team activities bridge this gap in knowledge by employing non-invasive interdisciplinary approaches to address management and conservation questions during a time when impacts related to environmental change are accelerating. The researchers propose to do the following: 1) Use a remotely operated vehicle (ROV), to map and quantify the impacts of Hurricane Walaka upon 10 nearshore shallow reefs at Nihoa (2 reefs) and at FFS (8 reefs), 2) Collect GPS data and aerial imagery using an unmanned aerial system (UAS) at three islands within FFS (pending approval), 3) Collect sediment samples (total: 200, ¾ cup volume) from the shallow marine environment (80, ¾ cup volume), and modern beach face (100, ¾ cup volume) at three islands within FFS. In addition at Tern Island two shallow trenches will be sampled (not to exceed a total of 20 samples, ¾ cup volume) to compare pre and post-Walaka derived sediments.

The research activities of this project build upon a 2018 data collection effort focused on assessing the impacts of sea level rise upon FFS. Pre (July 2018) and post (July 2020) Walaka UAS derived datasets will be compared to quantify island-specific volumes of sediment gains and losses. Furthermore pre and post-Walaka sediment analyses will elucidate shifts in island sediment composition and identification of island sediment sources from the nearshore reef. The resulting data of the activities proposed in this study will be critically valuable to better understandings of the timescales and spatial extent of island vulnerability and the potential for natural recovery following environmental stressors. The application and relevance of the products produced by the proposed activities extend beyond FFS and are applicable both across PMNM and to other low-lying island ecosystems such as the Maldives (Indian Ocean), Tuvalu, Kiribati and the Marshall Islands (Pacific).

Locations

At Nihoa, and French Frigate Shoals (East Island, Gin Island, La Perouse Pinnacle, and Tern Island) the researchers/team propose to collect video and photos of the shallow reef using a Trident Underwater drone (<https://www.sofarocan.com/products/trident>). At East island, Gin island, La Perouse Pinnacle, and Tern Island the researchers/team propose to collect imagery of the island and surrounding shallow nearshore environment using a unmanned aerial system (UAS) (pending USFWS approval).

At East island, Gin island, and Tern Island the researchers propose to survey, and collect sediment samples (3/4 cup) from the beach face, and the nearshore environment. At Tern Island the researchers propose to excavate two shallow trenches and collect sediment samples.

The researchers will follow best management practices for moving between islands, boat operations and diving activities, and unmanned aerial systems (UAS) (pending USFWS approval).

All survey and sample locations will be conducted at sites determined by the Dr. Kane, under the guidance of PMNM resource monitors that accompany this project. The exact locations are still to be decided. Additional photos and video collected by the researchers/team documenter will document research methods and the recovery of each island following Hurricane Walaka. Images and video will be used only for educational outreach and research purposes.

Minimization of Impact

The researchers acknowledge that there are concerns with disturbing sediment from the islands and nearshore. The researchers welcome discussion with PMNM staff including cultural experts to ensure that the researchers/team research is conducted in a manner that is respectful of the place, and its cultural, natural, and historical resources. All survey and sample locations will be conducted at sites determined by the Dr. Kane, under the guidance of PMNM resource monitors that accompany this project. For sediment sample collection at Tern Island the researchers will consult USFWS contaminants biologist. Collection equipment will be inspected and disinfected between sampling different areas to mitigate for the spread of aquatic invasive species, coral disease or other pathogens or parasitic organisms. Best efforts will be made to ensure that the collection of samples is conducted in such a manner as the process does not result in any additional harm to surrounding marine or terrestrial organisms. Efforts will be made to distribute collection activities across shoreline/reef flat/benthic areas, so as not to consolidate the impacts of data collection in one location.

As a means to ensure that the researchers/team research aligns with PMNM the researchers will follow best management practices for moving between islands, boat operations and diving activities, and unmanned aerial systems. The researchers will be operating a drone to collect high-resolution imagery of FFS islands (pending USFWS approval). In July 2018 the researchers/team drone pilot Kristian McDonald successfully collected drone imagery and constructed 3D, Digital Elevation Models (DEMs) of East Island, and Gin Island. This baseline data will be compared to 2020 3D DEMs to quantify changes in the volume of sediment loss and gain following Hurricane Walaka. Kristian is a DOT/FAA certified remote pilot and has experience piloting UAS in FFS and working with PMNM resource monitors to assure that the researchers make every effort to follow established drone protocols and best management practices. The researchers will also seek guidance from the PMNM before any UAS derived data is made publicly available. Additional photos and video collected by the researchers/team documenter will document research methods and the recovery of each island following Hurricane Walaka. Images and video will be used only for educational outreach and research purposes.

Cultural Protocol

The researchers/team research group will pay respect and conduct culturally appropriate protocols at each island visited as well as throughout the research to continue to connect to place and stay grounded as a group. As a part of researcher's cultural plan, the team's research cruise will be conducted in partnership

with the Office of Hawaiian Affairs and Nā Maka Onaona. The team will have group discussions centered around huli 'ia, a tool developed by Nā Maka Onaona, to document environmental observations experienced through all of the researchers/team senses while in Papahānaumokuākea. Researchers will participate in discussions contributing their observations sharing noticeable dominant characteristics of lani (sky), honua (earth), and kai (ocean) as a way to characterize that time (season) and space (Papahānaumokuākea). This broader holistic view will support the researchers/team research team in intimately understanding moods and characteristics of Papahānaumokuākea and through this documentation process, supports the development of best practices enabling communities to adjust and adapt their activities to assist in mālama 'āina (care for the land). In addition as a part of the researchers/team cultural plan, the researchers will provide data and information to assist the Cultural Working Group's effort to develop Hawaiian names and descriptions for new processes and spaces that may be encountered in the island and in the shallow nearshore environment. Finally, in an effort to create intergenerational capacity building, native Hawaiian students and early scholars will be included in the research team, and be mentored in all aspects from research development, fieldwork, and post-cruise data analysis.

Importance of Research in the PMNM

There is no practicable alternative to conducting activities in the Monument. The researchers are addressing questions that are directly relevant to the very existence of critical habitat within the Monument in a future of increased impacts related to more prevalent and intense hurricanes and elevated sea level. Hence the study must be carried out within the Monument. The researchers are limiting the study site to Nihoa and four islands at FFS. Lessons learned from FFS are applicable to low lying sandy islands throughout the PMNM. An important implication of this work is relevant to endangered species management plans. As sandy habitat in PMNM becomes unstable as a result of increased storminess and sea level rise the main Hawaiian Islands may be considered as future replacement habitat. Therefore, it is the specific location of PMNM that is necessary for this research.

The management value of data produced by the team's research activities outweighs the impacts upon Monument resources. FFS has already experienced island lost at Disappearing island, Trig Island, and most recently East Island following Hurricane Walaka in 2018. Devastating impacts on reefs at FFS have also documented. Furthermore, a preliminary study by the USGS predicts that under 2 m of sea level rise five of the nine islands at FFS will be completely submerged assuming a passive inundation model. Here the researchers propose to improve upon previous studies by characterizing Hurricane Walaka impacts and recovery of the critical island and shallow reef habitats.

This project will contribute to the formulation of monitoring and management action for reefs and island habitats at French Frigate Shoals. The researcher's project will increase conservation and management capacity for mitigating the impacts of hurricane damage and sea level rise thus contributing to the decision making ability for stewardship of PMNM. Research products produced at FFS are applicable across the PMNM. In addition, the researchers will do their best to ensure that the team's methods have minimal impact on monument resources. Finally, the researchers will work with PMNM staff, including the OHA, to return samples in a culturally appropriate manner.

Procedures/Methods

1.) Map shallow reefs using an ROV.

The researchers/team propose to use a remotely operated vehicle (ROV), to map and quantify the impacts of Hurricane Walaka upon 10 nearshore shallow reefs at Nihoa (2 reefs) and at FFS (8 reefs). ROV derived imagery will be post-processed at the University of Hawai‘i using Structure-from-Motion. 3D models and orthophotos of the shallow reef habitat will be created for each surveyed site. The researchers anticipate surveying at most 2 sites at Nihoa, and approximately 2 sites at each island at FFS (La Perouse, Gin, East, and Tern Islands). Surveyed sites will be approximately 100 m² in size. The ROV used by the team is a Trident Underwater drone (<https://www.sofarocan.com/products/trident>).

