State of Hawai'i
DEPARTMENT OF LAND AND NATURAL RESOURCES
Division of Aquatic Resources
Honolulu, Hawai'i 96813

June 22, 2018

Board of Land and Natural Resources
Honolulu, Hawai'i

Request for Authorization and Approval to Issue a Papahānaumokuākea Marine National Monument Research Permit to Dr. Charles H. Fletcher, University of Hawai'i, Department Of Geology and Geophysics, School of Ocean and Earth Science and Technology, for Access to State Waters to Assess the Effects of Sea Level Rise on Low Lying Atolls

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 Applicant Dr. Charles H. Fletcher, University of Hawai'i, Department of Geology and Geophysics, School of Ocean and Earth Science and Technology, pursuant to § 187A-6, Hawai'i Revised Statutes (HRS), Chapter 13-60.5, Hawai'i Administrative Rules (HAR), and all other applicable laws and regulations.

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

- French Frigate Shoals

The activities covered under this permit would occur between June 25, 2018 thru June 24, 2019.

INTENDED ACTIVITIES

The Applicant proposes to assess the impacts of past and present sea-level rise upon low lying islands to improve understanding of how future sea-level rise will impact essential habitats for priority species (e.g. sea turtles, monk seals, and various seabirds). The applicant proposes to use an unmanned aircraft system (UAS) (DJI Phantom), bucket augers, and coral cores to conduct sea level rise research. Up to eight (8) individuals including the applicant and resource monitor would access the Monument aboard the M/V Searcher (separately permitted under proposed permit number PMNM-2018-015) for up to 13 days between June 2018 to September 2018. Current proposed activity dates are June 30th-July 12th. Proposed locations include up to 3 of the following islands within French Frigate Shoals: East, Trig, Gin, Little Gin, and Shark Island.

Activities will be carried out from a small boat launched from M/V Searcher as well as on land. Modern sediment will be sampled along the seafloor (120, 2 tbsp. size samples) and comparisons will be made to island sediment to quantify how sediment source and type have changed over time. To interpret historical reef habitat and accretionary response to changes in sea-level the

applicant will recover short cores (12 total: 1 m long, and 5-8 cm diameter) from the surrounding fossil reef platform using a small hand held drill. At each island the applicant would assess the interior stratigraphic architecture (layering of sediment) by recovering sediment from a maximum of 12 sites total. Sediment recovered from the interior of the island will be strategically sampled in small quantities (120 samples total, approx. 2 tbsp. /sample) collected from within 12 x 1m^3 trenches. The island surface will subsequently be restored to an undisturbed state by infilling sites with previously extracted sediment and best efforts will be made to avoid existing vegetation, and critical habitat for birds, turtles, and monk seals.

The applicant proposes to operate a UAS over each island that they collect samples from. Predictive modeling of island habitat response to future sea-level requires the acquisition of high-resolution topographic (land) and bathymetric (shallow seafloor) elevation data. The applicant will derive digital elevation maps (DEMs) of each island from UAS imagery and Structure-from-Motion. Real Time Kinematic Global Positioning System (RTK-GPS) control points will also be collected at the time of the UAS survey to ensure that each DEM is adequately georeferenced. A vertical datum will be derived from RTK-GPS control points and a local short-term tide gauge that will be installed for the duration of field work at each island and removed before they depart. The DEM will be used to assess past changes in island habitat documented in historical imagery and their predictive model will simulate island response to future sea-level rise.

To safeguard Monument resources 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 FFS 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 FFS 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).

The activities described above may require the following regulated activities to occur in State waters:

- ☒ 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 submerged lands
- ☒ Discharging or depositing any material or matter into the Monument
- ☒ Possessing fishing gear except when stowed and not available for immediate use during passage without interruption through the Monument
- ☒ Attracting any living Monument resources
- ☒ Swimming, snorkeling, or closed or open circuit SCUBA diving within any Special Preservation Area or Midway Atoll Special Management Area

REVIEW PROCESS

The permit application was sent out for review and comment to the following scientific and cultural entities: Hawai'i Division of Aquatic Resources, Hawai'i 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 since April 12, 2018, 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.

Comments received from the scientific community are summarized as follows:

QUESTIONS:

1. Are researchers going to cap the short cores taken from the fossil reef platform at the end of the study?

Yes, we will cap short cores taken from the fossil reef platform.

2. Will there be an experienced person to help with drone monitoring if birds are present?

Yes, our drone operator has experience flying drones along coastal environments across the state of Hawai'i as well as Majuro atoll. He is currently in the process of obtaining his pilot certification (FAA Part 107 remote pilot certification) and he will obtain pilot certification by early May. We are also saving a berth on our research cruise for a resource manager. We will follow best management practices for operating drones within the monument.

3. Can Dr. Fletcher please document any previous interactions of drones and seabirds and the extent of the interactions?

In previous experiences operating the drone in the atolls of the Marshall Islands and in urban Waikiki we have had a few instances where we have encountered seabirds.

Typically in our experiences the seabirds have been curious but have avoided contact with the drone. We recognize that there are higher occurrences of seabirds in the Monument and we will be sensitive to their safety and wellbeing. We will follow the guidance of our resource manager and we will abide by protocols and guidance to ensure that we are implementing best management practices.

4. How is the drill going to be transported around (small vessel to intertidal area)?

The drill will be transported from the searcher to the island each day on a small vessel. The drill and its components will be stored in a box to ease transport.

5. How many days will be spent on land (intertidal area) for drilling activities during your visit to French Frigate Shoals?

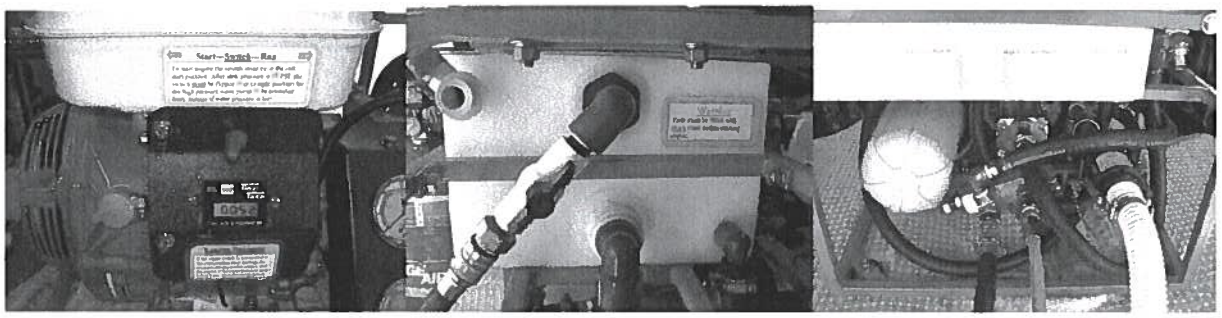
We anticipate being on land (intertidal area) for drilling activities for approximately 6-7 days.

6. How many gallons of gasoline are you planning on taking with you to operate your drill?

We anticipate storing 30 gallons of gasoline on the searcher to operate our drill. We will not take more than 5 gallons of gasoline to the island at any given time.

7. Please confirm that all your proposed activities are included in your permit application. If not, please describe any additional activities you propose to conduct in PMNM.