The researchers ROV is compact (7.5 lbs. and 16.1in x 8.1in x 3.4in) and is tethered to the surface where real-time video enables the pilot to navigate the ROV. The ROV will be deployed from a small boat operated by the SSV Makani Olu crew. The team is experienced in operating the ROV in numerous coastal and nearshore settings. The researchers will follow the protocols from the PMNM Boating and Diving BMP. The researchers will avoid contact with live corals and take great care when navigating around islands so that corals are not impacted by the team’s work.

2.) UAS island surveys (pending USFWS approval)

Topographic or island elevations will be acquired from UAS imagery. The researchers/team propose to collect high resolution imagery of 3 islands (Gin, East, and Tern Islands) and the surrounding nearshore environment using a UAS equipped with an internal GPS and a camera (pending USFWS approval). Canvas targets (1 m x 1 m) will be laid out on the island at the time that imagery is collected and later surveyed with an RTK-GPS for ground control. The RTKGPS includes a fixed base station that will sit on a tripod during the duration of the survey. The rover system is attached to a pole, and the surveyor will transport the rover to each survey site (corners of trenches, GPS control points, and geological features). UAS imagery and GPS control points will be post-processed at the University of Hawai‘i. A topographic DEM of each island will be derived from UAS imagery using Structure-from-Motion.

3.) Sediment collection.

The researchers propose to collect no more than 200 sediment samples (not to exceed $\frac{3}{4}$ cup volume) from the shallow marine environment (80, $\frac{3}{4}$ cup volume), and modern beach face (100, $\frac{3}{4}$ cup volume). Sampling the shallow seafloor will involve a small team (at least 2 people) deploying a benthic sediment sampler from a small boat operated by the crew of the SSV Makani Olu. The benthic sediment sampler will be tethered to the boat. Sediment will be sampled adjacent to ROV survey sites (at least 2 samples per survey site) and additional sandy sites surrounding each island. If necessary, the team may also enter the nearshore marine environment with snorkel gear to recover sediment. The researchers will follow the protocols from the PMNM Boating and Diving BMP. The researchers will avoid contact with live corals and take great care when navigating around islands so that corals are not impacted by the team’s work.

No more than 100 sediment samples will be collected from the beach face at Gin, East, and Tern island. At Tern Island, two shallow trenches will be sampled (not to exceed a total of 20 samples, $\frac{3}{4}$ cup volume) to compare pre and post Walaka derived sediments. The researchers anticipate trenching along the beach side of the runway as this site was noted in 2019 to have Walaka lagoon sediments deposited upon the Pre Walaka soil and subsurface sand layer. Trenches will not exceed 1 m x 1 m x 1 m in size. Trenches will be opened only long enough to be described, sampled (no more than 20 samples total), and photographed. Each trench will be backfilled with preexisting sediment. The researchers don’t anticipate any trenches being left unattended or opened overnight. The researchers hope these measures will limit the potential for a listed species (turtle or monk seal) from entering the trench. Furthermore, the researchers will consult with the resource monitor that accompanies them on the proposed project and the USFWS contaminants

biologist to determine the safest place to excavate at Tern island. Sediment samples will be taken back to the University of Hawai'i for compositional analysis under the microscope, and radiocarbon dating. Upon completion of analyses, samples will be returned to PMNM under the guidance of PMNM staff including the OHA. The researchers will not collect any living specimens however they do anticipate collecting skeletal reef derived material in the beach and nearshore sediment samples. Anticipated organisms include sand-sized fragments of unidentified coral species, red calcareous algae, green calcareous algae (*Halimeda* spp.), mollusks, and foraminifera (e.g. *Amphistigena*). Samples will not exceed 200 samples (each approximately ¾ cup in size). Sediment and fossil reef samples will be stored in sample bags and transported out of the monument on the chartered vessel. Specimens will be returned to PMNM staff under the guidance of PMNM. The Office of Hawaiian Affairs will be consulted for cultural guidance.

Gear. The following specialized gear and materials to be used in this activity: Shovel, Elevation survey equipment (total station, tripod, survey rod, survey ribbon, survey prism, canvas targets, brunton compass, RTK GPS base station and rover, etc.), Phantom drone – ONLY after approval (lithium batteries, ipad) Trident Underwater drone and ipad, Miscellaneous tools (handheld GPS, notebooks, walkie talkies, cameras, measuring, tape, etc.), Snorkeling gear (mask, fins) and Sample bags and vials

The purpose of the researchers/team proposed activities is to collect imagery and sediment samples to assess the impacts of Hurricane Walaka upon islands and the shallow marine environment. This work is needed in order to monitor and track changes in island erosion and accretion, and future island sediment availability. The researchers/team activities will improve understandings of potential loss and recovery of essential habitats for priority species.

The actual fieldwork component of this research involves the minimum time required to obtain the desired data necessary to assess the impacts and recovery of critical habitat following Hurricane Walaka. Because SSV Makani Olu is largely powered by wind, the researchers/team anticipate the majority of the 15 days will be for transiting from O'ahu, with a maximum of 5 days allotted for research at FFS and Nihoa. Weather permitting, the researchers/team propose to visit 4 islands at FFS (Gin, East, Tern, La Perouse), and Nihoa during the 15 day period.

The researchers surveying methods and procedures are designed to be as un-invasive and thorough as possible. The researchers will utilize a unique approach to assessing the impacts and recovery of the island and shallow reef environments to decipher the dynamics between sediment production at reefs and sediment delivery to adjacent islands. The researchers have successfully implemented these methodologies in similar studies at 'Upolu Island, Sāmoa, the Republic of the Marshall Islands, and at FFS in July of 2018. The researchers island and shallow reef surveys will enable 3D reconstructions of shallow coral habitats and island environments. These methods are non-invasive and provide high-resolution data pertaining to reef and island topography that cannot be acquired from remotely sensed satellite imagery. Sediment sampling will enable island sediment sources and availability from the shallow marine environment to be quantified. Comparisons to data collected in 2018 provide baselines for detecting changes in island and reef sediment sources following Hurricane Walaka.

Ultimately this work will provide the PMNM with a comprehensive and robust dataset pertaining to the vulnerability and or resiliency of atoll reef islands systems to environmental stressors such as storms and sea level rise. Islands and corals are cultural and ecological resources that provide critical habitat to a multitude of marine and terrestrial species.

To safeguard Monument resources, there will be at least two Papahānaumokuākea trained Resource Monitors on the expedition which the applicant has agreed to consult with on any activities. Additionally, the applicant would abide by the following PMNM Best Management Practices (BMPs) while conducting the aforementioned activities within the PMNM: Best Management Practices for Boat Operations and Diving Activities (BMP #004); Human Hazards to Seabirds (BMP#003); Special Conditions and Rules for Moving Between Islands/Atolls and Packing for Field Camps (BMP#007); Best Practices for Minimizing the Impact of Artificial Light on Sea Turtles (BMP#009); Marine Wildlife Viewing Guidelines (BMP #010); Disease and Introduced Species Prevention Protocol for Permitted Activities in the Marine Environment (BMP #011) and Best Management Practices for Maritime Heritage Sites (BMP#017).

The activity would provide manager's insight into how sea-level rise and perturbations to the island's shape and nearshore bathymetry at Lalo will affect the convergence or divergence of wave-driven sand transport, causing the islands to accrete or erode, respectively in the Monument. The research will provide Papahānaumokuākea Marine National Monument (PMNM) staff with guidance for responsive management of critical ecosystems and endangered species in a future of elevated sea-level. Lessons learned at Lalo will be applicable throughout the rest of Papahānaumokuākea.

The applicant's proposed activities directly support the Monument Management Plan (MMP) Marine Conservation Science (MCS) Action Plan Strategy MCS-1: *Continue and enhance research, characterization and monitoring of marine ecosystems* (PMNM MMP Vol. I, p. 122, 2008).

MMB Agency Reviewer Questions and Applicant Responses:

QUESTIONS:

1. What are the exact goals at Nihoa? The application mentions surveys on the impacts of Hurricane Walaka but were there actual hurricane impacts at Nihoa? If so, could the applicant expand on that?

The goal of research conducted at Nihoa will be to collect ROV derived video from 1-3 reefs depending upon time constraints. Prior reef surveys following Hurricane Walaka did not record hurricane Impacts at Nihoa. Rather our surveys will be conducted to document the current status of the reefs themselves and to collect high quality video for research and educational purposes.

2. What would be the roles of the 10th, 11th and 12th TBD people listed in the application? A science party of 12 seems more than necessary to conduct the proposed activities.

Researcher number 10 will be Kainalu Steward, a Coastal Geologist from UH Hilo. Kainalu will assist with sediment collection and surveying the islands. Researcher 11 and 12 have yet to be determined. Everyone on the ship is being counted under my permitted activities in the instance that I need certain persons help. This does not mean that all 12 will be on an islet at a given time.

3. Has the applicant successfully made DEMs from ROV video before? It would be good to ensure that the method is worked out before collecting data in PMNM.

Yes, our team has successfully made DEMs and photomosaics from ROV video. This process involves using a computer code to splice video into individual frames or photographs. These photographs are then rendered into orthophotomosaics and digital elevation models using photogrammetry software such as Structure-From-Motion. In addition a snorkeler will deploy and recover 1-5 small (approximate size of a standard ruler) survey markers within the surveyed area. The survey markers will be used to scale the final DEMs and orthophotos.

At least two individuals will be trained in all aspects of piloting, deploying survey markers, and creating DEMs prior to the trip to ensure that all methods are worked out before collecting data in PMNM.

4. What is the sediment sampler? Can the applicant describe or illustrate its configuration? What kind of controls will there be on its operation to ensure that hard bottom or live coral amongst the target sediment will not be damaged? Will the ROV or snorkelers ensure that the contact is made directly with the bottom to ensure it is sediment?

An image of the sediment sampler is provided below.



The metal cylinder is open on one end and attached to a rope. It is deployed from the small boat. This instrument was successfully used in 2018 by participants on this permit application to collect nearshore sediment surrounding East Island and the Gins. Prior to deployment either a snorkeler, the ROV, or in shallow waters a researcher will observe from the small boat to ensure that no contact is made with hard bottom or live coral. In areas with hard bottom or coral we will rely upon the snorkeler to retrieve sediment instead of the sediment sampler.

5. Given the potential for monk seals and sea turtles to be hauled out on East and Gin islands, and considering the relatively small size of these islands, access to conduct activities on East and Gin islands shall be determined in consultation with the designated resource monitor based on local conditions.

We will work with resource monitors prior to conducting activities at East and Gin Islands to ensure that we have limited impact upon wildlife.

6. NMFS requests that land access to Tern Island be limited to the minimum number of people necessary for the activities to be conducted, and that landing on the island be done at the boat ramp or pier on the west side of the island.

We will work with resource monitors to ensure that land access is made at the boat ramp or pier on the west side of the island. Land access will be limited to necessary personnel to conduct the activities outlined in our permit.

7. While accessing the land portions of Tern Island, all permitted individuals must be accompanied by the resource monitor, unattended individuals should not be allowed.

We will work with the resource monitor to ensure that he/she accompanies our team while accessing land portions of Tern Island.

8. The applicant must be aware of and abide by the minimum viewing distance in the Marine Life Viewing Guidelines for protected species while in the Monument.

We have referenced the Marine Life Viewing Guidelines best management practices and will follow guidance provided for the Hawaiian monk seal, other marine mammals, turtles, etc.

9. It is recommended prior to departure, that the applicant and designated resource monitor contact the Hawaiian Monk Seal Research Program (Michelle Barbieri at Michelle.Barbieri@noaa.gov) and Marine Turtle Biology and Assessment Program (Yonat Swimmer at Yonat.Swimmer@noaa.gov) to discuss protected species concerns in preparation for conducting the proposed activities.

The Office of Hawaiian Affairs, as the trip sponsor, is already discussing with the Hawaiian Monk Seal Research Program about ways to coordinate agency needs and concerns.

COMMENTS / RECOMMENDATIONS:

1. A PMNM designated Resource Monitor will be required to accompany this expedition. The USFWS thanks you for having Resource Monitors as part of your planned crew.

We look forward to working and learning alongside the Resource Monitor(s).

2. Due to DOI Secretarial Order, drone (UAS) use will not be permitted over USFWS managed lands or waters unless the order is reversed prior to conducting activities.

We understand this mandate and will not fly our drone over USFWS managed lands unless the ruling is overturned.

3. For trenching on islands with native vegetation, removed sand should be placed onto a tarp while digging and collecting is conducted in order to minimize disturbance. This was done on East Island under the Fletcher permit.

As was done in 2018, removed sand will be placed on a tarp while digging and collecting to minimize disturbance. All shallow trenches will be infilled immediately after sampling is completed.

4. Trenching locations must first be coordinated with LeeAnn Woodward (USFWS) to avoid contaminated areas of Tern Island.

We will coordinate with LeeAnn Woodward regarding trenching locations at Tern Island.

5. Trenching activities must first be coordinated with NOAAs Marine Turtle Biology and Assessment Program to mitigate risk to sea turtle nesting sites.

We will consult NOAAs Marine Turtle Biology and Assessment Program, and work with our resource manager to mitigate risk to turtle nesting sites.

6. The USFWS recommends approval of this permit.

Thank you.

7. If sediment is returned after analysis in the MHI, it should be sterilized before bringing it back to the PMNM.

Sediment will be sterilized before return to PMNM. In addition will consult PMNM management and resource monitors to determine the best way to carry out the return of materials prior to doing so.

8. DAR requests the following condition to be included in the permit (if this is not already stated in the permit conditions or BMPs): *No direct interaction with, disturbance of, impact to or placement of benthic sediment sampler, remotely operated vehicle (ROV), or other gear or equipment on coral or live rock (defined as any natural hard substrate to which marine life is visibly attached or affixed).*

Understood!

Environmental Compliance:

NEPA / HEPA: (check-one)

Categorical Exclusion / Exempt Class _____

EA _____

EIS _____

Other Consultations: (ESA/MMPA Section 7; NHPA Section 106, etc.)

- A request to the National Marine Fisheries Service (NMFS) for Section 7 informal consultation coverage pursuant to the Endangered Species Act of 1973 is underway to have the proposed activities considered under PMNM's programmatic Section 7 informal consultation. The outcome

of this request may require the applicant to adhere to other NMFS-prescribed conditions. Such conditions would be reflected in the PMNM permit, prior to issuance.

- An informal review of all aforementioned activities following section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA; 16 U.S.C. 1855(b)) was completed on March 25, 2021 by NOAA National Marine Fisheries Service (NMFS) Pacific Islands Regional Office (PIRO) for the Habitat Conservation Division. NMFS is concerned that there is the potential for the unavoidable loss of EFH from physical damage, and degradation of the quality of EFH from exposure to chemical contaminants, pollution, and waste and discharge. NMFS expects that many potential adverse effects from the proposed activity will be reduced due to implementation of the Monument-imposed BMPs. However, to further avoid and minimize the risk to EFH in the project area, NMFS offers the conservation recommendations to be added as Special Conditions below:
 - *Conservation Recommendation 1:* To avoid physical damage to corals during transit to and from Nihoa and FFS, a spotter should be placed in the bow of the dingy to watch for exposed or near surface coral heads.
 - *Conservation Recommendation 2:* Measures should be implemented to prevent detergents and other cleaners from being washed overboard.

This activity is exempt from the preparation of an environmental assessment under the Authority of Chapter 343, HRS and Chapter 11-200, HAR. In accordance with the revised Exemption List For The Department Of Land And Natural Resources (Concurred on by the Environmental Council on November 10, 2020), this activity does not require a declaration of exemption or “exemption notice” as this activity falls under “**Part 1**” of its exemption class. This revision separates exemption lists into categories listed in §11-200.1-16 (a)(1) and (2). Activities categorized as “**Part 1**” will fall under §11-200.1-16 (a) (1). **Activities categorized as “Part 2” will require an exemption notice** and fall under §11-200.1-16 (a) (2). However, in order to be transparent for BLNR review purposes, this exemption notice had been drafted.

Consulted Parties: The permit application was sent out for review and comment to the following scientific and cultural entities: Hawaii Division of Aquatic Resources, Hawaii Division of Forestry and Wildlife, Papahānaumokuākea Marine National Monument (NOAA/NOS), NOAA Pacific Islands Regional Office (NOAA-PIRO), United States Fish and Wildlife Service Hawaiian and Pacific Islands National Wildlife Refuge Complex Office, and the Office of Hawaiian Affairs (OHA). In addition, the permit application has been posted on the Monument Web site, giving the public an opportunity to comment. The application was posted within 40 days of its receipt, in accordance with the Monument’s Public Notification Policy.