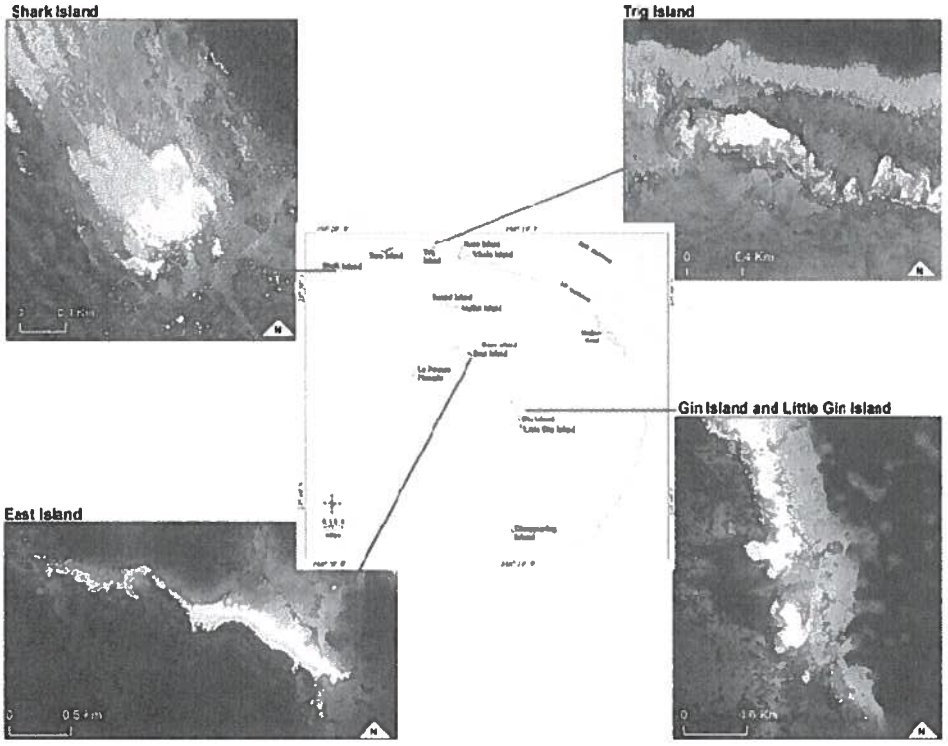
All proposed activities have been included in our permit. We plan to bring our original drill (ASC Pomeroy Gear Reduced Rock Core Drill), however we are also looking into bringing a second drill that is better suited to the wavy environment of FFS lagoon. As mentioned previously the gasoline powered engine of the ASC Pomeroy Gear Reduced Rock Core Drill is located just above the core bit and ultimately cannot get wet. The Tech 2000 drill is a hydraulic water powered core drill (no hydraulic oil) that takes in seawater to power the hydraulic drill motor. The power unit is attached to a handheld drill via a 30 m hose, and can be stored on the small vessel further containing the gasoline motor. Because the power unit is contained on the small vessel the drill itself can be submerged or get wet by rain or small waves within the lagoon. We will still limit our drilling to the intertidal area, however with this drill we would not be limited by a rising tide or by rainy conditions. We will not drill living coral heads and we will ensure that no equipment or human contact will impact living coral colonies. The Tech 2000 would be our primary drill, and the ASC Pomeroy Gear Reduced Rock Core Drill would serve as a back up drill.



The power unit of the Tech 2000 drill is composed of a 13 hp. Honda gasoline engine, a bronze low-pressure water pump, water filter, 6 gallon polyethylene water tank, high-pressure water pump, pressure relief valves, and pressure gauges. The power unit will be kept on the small vessel.

8. Besides Trig and East islands, what other islands (if any) at FFS does the applicant intend to conduct activities? We have received recent information from the field that Trig Island has been washed over. Field staff estimate that 75% of the island is awash.

Thank you for sharing with us the information about Trig Island. We propose to focus the majority of our efforts at East Island. Depending upon time, and weather we would also like to visit Gin and/or Little Gin island, Shark, and Trig. We realize that the current state of the windward most islands (Shark and Trig) may not enable us to trench, however it would be beneficial to at least obtain drone imagery of the islands, and to conduct elevation surveys. This data could help to document island change, especially when compared to historical imagery and maps. If there is an exposed fossil reef flat at low tide it may be feasible to core. We will work with our resource manager to determine the best location to conduct field work, especially when working at the windward islands that have recently experienced dramatic erosion.



9. Who will be operating the small boats, and do they have experience operating these boats in the complex environment of French Frigate Shoals?

The small boats will be operated by the crew from the M/V Searcher. The Searcher crew has experience transporting scientist and personnel to islets throughout Papahānaumokuākea and has done so as a part of the Intertidal Monitoring cruises. In 2016 the Searcher crew transported scientists and personnel to La Perouse pinnacle at FFS. Special care will be taken to ensure that safety precautions and best practices are used while navigating to, from and around the small islets.

COMMENTS / RECOMMENDATIONS:

1. Due to its prior military use, if the applicant selects Tern Island as a location for trenching and coring, they must first consult with USFWS contaminants biologists to determine the safest place to excavate.

Tern Island will not be a study site. Prior military use as well as heavy development makes it a less than ideal site as the subsurface environment most likely has been heavily overturned and would not allow for accurate reconstructions of historical beach erosion and accretion.

2. The resource monitor that is selected for this trip should be an expert or have a lot of experience in working with the impacted species. (Turtles, seals, birds.)

We are reserving a berth for a research monitor and we look forward to working with him/her.

3. The applicant must take steps to ensure that trenching and coring do not greatly impact burrow nesting seabirds or turtle nests, as well as make sure that moving around on islands do not greatly impact burrow nesting birds.

We will follow best management practices to ensure that our trenching, coring and movement on the islands does not impact burrow nesting seabirds or turtle nests.

4. The use of a drone must adhere to the UAS protocols in place for the monument. This will include – pilot certification, height and distance restrictions, avoidance of protected species, a recovery plan for pilot or equipment error/failure, etc.

Our drone pilot is currently working on his pilot certification (FAA Part 107 remote pilot certification) and he will obtain a license by early May. Our drone pilot will follow UAS protocols and best management practices that have been established for the monument.

5. The Hawaiian Monk Seal Research Program may not be present at French Frigate Shoals when the permittee is there; NMFS recommends that a qualified person from the monk seal program (or an appropriate surrogate) should accompany the permittee while at FFS.

We have a berth reserved for a natural resource manager. We look forward to working with the Monk Seal Research Program.

6. Since the application lacked details about the exact location of the trenches and the length of time the trench would be open, NMFS is concerned with the potential for a listed species (turtle or monk seal) falling into the trench. If the trench is likely to be open overnight and/or not monitored, then the applicant will need to consider ways to prevent access (i.e. setting up a barrier) to the open trench.

We will do our best to ensure that trenches are not left open overnight. If for some unforeseen reason we need to leave a trench open overnight then we will set up a barrier to prevent turtles or monk seals from falling into the trench.

6 a. We recommend that the applicant back fills all trenches before leaving a site for the day and plan accordingly to have enough time to collect all samples from a trench and back fill before deciding to dig a trench.

We will do our best to plan accordingly to dig, sample, and infill trenches within the same day. If for some reason we run out of time, we will work with our resource manager to determine whether or not we can establish a barrier around the trench or if it would be better to infill the trench.

7. For the nearshore sediment samples and reef cores, there is the potential for inadvertent damage to corals. The research team will need to review and follow the protocols from the PMNM Boating and Diving BMP. All contact with live coral must be avoided. Great care should also be taken when navigating to the islands so that corals are not impacted or hit with boats or props.

Thank you for providing us with the PMNM Boating and Diving BMP. We will follow these protocols and avoid contact with living coral.

8. DAR has no concerns regarding **modern sediment to be sampled along the seafloor (Approximately 40 samples per island/ each sample = 2 tbsp./ 2-3 sandy islands sampled within FFS: total = 120 modern sediment samples). No cumulative impacts are anticipated if the permittee adheres to the following conditions:** The permittee should mitigate for the spread of invasive species between areas of collection. Collection equipment should 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. Efforts should be made by permittee and authorized assistants to ensure that collection of samples is conducted in such a manner as the process does not result in any additional harm to surrounding marine organisms. Efforts will be made by permittee and authorized assistants to distribute collection activities across shoreline/reef flat/benthic areas, so as not to consolidate the impacts of collection in one location.

We will follow the suggestions listed above. Collection equipment will be disinfected between sampling different areas, and sampling will be conducted such that no additional harm is done to surrounding marine organisms. Sampling will be collected in such a way to minimize impacts to a single location.

9. DAR has no concerns regarding the collection of **short cores (12 total: 1 m long, and 5-8 cm diameter) from the surrounding fossil reef platform using a small hand-held drill. No cumulative impacts are anticipated if the permittee adheres to the following conditions:**

A) For fossil reef core sites that will **not** have temporary tide gauge installed: Fossil reef core scar-sites should be capped and filled in with prefabricated Portland Type II cement plugs (or other environmentally benign filler) to prevent bioerosion. The core/plug will be flush with the surface area of the fossil reef core sites to facilitate quicker overgrowth in the future of CCA, turf algae or other benthic organisms that colonize the area of collection. Non-toxic or environmentally inert filler, will be used to fill in or seal the plug/cap on fossil reef core scar-sites, **if necessary**, to minimize risk of introducing disease, parasitism, or settlement of sand in open spaces around exposed core sample site. **If initial plug/cap is secure by itself, it may be better practice to insert cap *without* a non-toxic or environmentally inert filler, as most fillers have a certain level of eco-toxicity.** Filler used should be graded as safe to coral health and benign to the normal processes of coral reproduction.

Drilling will take place only on fossil limestone surfaces. We will not drill living coral heads and we will ensure that no equipment or human contact will impact living coral colonies. We will plug holes if necessary but as it is not a living coral surface we question the necessity of cement plugs.

DAR's recommendation for cement caps/plugs was in the interest of preventing further bio-erosion in the fossil limestone by blocking off access to the core tunnel to bio-eroding organisms. However, after additional review, the possibility of bio-erosion occurring may be an acceptable risk in comparison to the placement of foreign materials such as Portland Type II cement for caps/plugs in a near pristine environment such as the PMNM. If there is any way the applicant can use calcium carbonate plugs for this activity DAR supports this mitigative measure; otherwise activity of not capping the cores (leaving the core tunnels open/uncapped) is also acceptable if necessary.
Thank you.

Figure 1. Here is an example of a fossil limestone surface that we have sampled at Majuro atoll.

Reef coring description:
Typically the sites that we core are exposed at low tide and as the tide rises and water levels increase beyond 1 foot water depth we halt coring operations until the tide subsides. Our hand-held gas powered drill is attached to 5.08 cm and 7.62 cm diameter diamond core bits. The drill itself operates off of a two stroke 50cc motor, and a portable gas powered water pump is used to prevent the cored limestone from adhering to the drill bit. Limestone cores are photographed, described, and placed into core boxes for subsequent analysis at UH Manoa. Samples will be returned to PMNM under the guidance of PMNM staff including OHA.

B) DAR requests follow-up photo-documentation of a subsample of fossil reef core sites (if possible) on future scientific expeditions to the NWHI, including before and after photos of fossil reef core scar-sites (with scales for size), core samples (with scales for size) and methodology used by researchers to collect cores. Follow-up photo-documentation should in any year post collection (within 3-5 years if possible). Permittee should provide locations for collection sites to facilitate this.

GPS locations, maps, and photos of cored locations will be provided so that follow up photo documentation can be accomplished.

C) Permittee is authorized to use pneumatic (air) drill to collect fossil reef core sites. All components of pneumatic drill should be cleaned of lubricants or

chemicals before deployment in water to minimize leaching. Permittee must minimize impact of gear and field technicians on coral colonies. **No gear (tools, air tanks, hoses, etc.) will be placed on any coral colonies** during any collection activities. Researchers will minimize impact from bodily contact with coral colonies (including standing on while drilling nearby fossil reef, holding for support, etc.).

We currently do not use a pneumatic drill and the use of such equipment or equipment that doesn't require a motor is not practical for obtaining cores from the fossil reef flat. We have established success with a 50cc gasoline driven motor and a portable gasoline powered water pump. Successful drilling requires years of field drilling experience. Over the past three decades Dr. Fletcher has successfully refined our coring methods and has implemented them across the state of Hawai'i and atoll islands within the Marshall Islands. To limit our impact we will ensure that all components of the drill are cleaned before use in the monument. We will reserve all drilling operations to fossil limestone surfaces areas below the high water mark. Our equipment limits drilling to water that is 1 foot in depth or shallower. We will not drill living coral heads and we will ensure that no equipment or human contact will impact living coral colonies.

We have demonstrated success recovering fossil reef cores using an ASC Pomeroy Gear Reduced Rock Core Drill. Our hand-held gas powered drill is attached to 5.08 cm and 7.62 cm diameter diamond core bits. The drill itself operates off of a two stroke 50cc motor, and a portable Honda WX10 water pump is used to prevent the cored limestone from adhering to the drill bit. We have previously used this drill in Majuro on a tidally exposed fossil reef flat (See images above & below).

To limit our impact we will ensure that all components of the drill are cleaned before use in the monument. We will reserve all drilling operations to fossil limestone surfaces areas below the high water mark. Through field experience we have found that our equipment limits drilling to water that is 1 foot in depth or shallower because the motor of the drill cannot be submerged. We will not drill living coral heads and we will ensure that no equipment or human contact will impact living coral colonies.

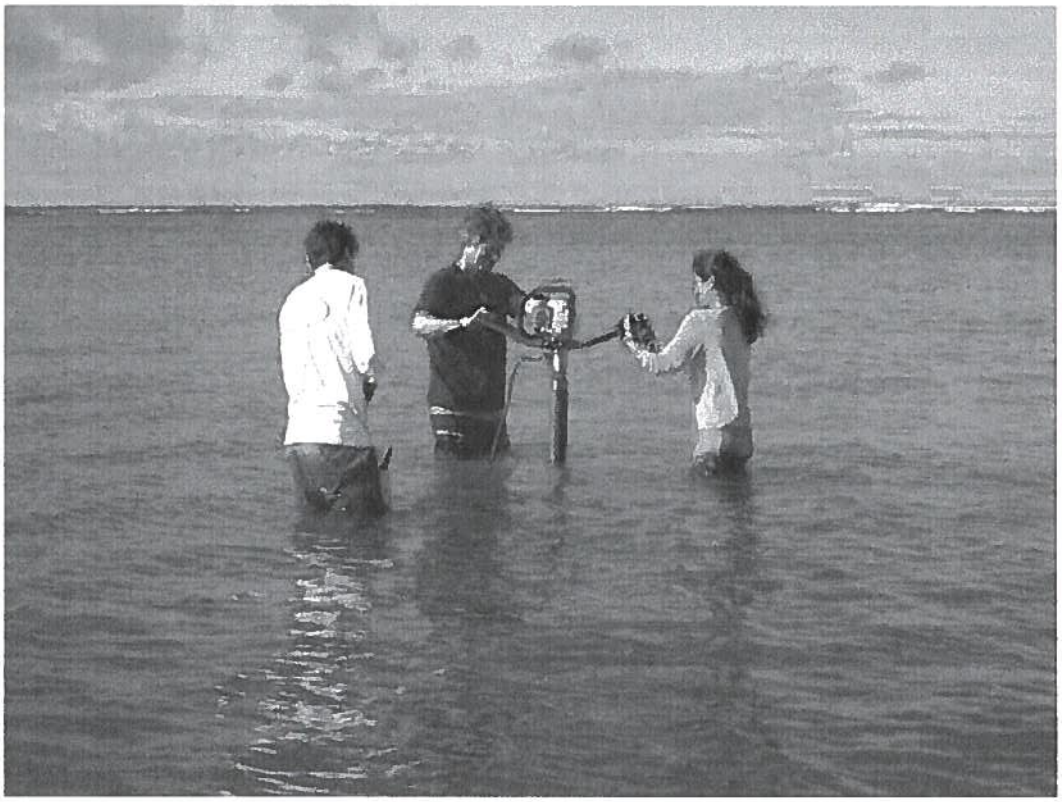


Figure 2. Fossil reef recovery will occur below the high water mark and no deeper than approximately 1 foot because the motor of the drill cannot be submerged.

10. Papahānaumokuākea is considered an ʻāina akua by many Native Hawaiians, and OHA appreciates the efforts of the applicant to respect the sacredness of the place by returning sediment samples to the areas where they may be removed from over the course of the research. We look forward to working with the applicant and his team in doing so. OHA also acknowledges the importance of climate change research to understanding the changes to our island environments.

Mahalo we look forward to working with OHA and PMNM staff to ensure that sediment samples are properly returned to French Frigate Shoals.

11. This research is critical for Monument managers to better understand the likely impacts of continued sea level rise on nesting and pupping habitat for our protected species.

    Mahalo nui.

12. As a special condition to your permit, the co-managing agencies of PMNM require that a spill kit consisting of the following be on board the small vessel and with the researchers while drilling operations are occurring: absorbent pads (equivalent for the amount of gas taken into the Monument), bags to dispose of clean-up efforts and gloves.

We will create a spill kit that will be on board the small vessel and with researchers while drilling operations occur. As recommended our drill kit will include absorbent pads equivalent to the volume of gas (30 gallons) taken into the Monument, and bags to dispose clean-up efforts and gloves.

13. We ask that when it comes to filling the drill with gasoline, that those operations take place either on the larger vessel (Searcher) or upon land at the discretion of the Resource Monitor.

At the beginning of each work day the drill will be topped off with gasoline on the Searcher. While on land the drill will most likely need to be refilled. We propose refilling the drill in the small boat or upon land at the discretion of the Resource Monitor.

> *13 a.* We concur that filling the drill at beginning of each work day on the Searcher is a good idea. We however don't want the drill filled up on the small boat and therefore recommend filling the drill on land in the upper part of the intertidal zone. Thank you.
>
> *Thank you if we need to refill the drill while on island we will do so on land in the upper part of the intertidal zone.*

We concur that filling the drill at beginning of each work day on the Searcher is a good idea. We however don't want the drill filled up on the small boat and therefore recommend filling the drill on land in the upper part of the intertidal zone. Thank you.