Exemption Determination: After reviewing §11-200-8, HAR, including the criteria used to determine significance under §11-200-12, HAR, DLNR has concluded that the activities under this permit would have minimal or no significant effect on the environment and that issuance of the permit is categorically exempt from the requirement to prepare an environmental assessment based on the following analysis:

1. All activities associated with this permit have been evaluated as a single action. Since this permit involves an activity that is precedent to a later planned activity, i.e., the same study methodology used throughout the permit period, the categorical exemption determination here will treat all planned activities as a single action under §11-200-7, HAR.

2. The General Exemption Type #5 for Basic Data Collection, Research and Experimental Management with no Serious or Major Environmental Disturbance Appears to Apply. §11-200.1-16 (a) (1) and §11-200.1-16 (a) (2), HAR, exempts the class of actions that involve “basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource.” This exemption type has been interpreted to include the surveys, monitoring and collection and analysis of sediments and imagery, such as those being proposed.

The proposed activities here appear to fall squarely under the general exemption type identified under HAR §11-200.1-16 (a) (1) and as described under the revised 2020 DLNR Exemption List (Concurred on by the Environmental Council on November 10, 2020), under the general exemption type #5 (Part 1), item #15, which includes, the conducting of “game and non-game wildlife surveys, vegetation and rare plant surveys, aquatic life surveys, inventory studies, new transect lines, photographing, recording, sampling, collection, culture, and captive propagation.”

The General Exemption Type #8 for Continuing Administrative Activities Appears to Apply. §11-200.1-16 (a) (1), HAR, exempts the class of actions that involve “continuing administrative activities.” This exemption type have been interpreted to include educational activities consisting of a cultural curriculum, such as those being proposed.

The proposed activities here appear to fall squarely under the general exemption type identified under HAR §11-200.1-16 (a) (1) and as described under the revised 2020 DLNR Exemption List (Concurred on by the Environmental Council on November 10, 2020), under the general exemption type #8 (Part 1), item #5, which includes, “training, environmental interpretation, public safety efforts and other educational activities.”

As discussed below, no significant disturbance to any environmental resource is anticipated. Thus, so long as the below considerations are met, an exemption class should include the action now contemplated.

3. Cumulative Impacts of Actions in the Same Place and Impacts with Respect to the Potentially Particularly Sensitive Environment Will Not be Significant. Even where a categorical exemption appears to include a proposed action, the action cannot be declared exempt if “the cumulative impact of planned successive actions in the same place, over time, is significant, or when an action that is normally insignificant in its impact on the environment may be significant in a particularly sensitive environment.” HAR § 11-200-8.B. To gauge whether a significant impact or effect is probable, an exempting agency must consider every phase of a proposed action, any expected primary and secondary consequences, the long-term and short-term effects of the action, the overall and cumulative effect of the action, and the sum effects of an action on the quality of the environment. HAR § 11-200-12. Examples of actions which commonly have a significant effect on the environment are listed under HAR § 11-200-12.

The cumulative impacts of this permit, in conjunction with a proposed permit (PMNM-2021-009) on the same expedition, have been considered. No deleterious effects have been observed from previous

expeditions, with similar types of sediment research and techniques, such as a permit issued to Dr. Fletcher's team (includes Dr. Kane, McDonald, and Dominique- Tavares listed on this permit) in 2018. With this in mind, significant cumulative impacts are not anticipated as a result of this activity, and numerous safeguards further ensure that the potentially sensitive environment of the project area will not be significantly affected. All activities will be conducted in a manner compatible with the management direction of the Monument Proclamation in that the activities do not diminish, but rather enhance monument resources, qualities, and ecological integrity, or have any indirect, secondary, cultural, or cumulative effects. The joint permit review process did not reveal any anticipated indirect or cumulative impacts, nor did it raise any cultural concerns, that would occur as a result of these activities.

Since no significant cumulative impacts or significant impacts with respect to any particularly sensitive aspect of the project area are anticipated, the categorical exemptions identified above should remain applicable.

4. Overall Impacts will Probably be Minimal and Insignificant.

Again, any foreseeable impacts from the proposed activity will probably be minimal, and further mitigated by general and specific conditions attached to the permit. Specifically, all research activities covered by this permit will be carried out with strict safeguards for the natural, historic, and cultural resources of the Monument as required by Presidential Proclamation 8031, other applicable law and agency policies and standard operating procedures.

Conclusion. Upon consideration of the permit to be approved by the Board of Land and Natural Resources, the potential effects of the above listed project as provided by Chapter 343, HRS and Chapter 11-200 HAR, have been determined to be of probable minimal or no significant effect on the environment and exempt from the preparation of an environmental assessment.

Papahānaumokuākea Marine National Monument
RESEARCH Permit Application

NOTE: *This Permit Application (and associated Instructions) are to propose activities to be conducted in the Papahānaumokuākea Marine National Monument. The Co-Trustees are required to determine that issuing the requested permit is compatible with the findings of Presidential Proclamation 8031. Within this Application, provide all information that you believe will assist the Co-Trustees in determining how your proposed activities are compatible with the conservation and management of the natural, historic, and cultural resources of the Papahānaumokuākea Marine National Monument (Monument).*

ADDITIONAL IMPORTANT INFORMATION:

- Any or all of the information within this application may be posted to the Monument website informing the public on projects proposed to occur in the Monument.
- In addition to the permit application, the Applicant must either download the Monument Compliance Information Sheet from the Monument website OR request a hard copy from the Monument Permit Coordinator (contact information below). The Monument Compliance Information Sheet must be submitted to the Monument Permit Coordinator after initial application consultation.
- Issuance of a Monument permit is dependent upon the completion and review of the application and Compliance Information Sheet.

INCOMPLETE APPLICATIONS WILL NOT BE CONSIDERED

Send Permit Applications to:
NOAA/Inouye Regional Center
NOS/ONMS/PMNM/Attn: Permit Coordinator
1845 Wasp Blvd, Building 176
Honolulu, HI 96818
nwhipermit@noaa.gov
PHONE: (808) 725-5800 FAX: (808) 455-3093

SUBMITTAL VIA ELECTRONIC MAIL IS PREFERRED BUT NOT REQUIRED. FOR ADDITIONAL SUBMITTAL INSTRUCTIONS, SEE THE LAST PAGE.

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: Haunani Hi'ilani Kane

Affiliation: National Science Foundation Postdoctoral Fellow at the University of Hawai'i at Hilo

Permit Category: Research

Proposed Activity Dates: July 2020

Proposed Method of Entry (Vessel/Plane): SSV Makani Olu

Proposed Locations: French Frigate Shoals, and Nihoa

Estimated number of individuals (including Applicant) to be covered under this permit:
20

Estimated number of days in the Monument: 15

Description of proposed activities: (complete these sentences):

a.) The proposed activity would...

Assess impacts of Hurricane Walaka upon islands and the shallow marine environment at French Frigate Shoals. Our survey techniques will use a non-invasive method to collect high resolution imagery to document island sediment and shallow reef lost and subsequent recovery following Hurricane Walaka. Our island and nearshore sediment data collection method will enable shifts in dominant sediment types and sources from the nearshore reef to be identified. This will enable estimates for future sediment production and replenishment to islands following environmental stressors. The proposed activities will improve the understandings of the potential loss and timescales for recovery of critical habitat following extreme storm events. The proposed activities will also improve understandings of how future sea level rise will impact essential habitats for priority species (e.g. sea turtles, monk seals, and various seabirds).

b.) To accomplish this activity we would

1.) Use a remotely operated vehicle (ROV), to map and quantify the impacts of Hurricane Walaka upon 10 nearshore shallow reefs at Nihoa (2 reefs) and at FFS (8 reefs). 2.) Collect GPS data and aerial imagery using an unmanned aerial system (UAS) at three islands within FFS. 3.) Collect sediment samples (total: 200, ¾ cup

volume) from the shallow marine environment (80, $\frac{3}{4}$ cup volume), and modern beach face (100, $\frac{3}{4}$ cup volume) at three islands within FFS. 3D digital reconstructions of the nearshore reef habitat, and island environments will be derived from ROV and UAS imagery. These models will be compared to 3D models of island environments collected in 2018 by Dr. Fletcher's team (includes Dr. Kane, McDonald, and Dominique-Tavares listed on this permit), and supplement reef models collected at deeper depths by Dr. John Burns. Comparing 2018 & 2020 3D island models and sediment composition will enable sediment budgets for each island to be quantified by both sediment source, and sediment volume. 3D models of the shallow reef will enable dominant sediment sources (including but not limited to calcareous red algae, *Halimeda*, coral) to be mapped and quantified. Ultimately we will obtain detailed data on the impacts of extreme storm events, and the capacity of atoll islands to naturally recover from environmental stressors. This research will allow us to decipher important characteristics of reduced resiliency affecting islands and critical island habitats across PMNM.

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

Providing detailed analyses of island habitat and nearshore reefs is useful for determining the severity and prevalence of Hurricane Walaka impacts across FFS. By resurveying sites visited in 2018 (Gin and East Island) we will provide visual representations of island recovery and loss. The 3D island reconstructions will provide useful data for assessing island elevation, and island sedimentary budgets. Both are useful metrics for predicting future time scales of vulnerability to storms and sea level rise. Furthermore analyses of island sediments will reveal the dependency of islands upon the adjacent nearshore reef for sediment replenishment following environmental stressors. Our research will provide PMNM staff with guidance for responsive management of critical ecosystems and endangered species in a future of elevated sea-level.

Other information or background:

Obtaining a better understanding of the fate of reef islands is vital for understanding the future of critical habitats at FFS and also for depicting what impacts we may foresee for cultural, natural, and historic resources of the PMNM as a whole. Our island surveying methods have proved useful for determining the impacts of past and future sea level rise and storms. Combining a geologic sedimentary approach with cutting edge 3D reconstruction techniques will produce excellent data products that will enhance our understandings of the bio-geological parameters that govern reef-island resiliency and vulnerability to climate related stressors. This research will ultimately provide useful information for managers such as the spatial and temporal dynamics of island evolution and recovery, keystone island sediment species that disproportionately contribute to island composition, and the ability to identify and map the source of keystone species upon adjacent reefs.

Section A - Applicant Information

1. Applicant

Name (last, first, middle initial): Kane, Haunani, H

Title: Postdoctoral Research Fellow, University of Hawai'i at Hilo

1a. Intended field Principal Investigator (See instructions for more information):
SEE ORIGINAL APPLICATION FOR CONTACT INFO

2. Mailing address (street/P.O. box, city, state, country, zip):
SEE ORIGINAL APPLICATION FOR CONTACT INFO

Phone: SEE ORIGINAL APPLICATION FOR CONTACT INFO

Fax:

Email: SEE ORIGINAL APPLICATION FOR CONTACT INFO

For students, major professor's name, telephone and email address: NA

3. Affiliation (institution/agency/organization directly related to the proposed project):
National Science Foundation and the Department of Marine Science, University of Hawai'i at Hilo.

4. Additional persons to be covered by permit. List all personnel roles and names (if known at time of application) here (e.g. John Doe, Research Diver; Jane Doe, Field Technician):

1. Kammie Dominique Tavares, Coastal Geologist & Survey technician
2. Kristian McDonald, Coastal Geologist & Drone operator
3. Aloha Kaponu, Coastal Geologist & ROV operator
4. Shacles Chong, Videographer
5. Pelika Andrade, Intertidal researcher
6. Kim Morishige, Intertidal researcher
7. Lauren Kaponu, Intertidal researcher
8. Anthony Mau, Intertidal researcher
9. Brad Kaaleleo Wong, Cultural specialist, Office of Hawaiian Affairs
- 10-12. 2-3 TBD
13. Makani Olu Crew 1 TBD
14. Makani Olu Crew 2 TBD
15. Makani Olu Crew 3 TBD
16. Makani Olu Crew 4 TBD

17. Makani Olu Crew 5 TBD
18. Makani Olu Crew 6 TBD
19. Makani Olu Crew 7 TBD
20. Makani Olu Crew 8 TBD

Section B: Project Information

5a. Project location(s):

		<u>Ocean Based</u>	
<input checked="" type="checkbox"/> Nihoa Island	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Necker Island (Mokumanamana)	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input checked="" type="checkbox"/> French Frigate Shoals	<input checked="" type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Gardner Pinnacles	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Maro Reef			
<input type="checkbox"/> Laysan Island	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Lisianski Island, Neva Shoal	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Pearl and Hermes Atoll	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Midway Atoll	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Kure Atoll	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Other			

NOTE: Shallow water is defined by water less than 100 meters in depth.

Remaining ashore on any island or atoll (with the exception of Sand Island, at Midway Atoll and field camp staff on other islands/atolls) between sunset and sunrise.

NOTE: There is a fee schedule for people visiting Midway Atoll National Wildlife Refuge via vessel and aircraft.

Location Description:

At Nihoa, and French Frigate Shoals (East Island, Gin Island, La Perouse Pinnacle, and Tern Island) we propose to collect video and photos of the shallow reef using a Trident Underwater drone (<https://www.sofarocan.com/products/trident>).

At East island, Gin island, La Perouse Pinnacle, and Tern Island we propose to collect imagery of the island and surrounding shallow nearshore environment using a unmanned aerial system.

At East island, Gin island, and Tern Island we propose to survey, and collect sediment samples (3/4 cup) from the beach face, and the nearshore environment. At Tern Island we propose to excavate two shallow trenches and collect sediment samples.

We will follow best management practices for moving between islands, boat operations and diving activities, and unmanned aerial systems. All survey and sample locations will be conducted at sites determined by the Dr. Kane, under the guidance of PMNM resource monitors that accompany this project. The exact loactions are still to be decided. Additional photos and video collected by our documenter will document research methods and the recovery of each island following Hurricane Walaka. Images and video will be used only for educational outreach and research purposes.

5b. Check all applicable regulated activities proposed to be conducted in the Monument:

- Removing, moving, taking, harvesting, possessing, injuring, disturbing, or damaging any living or nonliving Monument resource
- Drilling into, dredging, or otherwise altering the submerged lands other than by anchoring a vessel; or constructing, placing, or abandoning any structure, material, or other matter on the submerged lands
- Anchoring a vessel
- Deserting a vessel aground, at anchor, or adrift
- Discharging or depositing any material or matter into the Monument
- Touching coral, living or dead
- Possessing fishing gear except when stowed and not available for immediate use during passage without interruption through the Monument
- Attracting any living Monument resource
- Sustenance fishing (Federal waters only, outside of Special Preservation Areas, Ecological Reserves and Special Management Areas)
- Subsistence fishing (State waters only)
- Swimming, snorkeling, or closed or open circuit SCUBA diving within any Special Preservation Area or Midway Atoll Special Management Area

6. Purpose/Need/Scope *State purpose of proposed activities:*

The purpose of our proposed activities is to collect imagery and sediment samples to assess the impacts of Hurricane Walaka upon islands and the shallow marine environment. This work is needed in order to monitor and track changes in island erosion and accretion, and future island sediment availability. Our activities will improve understandings of potential loss and recovery of essential habitats for priority species. This information will provide guidance for PMNM managers tasked with developing responsive management plans.

Atoll reef islands within the PMNM, provide critical nesting habitat for 96% of the population of the threatened Hawaiian green sea turtle (*Chelonia mydas*), one-third of the population of endangered Hawaiian monk seal (*Monachus schauinslandi*), and the largest colony of tropical seabirds in the world (Baker et al., 2006; Reynolds, et al., 2012). These critical species require stable island habitats that are becoming increasingly threatened by sea level rise (Anderson et al., 2018; Romine et al., 2013) and more frequent tropical cyclone activity (Murakami et al., 2013). In 2018, FFS received international attention after East Island was removed in its entirety following a direct hit from Walaka, a category three tropical cyclone. Since 2018 reefs and islands have both accreted and eroded by bio-geological processes that are still not fully understood.

Our activities bridge this gap in knowledge by employing non-invasive interdisciplinary approaches to address management and conservation questions during a time when impacts related to environmental change are accelerating. We propose to do the following: 1.) Use a remotely operated vehicle (ROV), to map and quantify the impacts of Hurricane Walaka upon 10 nearshore shallow reefs at Nihoa (2 reefs) and at FFS (8 reefs). 2.) Collect GPS data and aerial imagery using an unmanned aerial system (UAS) at three islands within FFS. 3.) Collect sediment samples (total: 200, $\frac{3}{4}$ cup volume) from the shallow marine environment (80, $\frac{3}{4}$ cup volume), and modern beach face (100, $\frac{3}{4}$ cup volume) at three islands within FFS. In addition at Tern Island two shallow trenches will be sampled (not to exceed a total of 20 samples, $\frac{3}{4}$ cup volume) to compare pre and post-Walaka derived sediments.