14. All the islands at FFS with the exception of Tern are proposed Wilderness areas which are managed as Wilderness. All terrestrial proposed drilling activities will be restricted to the intertidal area (below the mean High tide line). Machine powered drills are not allowed in Wilderness areas at FFS.

We will limit drilling and launching the drone in Wilderness areas at FFS. All drilling activities will occur below the mean high tide line.

15. The Resource Monitor and the NMFS field staff will help determine the best location to dig trenches on the islands of FFS. Nesting seabirds, turtle nests and seals with pups will come into the decision process. East Island has an extremely high density of green sea turtle nests which will make digging a trench more difficult.

We look forward to working with the resource monitor and NMFS field staff to determine the best location to dig trenches on the islands of FFS. We will include nesting sites, and seals with pups into the decision process.

16. The permittee must be aware of the unique biosecurity rules of FFS. East Island has separate biosecurity from the rest of FFS due to the introduction of *Cenchrusa echinatus* many years ago. Therefore, a separate set of quarantine gear (including

soft gear) will be needed for East Island. We also strongly recommend that East island be visited last.

We will abide by the special conditions and rules for moving between islands/atolls. We will pack adequate quarantine gear and sequester clothing so that no contamination occurs. We will do our best to scope out all four islands first and when determining which islands we will conduct field work (coring and trenching) we will do our best to try to work at East island last.

17. The resource monitor (possibly with help from the NMFS turtle field staff, if they're present) will safely probe the area for nests before trenching begins if the RM deems necessary. This activity shouldn't take too long (10-15 min max per trenching area) but it may be a necessary precaution.

Thank you.

Comments received from the Native Hawaiian community are summarized as follows:

Cultural reviews support the acceptance of this application. No concerns were raised.

Comments received from the public are summarized as follows:

No comments were received from the public on this application.

Additional reviews and permit history:
Are there other relevant/necessary permits or environmental reviews that have or will be issued with regard to this project? (e.g., MMPA, ESA, EA) Yes ☒ No ☐
If so, please list or explain:

- The proposed activities are incompliance with the National Environmental Policy Act.
- The proposed activities are in compliance with the National Historic Preservation Act.
- An informal consultation pursuant to section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. §1531 et seq.) was conducted. The outcome of this review 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)) is currently underway. The outcome of this review may require the applicant to adhere to other NMFS-prescribed conditions. Such conditions would be reflected in the PMNM permit, prior to issuance.

- 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 PAPAHĀNAUMOKUĀKEA MARINE NATIONAL MONUMENT RESEARCH PERMIT TO DR. CARL MEYER, HAWAI'I INSTITUTE OF MARINE BIOLOGY, UNIVERSITY OF HAWAI'I, FOR ACCESS TO STATE WATERS TO CONDUCT TOP PREDATOR FEEDING HABITS AND MOVEMENT RESEARCH ACTIVITIES UNDER PERMIT PMNM-2018-018."

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

PMNM staff is of the opinion that the Applicant has properly demonstrated valid justification for their application and should be allowed to enter the NWHI State waters and 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 PMNM staff.

RECOMMENDATION:

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.

That the Board authorize and approve a Research Permit to Dr. Charles Fletcher, University of Hawai'i, with the following special conditions:

1. This permit is not to be used for nor does it authorize the sale of collected organisms. Under this permit, the authorized 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.

2. 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.

3. To prevent introduction of disease or the unintended transport of live organisms, the permittee must comply with the disease and transport protocols attached to this permit.

4. Tenders and small vessels must be equipped with engines that meet EPA emissions requirements.

5. 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 NWHI Marine Refuge.

Respectfully submitted,

Maria Carnevale
State Co-Manager
Papahānaumokuākea Marine National Monument

APPROVED FOR SUBMITTAL

SUZANNE CASE
Chairperson

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
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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: Charles H. Fletcher
Affiliation: Department of Geology and Geophysics, School of Ocean and Earth Science and Technology University of Hawai'i (UH) at Mānoa

Permit Category: Research
Proposed Activity Dates: May thru September 2018
Proposed Method of Entry (Vessel/Plane): Vessel (M/V Searcher)
Proposed Locations: French Frigate Shoals (FFS)

Estimated number of individuals (including Applicant) to be covered under this permit: 9

Estimated number of days in the Monument: 13

Description of proposed activities: (complete these sentences):

a.) The proposed activity would…

Assess the impacts of past and present sea-level rise upon low lying islands to improve understanding 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 ….

Develop historical reconstructions of beach erosion and accretion during the recent Holocene (approximately 6,000 years ago to present), and provide managers with predictive models of sea-level rise impacts to nesting and foraging habitats for sea turtles, monk seals, and birds in Papahānaumokuākea. At FFS we propose to visit 2-3 sandy islands. At each island we would assess the interior stratigraphic architecture (layering of sediment) by recovering sediment from a maximum of 12 sites total. . Sediment recovered from the interior of the island will be strategically sampled in small quantities (120 samples total, approx. 2 tbsp/sample). The island surface will subsequently be restored to an undisturbed state by infilling sites with previously extracted sediment and best efforts will be made to avoid existing vegetation, and critical habitat for birds, turtles, and monk seals. Modern sediment will be sampled along the seafloor (120, 2 tbsp size samples) and comparisons will be made to island

sediment to quantify how sediment source and type have changed over time. To interpret historical reef habitat and accretionary response to changes in sea-level we will recover short cores (12 total: 1 m long, and 5-8 cm diameter) from the surrounding fossil reef platform using a small hand held drill.

Predictive modeling of island habitat response to future sea-level requires the acquisition of high-resolution requires topographic (land) and bathymetric (shallow seafloor) elevation data. We will derive digital elevation maps (DEMs) of each island from drone imagery and Structure-from-Motion. Real Time Kinematic Global Positioning System (RTK-GPS) control points will also be collected at the time of the drone survey to ensure that each DEM is adequately georeferenced. A vertical datum will be derived from RTK-GPS control points and a local short-term tide gauge that we will install for the duration of field work at each island. The DEM will be used to assess past changes in island habitat documented in historical imagery and in our predictive model to simulate island response to future sea-level rise.

c.) This activity would help the Monument by …

Sea-level rise is predicted to exceed 1-2 m by the end of the century (Sweet et al., 2017), which threatens the very existence of low lying islands and critical habitats for priority species found throughout Papahānaumokuākea. Ultimately our 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. This will be accomplished by first reconstructing beach erosion and accretion during the recent Holocene as sea-level rose 1-2 m approximately 2,000-4,000 years ago. For example did islands form and persist as sea-level rose, or was island formation triggered as sea-level fell below some perceived critical value? Answering this question will provide a historical basis for the capacity of island evolution and habitat response to anticipated sea-level rise.

Secondly, predictive modeling of sediment transport and wave environment will provide managers insight into how sea-level rise and perturbations to the island's shape and nearshore bathymetry at FFS will affect the convergence or divergence of wave-driven sand transport, causing the islands to accrete or erode, respectively. We strive to determine whether or not sand production from the reef is large enough to support island emergence and growth under static or rising mean sea-level conditions. If island emergence is only possible during falling sea-levels then it may be necessary to begin identifying solutions to the loss of nesting and foraging habitats for sea turtles, monk seals, and birds. Lessons learned at FFS are applicable throughout Papahānaumokuākea.

Other information or background:
Sweet et al., (2017) identifies six scenarios of potential sea-level rise that should be considered for management planning. In all scenarios there is little variation by mid-century. Approximately 30 cm (1 foot) is projected by 2050. In the second half of the

century various scenarios diverge dynamically to a mean of roughly 1.0 m by 2100, extreme of 2.0 m by 2100, and a minimum of less than 1.0 m by 2100. Which scenario plays out is being determined today by the greenhouse gas emissions of our modern society.

Models of paleo sea-level and morphologic evolution, as revealed by the proposed field work, will help to understand the processes that govern the stability of low lying islands as sea-level continues to rise in the future. This study is the first of its kind to model future impacts of sea-level rise using a process-based, shoreline evolution that couples historical geological data, high resolution imagery, and modern sediment dynamics. Considering that island loss has already been documented at FFS and prior assessments predict five of the nine islands at FFS will be entirely inundated at 2.0 m (using a passive inundation model) (Reynolds et al., 2012) it is imperative that improved scientific qualitative data be provided to guide responsive management plans for critical ecosystems and endangered species.