The research activities of this project build upon a 2018 data collection effort focused on assessing the impacts of sea level rise upon FFS. Pre (July 2018) and post (July 2020) Walaka UAS derived datasets will be compared to quantify island-specific volumes of sediment gains and losses. Furthermore pre and post-Walaka sediment analyses will elucidate shifts in island sediment composition and identification of island sediment sources from the nearshore reef. The resulting data of the activities proposed in this study will be critically valuable to better understandings of the timescales and spatial extent of island vulnerability and the potential for natural recovery following environmental stressors. The application and relevance of the products produced by the proposed activities extend beyond FFS and are applicable both across PMNM and to

other low-lying island ecosystems such as the Maldives (Indian Ocean), Tuvalu, Kiribati and the Marshall Islands (Pacific).

References

Baker, J. D., Littnan, C. L. & Johnston, D. W., 2006. Potential effects of sea level rise on the terrestrial habitats of endangered and endemic megafauna in the Northwestern Hawaiian Islands. *Endanger. Species Res.* 2, 21–30.

Reynolds, M., Berkowitz, P., Courlot, K. N. & Krause, C. M., 2012. Predicting Sea-Level Rise Vulnerability of Terrestrial Habitat and Wildlife of the Northwestern Hawaiian Islands.

Anderson, T. R. et al., 2018. Modeling multiple sea level rise stresses reveals up to twice the land at risk compared to strictly passive flooding methods. *Sci. Rep.* 8.

Romine, B. M., Fletcher, C. H., Barbee, M. M., Anderson, T. R. & Frazer, L. N., 2013. Are beach erosion rates and sea-level rise related in Hawaii? *Glob. Planet. Change* 108, 149–157.

Murakami, H., Wang, B., Li, T. & Kitoh, A., 2013. Projected increase in tropical cyclones near Hawaii. *Nat. Clim. Chang.* 3, 749–754.

*Considering the purpose of the proposed activities, do you intend to film / photograph federally protected species? Yes No

If so, please list the species you specifically intend to target.

We do not plan to specifically target protected species. However, we will be using a drone to collect imagery of the islands, and nearshore environment and Shacles Chong intends to capture on camera whatever he encounters naturally while at FFS. Thus, our images may ultimately capture endangered species.

For a list of terrestrial species protected under the Endangered Species Act visit:

<http://www.fws.gov/endangered/>

For a list of marine species protected under the Endangered Species Act visit:

<http://www.nmfs.noaa.gov/pr/species/esa/>

For information about species protected under the Marine Mammal Protection Act visit:

<http://www.nmfs.noaa.gov/pr/laws/mmpa/>

7. Answer the Findings below by providing information that you believe will assist the Co-Trustees in determining how your proposed activities are compatible with the conservation and management of the natural, historic, and cultural resources of the Monument:

The Findings are as follows:

a. How can the activity be conducted with adequate safeguards for the cultural, natural and historic resources and ecological integrity of the Monument?

The activities proposed will be conducted with adequate safeguards for the resources and ecological integrity of the Monument. We acknowledge that there are concerns with disturbing sediment from the islands and nearshore. We welcome discussion with PMNM staff including cultural experts to ensure that our research is conducted in a manner that is respectful of the place, and its cultural, natural, and historical resources. All survey and sample locations will be conducted at sites determined by the Dr. Kane, under the guidance of PMNM resource monitors that accompany this project. For sediment sample collection at Tern Island we will consult USFWS contaminants biologist. Collection equipment will be inspected and disinfected between sampling different areas to mitigate for the spread of aquatic invasive species, coral disease or other pathogens or parasitic organisms. Best efforts will be made to ensure that the collection of samples is conducted in such a manner as the process does not result in any additional harm to surrounding marine or terrestrial organisms. Efforts will be made to distribute collection activities across shoreline/reef flat/benthic areas, so as not to consolidate the impacts of data collection in one location.

As a means to ensure that our research aligns with PMNM we will follow best management practices for moving between islands, boat operations and diving activities, and unmanned aerial systems. We will be operating a drone to collect high-resolution imagery of FFS islands. In July 2018 our drone pilot Kristian McDonald successfully collected drone imagery and constructed 3D, Digital Evolution Models (DEMs) of East Island, and Gin Island. This baseline data will be compared to 2020 3D DEMs to quantify changes in the volume of sediment loss and gain following Hurricane Walaka. Kristian is a DOT/FAA certified remote pilot and has experience piloting UAS in FFS and working with PMNM resource monitors to assure that we make every effort to follow established drone protocols and best management practices. We will also seek guidance from the PMNM before any UAS derived data is made publically available. Additional photos and video collected by our documenter will document research methods and the recovery of each island following Hurricane Walaka. Images and video will be used only for educational outreach and research purposes.

Our research group will pay respect and conduct culturally appropriate protocols at each island visited as well as throughout the research to continue to connect to place and stay grounded as a group. As a part of our cultural plan, our research cruise will be conducted in partnership with the Office of Hawaiian Affairs and Nā Maka Onaona. We will have group discussions centered around huli 'ia, a tool developed by Nā Maka Onaona, to document environmental observations experienced through all of our senses while in Papahānaumokuākea. Researchers will participate in discussions contributing their observations sharing noticeable dominant characteristics of Iani (sky), honua (earth), and kai (ocean) as a way to characterize that time (season) and space (Papahānaumokuākea). This broader holistic view will support our research team in intimately understanding moods and characteristics of Papahānaumokuākea and through this documentation process, supports the development of best practices

enabling communities to adjust and adapt their activities to assist in mālama 'āina (care for the land). In addition as a part of our cultural plan, we will provide data and information to assist the Cultural Working Group's effort to develop Hawaiian names and descriptions for new processes and spaces that may be encountered in the island and in the shallow nearshore environment. Finally, in an effort to create intergenerational capacity building, native Hawaiian students and early scholars will be included in the research team, and be mentored in all aspects from research development, fieldwork, and post-cruise data analysis.

b. How will the activity be conducted in a manner compatible with the management direction of this proclamation, considering the extent to which the conduct of the activity may diminish or enhance Monument cultural, natural and historic resources, qualities, and ecological integrity, any indirect, secondary, or cumulative effects of the activity, and the duration of such effects? Our research activities will temporarily disturb island sediment at two shallow trenches at Tern Island. However, the lessons learned from our research has the potential for researchers and managers to better plan for the very existence of low lying islands throughout PMNM as hurricane impacts become more prevalent and sea-level continues to rise into the future.

c. Is there a practicable alternative to conducting the activity within the Monument? If not, explain why your activities must be conducted in the Monument.

There is no practicable alternative to conducting activities in the Monument. We are addressing questions that are directly relevant to the very existence of critical habitat within the Monument in a future of increased impacts related to more prevalent and intense hurricanes and elevated sea level. Hence the study must be carried out within the Monument. We are limiting our study site to Nihoa and four islands at FFS. Lessons learned from FFS are applicable to low lying sandy islands throughout the PMNM. An important implication of this work is relevant to endangered species management plans. As sandy habitat in PMNM becomes unstable as a result of increased storminess and sea level rise the main Hawaiian Islands may be considered as future replacement habitat. Therefore, it is the specific location of PMNM that is necessary for this research.

d. How does the end value of the activity outweigh its adverse impacts on Monument cultural, natural and historic resources, qualities, and ecological integrity?

The management value of data produced by our research activities outweighs the impacts upon Monument resources. FFS has already experienced island lost at Disappearing island, Trig Island, and most recently East Island following Hurricane Walaka in 2018. Devastating impacts on reefs at FFS have also documented. Furthermore, a preliminary study by the USGS predicts that under 2 m of sea level rise five of the nine islands at FFS will be completely submerged assuming a passive inundation model. Here we propose to improve upon previous studies by characterizing Hurricane Walaka impacts and recovery of the critical island and shallow reef habitats. This project will contribute to the formulation of monitoring and management action for reefs and island habitats at French Frigate Shoals. Our project will increase

conservation and management capacity for mitigating the impacts of hurricane damage and sea level rise thus contributing to the decision making ability for stewardship of PMNM. Research products produced at FFS are applicable across the PMNM. In addition, we will do our best to ensure that our methods have minimal impact on monument resources. Finally, we will work with PMNM staff including the OHA to return samples in a culturally appropriate manner.

e. Explain how the duration of the activity is no longer than necessary to achieve its stated purpose.

The actual fieldwork component of this research involves the minimum time required to obtain the desired data necessary to assess the impacts and recovery of critical habitat following Hurricane Walaka. Because SSV Makani Olu is largely powered by wind, we anticipate the majority of the 15 days will be for transiting from O'ahu, with a maximum of 5 days allotted for research at FFS and Nihoa. Weather permitting, we propose to visit 4 islands at FFS (Gin, East, Tern, La Perouse), and Nihoa during the 15 day period.

f. Provide information demonstrating that you are qualified to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.

Key project members:

Haunani H. Kane (National Science Foundation and the University of Hawai'i at Hilo): Dr. Kane is currently funded through a National Science Foundation Postdoctoral Research Fellowship to assess the impacts of sea level rise and storms upon atoll reef islands at French Frigate Shoals. Haunani was a part of the team that collected the baseline data for her postdoctoral research in July of 2018. Dr. Kane returned in 2019 with the FWS and NOAA to assist with debris removal following Hurricane Walaka and field camp set up at Tern Island. Haunani's previous research modeled future impacts of coastal erosion and sea level rise upon cultural assets (Journal of Coastal Research, 2012), and Hawaiian wetlands (Climatic Change, 2015; Regional Environmental Change, 2015). Haunani has investigated the impacts of sea level rise upon islands within Sāmoa (Quaternary Research, 2017; The Holocene, 2015), and the Republic of the Marshall Islands (Earth's Futures in review). Haunani has worked with the USGS to collect sediment data that contributed to a 700-year paleotsunami record for Hawai'i (Sedimentology, 2019). Haunani has published 6 peer-reviewed manuscripts and presented her research to the PMNM Board (January 2020) and numerous local and international conferences. More information on Haunani's research can be found at haunanikane.com

Kammie Dominique Tavares, Coastal Geologist & Survey technician: Kammie recently completed defended her M.S. thesis in the Earth Sciences department at the University of Hawai'i at Mānoa. Kammie's research models the risk of hardening future beaches in Hawai'i in response to sea level rise. Kammie is also a former NOAA Educational Partnership Program Minority Serving Institution (NOAA EPP/MSI) scholar and has worked with Dr. Randy Kosaki to identify the vulnerability of Hawaiian monk seal critical

habitat to sea level rise. Kammie participated in the 2018 research expedition to FFS and is well versed in best management practices and cultural protocol for collecting sediments and survey data.

Kristian McDonald, Coastal Geologist & Drone operator: Kristian McDonald is a DOT/FAA-certified remote pilot (certification # 4156006) and a current M.S. student in the department of Earth Sciences at the University of Hawai'i at Mānoa. Kristian successfully conducted drone surveys in 2018 at Gin and East Island, FFS. Kristian is well versed in best management practices related to UAS in the PMNM. Kristian also has experience conducting drone surveys in the remote islands of the Republic of the Marshall Islands, and coastal settings across Hawai'i.

Aloha Kapono, Coastal Geologist & ROV operator: Aloha Kapono's background is in Geographic Information System (GIS) mapping and cultural resource management at the Pōhakuloa Training Area. Aloha will begin the Tropical Conservation Biology and Environmental Science graduate program at the University of Hawai'i at Hilo in the fall and her research project will focus upon assessing impacts of storms and sea level rise upon atoll islands within PMNM. Aloha's background in both GIS and resource management make her well qualified to assess the Walaka impacts on resource management in PMNM.

Shacles Chong, Documenter: Shacles Chong has a BA in both Hawaiian Studies and Art, with a focus on photography and videography from the University of Hawai'i at Mānoa. Shacles has experience documenting cultural and natural resource management within various communities across Hawai'i.

Pelika Andrade, Intertidal researcher: Pelika Andrade is the Hawai'i Island Seagrass Extension Agent. Pelika has a long history of developing alternative approaches to monitoring Hawai'i's shoreline and supporting the implementation of a management strategy that supports healthy, balanced communities in Hawai'i. Pelika has conducted numerous forms of research and huli 'ia trainings both across Hawai'i and within PMNM. Pelika will assist in assessing impacts and recovery specific to the intertidal zone and lead the Huli 'ia component.

Kim Morishige, Intertidal researcher: Kim Morishige is a Zoology PhD student at the University of Hawai'i at Mānoa. Kim's research focuses upon Hā'uke'uke (*Colobocentrotus atratus*), an important Hawaiian intertidal resource. Kim will assist in huli 'ia and assessing impacts and recovery specific to the intertidal zone.

Lauren Kapono, Intertidal researcher: Lauren Kapono will begin the Tropical Conservation Biology and Environmental Science graduate program at the University of Hawai'i at Hilo in the fall and her research project will focus upon assessing the impacts of sea level rise upon intertidal resources. Lauren will assist in assessing the impacts of Hurricane Walaka, and recovery specific to the intertidal zone.

Anthony Mau, Intertidal researcher: Anthony Mau received a Ph.D. Molecular Biosciences and Bioengineering from the University of Hawai'i at Mānoa. His research focuses upon intertidal natural resources such as 'Opihi (*Cellan sandwicensis*). Anthony will assist in assessing the impacts of Hurricane Walaka, and recovery specific to the intertidal zone.

g. Provide information demonstrating that you have adequate financial resources available to conduct and complete the activity and mitigate any potential impacts resulting from its conduct. The Office of Hawaiian Affairs will provide vessel funding support for the upcoming 2020 PMNM access to French Frigate Shoals. National Science Foundation Postdoctoral research funds obtained by Dr. Kane have been allocated to support post PMNM access sample and data processing. Dr. Kane is also a co-PI on a National Fish and Wildlife Refuge grant proposal and we are optimistic about receiving this source of funding. These resources will be adequate to conduct and complete the proposed activities and mitigate any potential impacts resulting from its conduct.

h. Explain how your methods and procedures are appropriate to achieve the proposed activity's goals in relation to their impacts to Monument cultural, natural and historic resources, qualities, and ecological integrity.

Our surveying methods and procedures are designed to be as un-invasive and thorough as possible. We utilize a unique approach to assessing the impacts and recovery of the island and shallow reef environments to decipher the dynamics between sediment production at reefs and sediment delivery to adjacent islands. We have successfully implemented our methodologies in similar studies at 'Upolu Island, Sāmoa, the Republic of the Marshall Islands, and at FFS in July of 2018. Our island and shallow reef surveys will enable 3D reconstructions of shallow coral habitats and island environments. These methods are non-invasive and provide high-resolution data pertaining to reef and island topography that cannot be acquired from remotely sensed satellite imagery. Sediment sampling will enable island sediment sources and availability from the shallow marine environment to be quantified. Comparisons to data collected in 2018 provide baselines for detecting changes in island and reef sediment sources following Hurricane Walaka. Ultimately this work will provide the PMNM with a comprehensive and robust dataset pertaining to the vulnerability and or resiliency of atoll reef islands systems to environmental stressors such as storms and sea level rise. Islands and corals are cultural and ecological resources that provide critical habitat to a multitude of marine and terrestrial species.

i. Has your vessel been outfitted with a mobile transceiver unit approved by OLE and complies with the requirements of Presidential Proclamation 8031?

Yes the SSV will be equipped with appropriate mobile transceiver units.

j. Demonstrate that there are no other factors that would make the issuance of a permit for the activity inappropriate.

There are no other factors that would make the issuance of a permit for our proposed activities inappropriate.

8. Procedures/Methods:

1.) Map shallow reefs using an ROV

We propose to use a remotely operated vehicle (ROV), to map and quantify the impacts of Hurricane Walaka upon 10 nearshore shallow reefs at Nihoa (2 reefs) and at FFS (8 reefs). ROV derived imagery will be post-processed at the University of Hawai'i using Structure-from-Motion. 3D models and orthophotos of the shallow reef habitat will be created for each surveyed site. We anticipate surveying at most 2 sites at Nihoa, and approximately 2 sites at each island at FFS (La Perouse, Gin, East, and Tern Islands). Surveyed sites will be approximately 100 m² in size. The ROV used by our team is a Trident Underwater drone (<https://www.sofaroccean.com/products/trident>). Our ROV is compact (7.5 lbs and 16.1in x 8.1in x 3.4in) and is tethered to the surface where real-time video enables the pilot to navigate the ROV. The ROV will be deployed from a small boat operated by the SSV Makani Olu crew. Our team is experienced in operating the ROV in numerous coastal and nearshore settings. We will follow the protocols from the PMNM Boating and Diving BMP. We will avoid contact with live corals and take great care when navigating around islands so that corals are not impacted by our work.