We have successfully implemented our methodologies in similar studies at Kapapa Island, O'ahu, 'Upolu Island, Sāmoa, and Bokollap Island, Majuro atoll. At Kapapa Island, Dr. Fletcher's research has provided the best record of the Mid-Holocene higstand (Fletcher and Jones, 1996), which is the basis for our understanding of the local sea-level record for Hawai'i over the past 6,000 years. At 'Upolu, we have successfully employed trench and auger methods to accurately document the evolution of the sandy coastal plain environment in response to changes in Holocene sea-level (Kane et al., 2017). The sedimentological record developed at 'Upolu shows that as sea-level fell following the mid-Holocene highstand, the coastal plain prograded (grew in the oceanward direction) allowing for increased habitatbility of coastal plain environments, and establishment of initial Sāmoan settlement sites (Cochrane et al., 2016; Kane et al., 2017a). Finally at Majuro we have shown that fossil reefs can be sampled with minimal environmental impact using a handheld drill and that our methods enable accurate reconstructions of habitat change in response to changes in sea-level (Kane et al., 2017b).

Obtaining a better understanding of the fate of reef islands is vital for understading the future of critical habitats at FFS and also for eludicating what impacts we may forsee for cultural, natural, and historic resources of the PMNM as a whole.

Section A - Applicant Information

1. Applicant

Name (last, first, middle initial): Fletcher, Charles, H.

Title: Associate Dean for Academic Affairs and Professor of Geology and Geophysics

1a. Intended field Principal Investigator (See instructions for more information):
Dr. Charles H. Fletcher

2. Mailing address (street/P.O. box, city, state, country, zip):
[redacted]

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

3. Affiliation (institution/agency/organization directly related to the proposed project):
Department of Geology and Geophysics, School of Ocean and Earth Science and Technology University of Hawai'i at Mānoa

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):
Sean Vitousek, Coastal Geologist, Modeler
Haunani Kane, Coastal Geologist
Kammie Dominique Tavares, Costal Geologist
Kristian McDonald, Coastal Geologist, Drone operator
Dr. Jade Delevaux, Coastal Geologist, Geospatial technician
Clifford Kapono, Researcher

Section B: Project Information

5a. Project location(s):

		Ocean Based	
☐ Nihoa Island	☐ Land-based	☐ Shallow water	☐ Deep water
☐ Necker Island (Mokumanamana)	☐ Land-based	☐ Shallow water	☐ Deep water
X French Frigate Shoals	**X** Land-based	**X** Shallow water	☐ Deep water
☐ Gardner Pinnacles	☐ Land-based	☐ Shallow water	☐ Deep water
☐ Maro Reef			
☐ Laysan Island	☐ Land-based	☐ Shallow water	☐ Deep water
☐ Lisianski Island, Neva Shoal	☐ Land-based	☐ Shallow water	☐ Deep water
☐ Pearl and Hermes Atoll	☐ Land-based	☐ Shallow water	☐ Deep water
☐ Midway Atoll	☐ Land-based	☐ Shallow water	☐ Deep water
☐ Kure Atoll	☐ Land-based	☐ Shallow water	☐ Deep water
☐ 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:
We propose to conduct our analysis at East Island, Trig Island, and if time and weather permits a third island location (e.g. Shark Island, Gin Island, round Island, or Disappearing Island) will be determined. We propose to trench, and collect aerial imagery of the subaerial portion of each island. Within the shallow nearshore environment we propose to survey, and collect sediment samples. Reef coring will occur along shallow (less than 1 m deep, or subaerial) fossil (non living) reefs. We will also install a temporary tide gauge within one of the reef core holes and temporarily deploy current and wave sensors.

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

X Removing, moving, taking, harvesting, possessing, injuring, disturbing, or damaging any living or nonliving Monument resource

X 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

X 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)
X 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:
(a) Purpose of proposed activities
The purpose of our research is to assess the impacts of past and present sea-level rise upon low lying islands to improve understanding of how future sea-level rise will impact essential habitats for priority species (e.g. sea turtles, monk seals, and various seabirds). This information will provide guidance for PMNM managers tasked with developing responsive management plans.

We aim to answer the following specific management questions related to the Kapapa highstand which reached a maximum 2.00 ± 0.35 m sea-level value in Hawai'i 3,500 years BP: Did the reef islands at FFS form ca. 6,000 to 4,000 years ago as sea-level rose out of the last ice age toward this highstand? Or did they emerge as sea-level fell in the more recent 1,000 to 2,000 years? The objective of the historical analysis is to develop historical reconstructions of beach erosion and accretion during the recent Holocene (approximately 6,000 years ago to present).

We also seek to answer the following specific management question related to the management of priority species in a future of elevated sea-level: How will sea-level rise impact wave driven sand transport and cause islands to accrete or erode? How will changes in island size and configuration affect nesting and foraging habitats for sea turtles, monk seals and birds in Papahānaumokuākea? The objective of this component will be to provide managers with predictive models of sea-level rise impacts to priority species within Papahānaumokuākea.

(b) Need for proposed activities
As global mean sea-level rise continues to accelerate (Chen et al., 2017), administrators of the PMNM are faced with the need to develop responsive management plans for critical ecosystems and endangered species. Central to this is the challenge of improving understanding of how essential habitats will respond to sea-level rise. Reef islands at FFS provide critical habitat to sea turtles, monk seals, and various seabirds. Prior assessments predict using passive inundation models that a 2 m rise in sea-level will result in complete submergence of five of the nine islands at FFS (Reynolds et al., 2012). While passive models provide a good first assessment of sea-level rise impacts, they do not account for sediment dynamics, or sand transport which is inherently captured in the sedimentological record of reef islands and the adjacent reef flat. Here we propose to build upon existing passive sea-level assessments by

using observations from the historical record to guide a predictive model that integrates longshore and cross-shore sediment transport processes by waves and sea-level rise to predict shoreline change on a variety of timescales. Developed by Co-PI Sean Vitousek, this is the only process-based, observation assimilating, shoreline evolution model in the scientific literature.
Low lying reef islands like FFS are geologically-ephemeral sedimentary features composed of carbonate sand and gravel, and are constantly reshaped by tides, waves, and wave-driven currents. These sandy environments are highly responsive to sea-level rise and are likely to undergo significant geomorphic change that will intensify with time (Romine et al., 2016; Vitousek et al., 2017). Understanding and predicting these geomorphic changes will provide managers with the information required to effectively conserve these important habitats at FFS.

Our proposed research will be the first to document reef island history anywhere in the PMNM. The described results are achievable because we are applying proven methodology to a new system and possess the expertise to execute the proposed research activities. The resulting data will be critically valuable for providing historical records to enable modeling of how predicted sea-level rise will impact essential island habitat for sea turtles, monk seals, and various seabirds no only at FFS but throughout PMNM.

(c) Scope for proposed activities
To interpret the historical reconstructions of beach erosion and accretion during the recent Holocene we propose to visit 2-3 sandy islands within FFS. This will enable us to interpret the response of sandy island reconfiguration and existence as past sea-level rose to max values of 2.0 m and fell to present values. Our research has the potential to quantify the historical record of island response to over 6,000 years of local sea-level change. In order to quantify the evolutionary response of the island environment we propose to sample up to four sites at each island (120 total samples from 12 sites) from geologic trenches. Each geologic trench will have a maximum size of approximately 1 m^3. Sampled sites will be infilled with original sediment. To quantify modern sediment transport and composition, two transects will be established within the nearshore environment and sampled at each island (120 samples total from 6 nearshore survey transects). Comparisons of sediment age and composition will be made amongst island sediment and modern nearshore sediment in order to quantify how sediment source and composition has change over time. To provide understanding of historical reef habitat and accretionary response to changes in sea-level we propose to recover four short cores at each island (12 short cores total) from the surrounding fossil reef platform using a small hand held drill. All sampled material will be taken back to the University of Hawai'i for subsampling, dating (radiocarbon) and compositional analysis. All samples that are temporarily removed from the monument will be returned to FFS under the guidance PMNM staff including the OHA.

Observations gained from the historical record will enable our predictive model to model future impacts to priority species within Papahānaumokuākea. Predictive modeling

requires the acquisition of high-resolution topographic (elevation) data. We propose to use a drone to collect high resolution imagery of 2-3 islands and their surrounding nearshore environment. Imagery will be post processed at the University of Hawai'i, where we will derive digital elevation maps (DEMs) of each island from drone imagery and Structure-from-Motion (McDonald et al., 2017). In order to quantify the accuracy of our DEMs will need to establish RTK-GPS control points at each study site at the time of the drone survey. To quantify the vertical accuracy of our DEM, as well as tie sea-level to common vertical datum we propose to establish a local short-term tide gauge (automated water level data logger) at each of the study sites. The tide gauge will occupy a core hole for the duration of time spent at each of the three study sites. The DEM, drone imagery, historical sedimentary record, and wave data will be used by the predictive model to explore how sea-level rise and perturbations to the island will accrete or erode each surveyed island.

References

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

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 of 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 removing cores from the fossil reef flat. 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. As a means to ensure that our research aligns with PMNM best management practices and policies we acknowledge that value of FFS islands for critical habit for the threatened Hawaiian Green sea turtle, endangered Hawaiian habitat and a number of endangered and native seabirds. Special care will be taken to avoid nesting sites and burrows. To minimize impact, we will be using a combination of bucket augering and trenching to extract sediment from the island.

Trenching is necessary in order to observe the stratigraphic architecture of the island which is not otherwise available and is a key element in understanding the island accretion and erosion process. We will ensure that sampled areas on the island are infilled with existing sediment and every attempt will be made to ensure that sampled areas are returned to preexisting conditions.

Efforts will be made to ensure that fossil reef cores are only extracted from non-living coral samples or cemented carbonate pavement. No living corals will be sampled. Our drill is a powered by a gas motor and safety protocols have been established to ensure that fuel and oil are safely contained and stored. These protocols have been tested in the field and have been used during two prior field expeditions at Majuro atoll. Sediment and fossil reef samples will be returned to PMNM staff under the guidance of the OHA to ensure that our efforts are culturally appropriate.

We will be operating a drone to collect high resolution imagery of FFS islands. We will make every effort to follow established drone protocols and best management practices.

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, while at sea we will have group discussions centered around huli 'ia, a tool developed by Nā Maka 'o Papahānaumokuākea, to document environmental observations experienced through all of our senses while in Papahānaumokuākea. Researchers 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 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 species and spaces that may be encountered in the mesophotic zone. Finally, in an effort to create intergenerational capacity building, three native Hawaiian students will be included in the research team, and be mentored in all aspects from research development, field work, 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 and fossil reef, however the lessons learned from our research has the potential to enable researchers and managers to better plan for the very existence of these sites as sea-level continues to rise into the future. In addition by applying our coring methods on previous research

expeditions on O'ahu and Majuro atoll we have observed that cored reef flats naturally infill (8 cm max diameter cored hole) with sediment relatively quickly.

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 elevated sea-level. Hence the study must be carried out within the Monument. We are limiting our study site to three 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 and as sandy habitat in PMNM becomes unstable as a result of 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 (e.g. Disappearing island), and 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 this study by coupling a historical analysis that extends 1000s of years into the past, as well as high resolution imagery and elevation data sets to model shifts in the sedimentary budget into the future. By coupling all of these components we will produce the first study of its kind that provides guidance for future management of critical habitats based upon lessons learned from the historical record, and allows for an evolving sedimentary budget. 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 upon monument resources. For example, no live samples of coral will be sampled or removed from the monument. Finally we will work with PMNM staff including the OHA to ensure that all samples are returned 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 reach the desired data required to reconstruct the paleo sea-level record as well as collect topographic data to model future sea-level impacts. We propose to visit and sample 2-3 islands during the 13 day period. The outcome will be a historical record of island evolution that encompasses nearly 6,000 years. From this record we hope to project sea-level impacts upon critical habitat 100+ years into the future.

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:

Charles H. Fletcher (UH at Mānoa): Dr. Fletcher has over 100 peer-reviewed publications, and 30 years of experience leading investigations related to island evolution, beach processes, sea-level history and impacts, and carbonate sedimentary processes. Dr. Fletcher serves as the Associate Dean of the School of Ocean and Earth Science and Technology, was recognized in 2011 by the U.S. Environmental Protection Agency with an Environmental Achievement Award in Climate Change Science, in 2018 became a Honolulu city council climate change commissioner, and has worked actively with managers, stakeholders, and policy makers over the past 30 years to determine best practices and adaptive management strategies across the state of Hawai'i and in the Republic of the Marshall Islands.

Sean Vitousek (University of Illinois at Chicago): Dr. Vitousek has developed a model that integrates longshore and cross-shore sediment transport processes by waves and sea-level rise to predict shoreline change on a variety of timescales. The model uses an extended Kalman filter data-assimilation technique to auto-tune model parameters and improves confidence in long-range shoreline predictions. This is the only process-based, observation assimilating, shoreline evolution model in the scientific literature. Dr. Vitousek's model will be applied to FFS to model island response to future sea-level rise. Dr. Vitousek is an experienced ocean and coastal modeler who brings extensive quantitative expertise to this project.

Haunani Kane (SOEST, UH Mānoa): Haunani has nearly a decade of experience in assessing past, present, and future impacts of sea-level rise upon Pacific Islands. Haunani has spent the past four years interpreting the sedimentological record of Pacific Islands and reefs (e.g. Sāmoa, Majuro atoll, Hawai'i) so that Island communities can better understand the role of the mid to late Holocene sea-level change played in the reconfiguration of coastal environments and habitats. Haunani has visited the PMNM twice before as a part of the 2016 intertidal monitoring cruise, and as a crew member and apprentice navigator aboard Hikianalia in 2013.

Kammie Tavares (SOEST, UH Mānoa): As a part of the NOAA educational partnership program, Kammie conducted a sea-level rise assessment that will assist PMNM managers in prioritzining future impacts upon the Hawaiian monk seal. Kammie's research also looks at the impacts of sea-walls upon beach stability and degradation of critical habitat.

Kristian McDonald (SOEST, UH Mānoa): Kristian's research focuses upon the use of unmanned aerial vehicles (e.g. drones) to image and develop digital elevation models that are used to assess changes in beach volume and shape. Kristian has developed such products for Waikiki beach, and Majuro atoll both of which have applications for assessments of future sea-level rise impacts.

Jade Delevaux (SOEST, UH Mānoa): Dr. Delevaux is a geospatial analyst and is currently updating the historical shoreline database for the Kaua'i, Maui and O'ahu.

Jade is also experienced in developing spatially-explicit linked land-sea models coupled with scenario planning to quantify the impact of land cover change on coral reefs.

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.
Our research will be supported by resources from the University of Hawai'i. Four members of the field team come to the project at no cost. We are also optimistic about receiving the National Fish and Wildlife Foundation 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.
The methods and procedures that we are proposing are ideal for achieving our goals while attempting to minimize impacts to Monument resources, qualities, and ecological integrity. We have successfully implemented our methodologies in similar studies at Kapapa Island, O'ahu, 'Upolu Island, Sāmoa, and Bokollap Island, Majuro atoll. At Kapapa Island, Dr. Fletcher's research has provided the best record the of Mid-Holocene higstand (Fletcher and Jones, 1996), which is the basis for our understanding of the local sea-level record for Hawai'i over the past 6,000 years. At 'Upolu, we have successfully employed the trench and auger method to accurately document the evolution of the sandy coastal plain environment in response to changes in Holocene sea-level (Kane et al., 2017). Finally at Majuro we have shown that fossil reefs can be sampled with minimal environmental impact using a handheld drill and we have worked

with the USGS to develop a high resolution DEM from drone imagery (Kane et al., 2017b).

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 private vessel will be equipped with appropriate mobile transceiver units. The vessel and the captain of the M/V Searcher have accessed the PMNM on multiple occasions, including FFS and will comply with all Monument BMPs and vessel requirements. The M/V Searcher will be applying for their own permit.

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:
FFS will be accessed using the M/V Searcher. Small boats will be used for the daily transport of researchers and equipment to each island. The vessel and the captain of the M/V Searcher have accessed the PMNM on multiple occasions, including FFS and will comply with all Monument BMPs and vessel requirements.

Historical assessment:
(i) Collecting island sediment
We propose to interpret the subsurface island stratigraphy at East Island, Trig Island, and a third island (e.g. Shark Island, Gin Island, round Island, or Disappearing Island) will be determined based upon weather and time availability. A total of 12 sites will be identified from the 2-3 islands using a combination of island trenching and bucket augering (Figure 1). A total of 120 (approximately 2 tbsp volume/sample) sediment samples will be strategically selected in the same manner in both the trenched and the augered sites. The number of samples taken from island will vary depending upon island size, depth of sampling site, and complexity of island stratigraphy. Samples will be taken back to UH Mānoa for compositional analyses 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. A detailed description of sampling methods is provided below.