2.) UAS island surveys

Topographic or island elevations will be acquired from UAS imagery. We propose to collect high resolution imagery of 3 islands (Gin, East, and Tern Islands) and the surrounding nearshore environment using a UAS equipped with an internal GPS and a camera. Canvas targets (1 m x 1 m) will be laid out on the island at the time that imagery is collected and later surveyed with an RTK-GPS for ground control. The RTK-GPS includes a fixed base station that will sit on a tripod during the duration of the survey. The rover system is attached to a pole, and the surveyor will transport the rover to each survey site (corners of trenches, GPS control points, and geological features). UAS imagery and GPS control points will be post-processed at the University of Hawai'i. A topographic DEM of each island will be derived from UAS imagery using Structure-from-Motion.

3.) Sediment collection

We propose to collect no more than 200 sediment samples (not to exceed ¾ cup volume) from the shallow marine environment (80, ¾ cup volume), and modern beach face (100, ¾ cup volume). Sampling the shallow seafloor will involve a small team (at least 2 people) deploying a benthic sediment sampler from a small boat operated by the crew of the SSV Makani Olu. The benthic sediment sampler will be tethered to the boat. Sediment will be sampled adjacent to ROV survey sites (at least 2 samples per survey site) and additional sandy sites surrounding each island. If necessary, the team may also enter the nearshore marine environment with snorkel gear to recover sediment. We will follow the protocols from the PMNM Boating and Diving BMP. We will avoid contact with live corals and take great care when navigating around islands so that corals are not impacted by our work.

No more than 100 sediment samples will be collected from the beach face at Gin, East, and Tern island. At Tern Island two shallow trenches will be sampled (not to exceed a total of 20 samples, ¾ cup volume) to compare pre and post Walaka derived sediments. We anticipate trenching along the beach side of the runway as this site was noted in 2019 to have Walaka lagoon sediments deposited upon the Pre Walaka soil and subsurface sand layer. Trenches will not exceed 1 m x 1 m x 1 m in size. Trenches will be opened only long enough to be described, sampled (no more than 20 samples total), and photographed. Each trench will be backfilled with preexisting sediment. We don't anticipate any trenches being left unattended or opened overnight. We hope these measures will limit the potential for a listed species (turtle or monk seal) from entering the trench. Furthermore, we will consult with the resource monitor that accompanies us on our proposed project and the USFWS contaminants biologist to determine the safest place to excavate at Tern island.

Sediment samples will be taken back to the University of Hawai'i for compositional analysis under the microscope, and radiocarbon dating. Upon completion of analyses, samples will be returned to PMNM under the guidance of PMNM staff including the OHA.

NOTE: If land or marine archeological activities are involved, contact the Monument Permit Coordinator at the address on the general application form before proceeding.

9a. Collection of specimens - collecting activities (would apply to any activity): organisms or objects (List of species, if applicable, attach additional sheets if necessary):

We will not collect any living specimens however we do anticipate collecting skeletal reef derived material in the beach and nearshore sediment samples. Anticipated organisms include sand-sized fragments of unidentified coral species, red calcareous algae, green calcareous algae (*Halimeda*), mollusks, and foraminifera (e.g. *Amphistigena*).

Common name:

Scientific name:

& size of specimens:

Not to exceed 200 samples, each approximately ¾ cup in size.

Collection location:

Gin, East, and Tern Island.

Whole Organism Partial Organism

9b. What will be done with the specimens after the project has ended?

Specimens will be returned to PMNM staff under the guidance of PMNM. The Office of Hawaiian Affairs will be consulted for cultural guidance.

9c. Will the organisms be kept alive after collection? Yes No

No live organisms will be sampled.

• General site/location for collections:

Gin, East, Tern Island

• Is it an open or closed system? Open Closed

N/A

• Is there an outfall? Yes No

N/A

• Will these organisms be housed with other organisms? If so, what are the other organisms?

N/A

• Will organisms be released?

N/A

10. If applicable, how will the collected samples or specimens be transported out of the Monument?

Sediment and fossil reef samples will be stored in sample bags and transported out of the monument on the chartered vessel.

11. Describe collaborative activities to share samples, reduce duplicative sampling, or duplicative research:

All results, imagery, and products will be made publicly available, and provided to PMNM.

12a. List all specialized gear and materials to be used in this activity:

Shovel

Elevation survey equipment (total station, tripod, survey rod, survey ribbon, survey prism, canvas targets, brunton compass, RTK GPS base station and rover, etc.)

Phantom drone (lithium batteries, ipad)

Trident Underwater drone and ipad

Miscellaneous tools (handheld GPS, notebooks, walkie talkies, cameras, measuring tape, etc)

Snorkeling gear (mask, fins)

Sample bags and vials

12b. List all Hazardous Materials you propose to take to and use within the Monument:

Lithium batteries for the drone

13. Describe any fixed installations and instrumentation proposed to be set in the Monument:

N/A


14. Provide a time line for sample analysis, data analysis, write-up and publication of information:

Sample analysis, data analysis, and write-up/publication of information will be completed within 24 months of the proposed research cruise.

15. List all Applicants' publications directly related to the proposed project:

- *Kane, HH, Fletcher, CH. Rethinking reef island stability in relation to future sea level rise. *Earth's Future*. In Review.
- *Dominique-Tavares, K, Fletcher, C, and Anderson, T. Risk of shoreline hardening and associated beach loss peaks before mid-century. *Scientific Reports*. In Review.
- *McDonald, K. UAS surveys reveal high spatiotemporal variability in beach morphology including subcell sand exchange and accretion during swell events: Waikīkī, Hawai'i. MS thesis, University of Hawaii, USA. In preparation.
- Summers, A, Fletcher, CH, Spirandelli, D, *McDonald, K, Over, J-S, Anderson, T, Barbee, M, Romine, BM. 2018. Failure to protect beaches under slowly rising sea level. *Climatic Change* 151: 427-443.
- *Kane, HH, Fletcher, CH, Cochrane, EE, Mitrovica, JX, Habel, S, Barbee, M. 2017. Coastal plain stratigraphy records tectonic, environmental, and human habitability changes related to sea-level drawdown, 'Upolu, Samoa. *Quaternary Research* 87: 246-257.
- *Kane, HH, Fletcher, CH, Frazer, LN, Anderson, T, Barbee, M. 2015. Modeling sea level rise vulnerability of coastal environments using ranked management concerns. *Climatic Change* 131: 349-361.
- *Kane, HH, Fletcher, CH, Frazer, N, Barbee, M. 2015. Critical elevation levels for flooding due to sea-level rise. *Regional Environmental Change*. *Regional Environmental Change* 15: 1679-1687.
- *Kane, HH, Fletcher, CH, Romine, BM, Anderson, TR, Frazer, NL, Barbee, MM. 2012. Vulnerability Assessment of Hawai'i's Cultural Assets Attributable to Erosion Using Shoreline Trend Analysis Techniques. *Journal of Coastal Research* 28: 533-539.

With knowledge of the penalties for false or incomplete statements, as provided by 18 U.S.C. 1001, and for perjury, as provided by 18 U.S.C. 1621, I hereby certify to the best of my abilities under penalty of perjury of that the information I have provided on this application form is true and correct. I agree that the Co-Trustees may post this application in its entirety on the Internet. I understand that the Co-Trustees will consider deleting all information that I have identified as “confidential” prior to posting the application.


Signature _____ Date 4/2/2020

SEND ONE SIGNED APPLICATION VIA MAIL TO THE MONUMENT OFFICE BELOW:

NOAA/Inouye Regional Center
NOS/ONMS/PMNM/Attn: Permit Coordinator
1845 Wasp Blvd, Building 176
Honolulu, HI 96818
FAX: (808) 455-3093

DID YOU INCLUDE THESE?

- Applicant CV/Resume/Biography
- Intended field Principal Investigator CV/Resume/Biography
- Electronic and Hard Copy of Application with Signature
- Statement of information you wish to be kept confidential
- Material Safety Data Sheets for Hazardous Materials