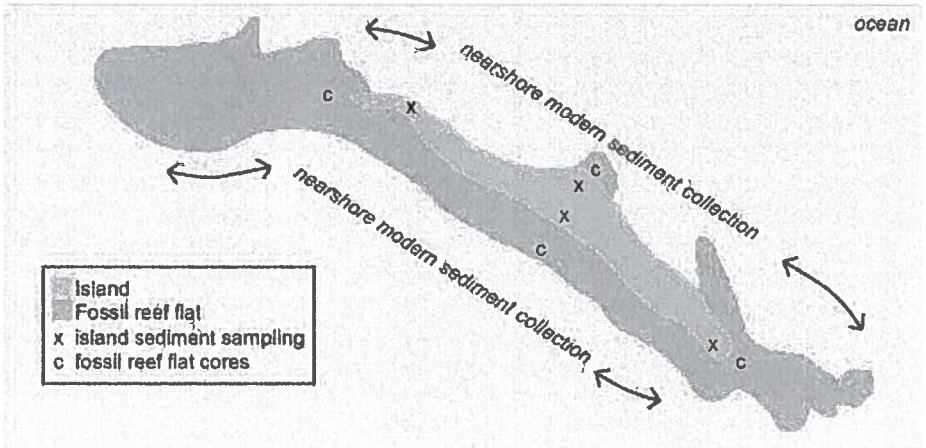

Figure 1. Generalized island sampling layout. The number of island sediment sampling sites and fossil reef flat coring sites will vary based upon island size and accessibility. In total we propose to sample 12 island sediment sites (trench and/or bucket auger), and 12 fossil reef coring sites on 2-3 islands.

Island trenching:
Trenching is necessary in order to observe the stratigraphic architecture of the island which is not otherwise available by bucket augering alone. Interpreting the composition and age of island sediment is a key element in understanding the island's historical accretion and erosion processes.

1. 1 m x 1 m areas will be excavated using shovels (Figure 2A). The depth of the trench will vary depending upon the composition of the island, however we estimate approximately 1 m trench depth. Typically the depth of the trench is limited by cemented substrate or the height of the water table, which causes the base of the trench to cave in.
2. The trench wall will be cleaned of sediment that may have fallen from above, and changes in sediment (e.g. of texture, depth of sediment horizons, and presence of datable material will be recorded) in relation to depth will be described (Figure 2B).
3. The wall face will be photographed and sub sampled. Samples taken from the wall of the trench will be approximately 2 tbsp in volume and will be placed in plastic sample bags. Upon completion of compositional analysis and dating at UH Mānoa, all samples will be returned to PMNM.
4. The 1 m x 1 m trench will be infilled with existing sediment and every attempt will be made to ensure that sampled areas are returned to preexisting conditions. Special consideration will be given to the presence of endangered and protected species.

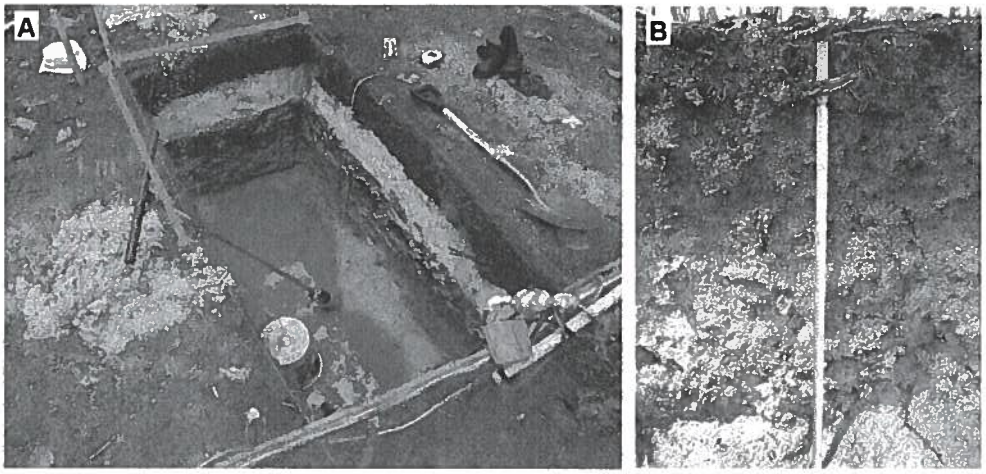

Figure 2. Island trench. The trench shown above (2A) is larger than what we propose in this project.

Bucket augering:
1. A t-handle bucket auger will be used to recover successive units of sediment until refusal, typically at 1 m or so (Figure 3A-C).
2. Each successive bucket full of sediment (Figure 3C) will be laid out, photographed, and field descriptions of texture, depth of sediment horizons, and presence of datable material will be recorded (Figure 3D).
3. Bucket auger samples will be approximately 2 tbsp in volume and will be placed in plastic sample bags. Upon completion of compositional analysis and dating at UH Mānoa, all samples will be returned to PMNM.
4. The auger hole (Figure 3E) will be infilled with existing sediment and every attempt will be made to ensure that sampled areas are returned to preexisting conditions. Special consideration will be given to the presence of endangered and protected species.

The size of the sampled area is reduced with the bucket auger and as such limits our ability to accurately describe the sedimentary architecture of the island and ultimately our understanding of the islands erosional and accretional history. However to limit our impact to the natural and culture resources of each island we propose to do a combination of island trenching and bucket augering at each island.

Figure 3. Bucket auger.

(ii) Modern sediment collection
We propose to compare island sediment samples to 120 modern sediment samples (approximately 2 tbsp volume/sample) taken from the nearshore environment. Sampling the shallow seafloor will require a small team (at least 2 people) to enter the nearshore marine environment with snorkel gear to recover sediment. Modern sediment samples will be taken back to UH Mānoa 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.

(iii) Reef cores
We propose to collect a total of 12 fossil reef flat cores from the 2-3 islands using a hand-held gas powered drill attached to 5.08 cm and 7.62 cm diameter diamond core bits. This will be accomplished by establishing shore perpendicular transects extending from one side of each island to the other. We hope to quantify the age and rate of lateral accretion of the fossil reef in relation to changes in historical sea-level. Cored

samples will be taken back to UH Mānoa for compositional analyses 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.

(b) Predictive model
(i) Acquisition of topographic data
The predictive sea-level model that will be employed in this study requires topographic (land) and bathymetric (shallow seafloor) elevation data. Topographic or island elevations will be acquired from unmanned aerial vehicle (UAV) imagery. We propose to collect high resolution imagery of 2-3 islands and the surrounding nearshore environment at FFS using an UAV 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, bucket auger sites, and reef core sites). UAV 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 UAV imagery using Structure-from-Motion (McDonald et al., 2017).

Bathymetric elevation data will be collected using beach profile methodology that we have successfully employed across the state of Hawai'i (Habel et al., 2016). Using a Leica Total Station, beach profiles will be surveyed by tracking a swimmer moving a rod-mounted prism across nearshore waters. The swimmer will follow shore perpendicular transect lines collecting measurements every 3–5 m and at pertinent geomorphic features.

(ii) Installing sensors
To quantify the vertical accuracy of our DEM, as well as tie sea-level to a common vertical datum we propose to establish a local short-term tide gauge (automated water level data logger) at each of the study sites. The tide gauge will occupy a reef core hole for the duration of time spent at each of the three study sites.

To explore how sea-level rise and perturbations to the island will accrete or erode each surveyed island, the predictive sea-level model also requires wave and current information. We propose to temporarily deploy 1-2 PUV-type wave gauges, and 3-10 pressure sensors. Like the tide gauge, the wave gauges and pressure sensors will only record data during the duration of our field expedition. Sensors will be attached to weighted supports and placed on sandy patches of the seafloor. Prior to our departure from FFS all temporary sensors will be collected and taken back to UH Mānoa for data retrieval and analysis.

Post processing data at UH Mānoa
(i) To determine the age of the island and surrounding fossil reef we will submit samples of island sediment and coral (40 mg of carbonate sample) to a commercial laboratory.

All remaining sample material will be returned to PMNM under the guidance of PMNM staff including the OHA.
(ii) Compositional analysis of sediment and cores will require that a small sample size be used to create thin sections so that the samples can be viewed under the microscope. All remaining sample material will be returned to PMNM under the guidance of PMNM staff including the OHA.
(iii) Maps will be created that depict historical changes in critical habitat as sea-level changed in the recent Holocene. All maps, figures, and data will be made publically available.
(iv) Predictive modeling will be used to assess changes in critical habitat under future sea-level scenarios. All maps, figures, and data will be made publically available.

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):

It is difficult to anticipate the exact types of specimens that will be collected in our reef cores or to determine whether or not modern coral abundance has persisted as sea-level changed over the past 6,000 years. However from our experience in it is possible that we will recover grainstone (cemented beach sand), fossil coral (genus Porites, Acropora, Pocillopora, etc), and fossil intertidal mollusks. Because this study is the first of its kind being employed in PMNM there is a lot of uncertainty associated with the historical composition of the fossil reef flats and islands. Reducing this uncertainty and quantifying the age and composition of these environments is a priority of this study.

Common name:

Scientific name:

& size of specimens:
120, 2 tbsp size samples of island sediment
120, 2 tbsp size samples of lagoon sediment
12 reef cores 5.08-7.62 cm diameter, approximately 1 m long

Collection location:
Figure 4 shows the potential field location sites. These sites include East Island, Trig Island, and Site 3 will be determined based upon weather/if time permits. Site 3 may take place at Shark Island, or Gin Island, but if weather does not permit access to either of these two sites then we may look into working at Round Island or Disappearing island. Samples will be collected from the island, fossil reef flat and nearshore environment.

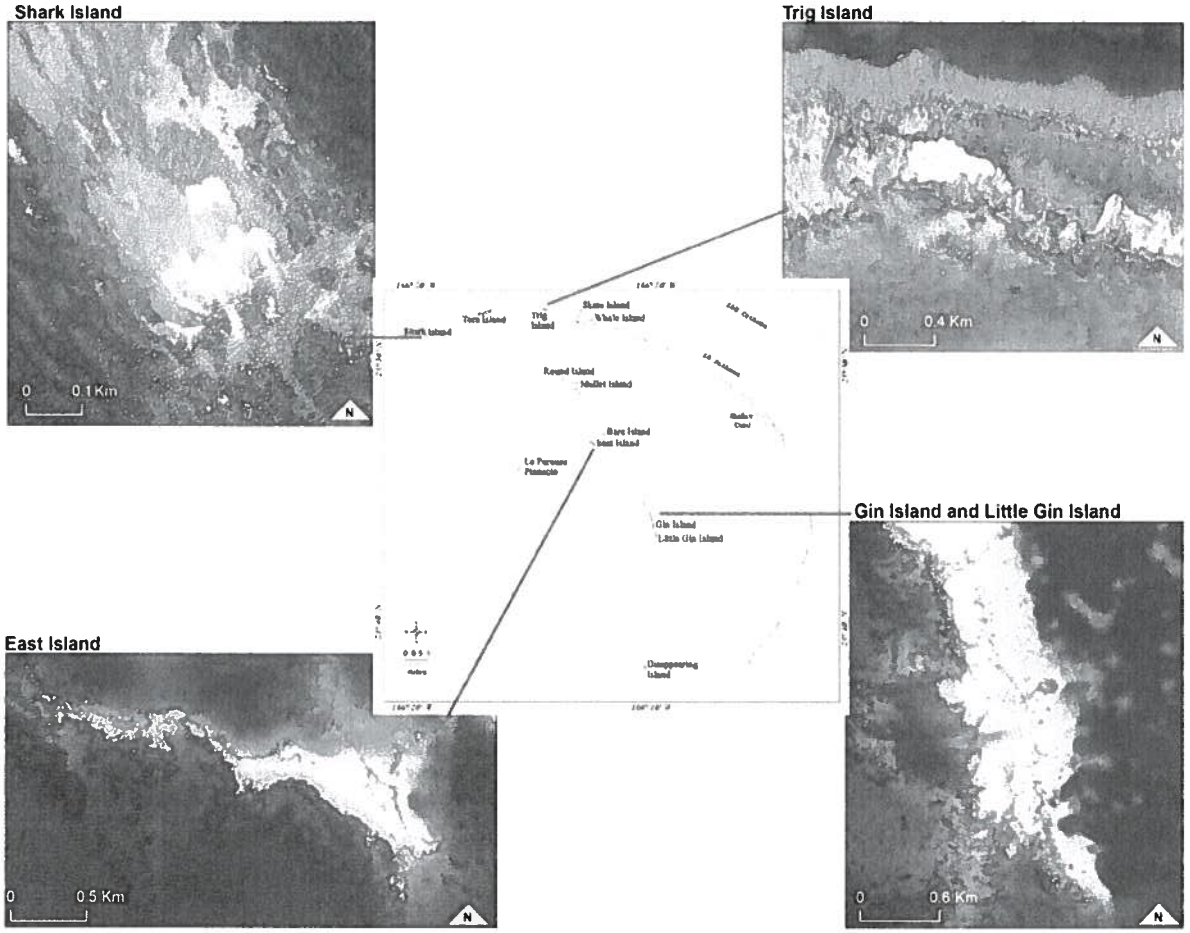

Figure 4. Potential collection sites at French Frigate Shoals.

☐ Whole Organism **X** 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 X No**
No live organisms will be sampled.

• General site/location for collections:
East island
Trig Island
Site 3 TBD based upon weather/if time permits

• 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 core boxes 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 publically available, and provided to PMNM.

12a. List all specialized gear and materials to be used in this activity:
Coring equipment (gas powered drill, bucket auger, core bits, extension rods)
Water pump
Shovel
Elevation survey equipment (total station, tripod, survey rod, survey ribbon, survey prism, canvas targets, water level, brunton compass, RTK GPS base station and rover, etc.)
Phantom drone (lithium batteries, ipad)
Miscellaneous tools (hammer, wrench, electrical tape, tephlon tape, rubber mallot, etc.)
Snorkeling gear (mask, fins)
Sample bags and vials

12b. List all Hazardous Materials you propose to take to and use within the Monument:
Gasoline, and 2 stroke oil to power drill and water pump, lithium batteries for the drone. Safety sheets have been attached in our permit application.

13. Describe any fixed installations and instrumentation proposed to be set in the Monument:
A temporary tide gauge within a PVC pipe will be temporarily placed within a core hole to capture a 24 hour tidal cycle. To capture wave and current information, 1-2 PUV-type wave gauges, and 3-10 pressure sensors will be attached to weighted supports and placed on sandy patches of the seafloor at each island. Prior to our departure from FFS all temporary sensors will be collected and taken back to UH Mānoa for data retrieval and analysis.

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

Photo analyses, data analyses, a report write-up, and at least one publication will be completed within a year of the field surveys. We hope to complete several publications utilizing island and fossil reef composition and age within a few years of data collection.

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

Fletcher, CH, Jones AT. 1996. Sea-level highstand recorded in Holocene shoreline deposits on Oahu, Hawaii. Journal of Sedimentary Research 66.3: 632-641.

Grossman, E., Fletcher, C., and Richmond, B. (1998) The Holocene sea-level highstand in the Equatorial Pacific: Analysis of the insular paleosea-level database. Coral Reefs. Special Issue on Holocene and Pleistocene coral reef geology 17: 309-327.

Grossman, EE, Fletcher, CH. 1998. Sea level 3500 years ago on the Northern Main Hawaiian Islands. Geology 26:363-366.

Habel, S, Fletcher, CH, Rotzoll, K, El-Kadi, A. 2017. Development of a model to simulate groundwater innundation induced by sea-level rise and high tides in Honolulu, Hawaii. Water Research 114: 122-134.

Habel, S, Fletcher, CH, Barbee, M, Anderson, TR. 2016. The influence of seasonal patterns on a beach nourishment project in a complex reef environment. Coastal Engineering 116: 67-76.

Kane, HH, Fletcher, CH, Cochrane, EE, Mitrovica, JX, Habel, S, Barbee, M. 2017a. 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, Habel, S, McDonald, K, Tavares, K.-D.A., 2017b. The evolution of Majuro atoll in response to sea-level change during the mid-Holocene, in: GSA Annual Meeting in Seattle, Washington.

Kane, HH, Fletcher, CH, Romine, BM, Anderson, TR, Frazer, NL, Barbee, MM. 2012. Vulnerability Assessemtne of Hawai'i's Cultural Assests Attributable to Erosion Using Shoreline Trend Analysis Techniques. Journal of Coastal Research 28: 533-539.

McDonald, K, Fletcher, CH, Barbee, M, Habel, SL, Anderson, T, Tavares, K-DA. 2017. UAV SURVEYS TO MONITOR VOLUMETRIC BEACH CHANGES OVER AN EXTREME HIGH-TIDE EVENT: WAIKIKI, HAWAII, in: GSA Annual Meeting in Seattle, Washington.

Romine, BM, Fletcher, CH, Frazer, LN, Anderson, TR. 2016. Beach erosion under rising sea-level modulated by coastal geomorphology and sediment availability on carbonate reef-fringed island coasts. Sedimentology. 63: 1321-1332.

Tavares, K-DA, Fletcher, CH, Barbee, M, Anderson, T, Burstein, J. 2017. Will seawalls damage critical habitat for endangred species in Hawaii as sea level rises? in: GSA Annual Meeting in Seattle, Washington.

Vitousek, S, Barnar, PL, Fletcher, CH, Frazer, LN, Erikson, L, Storlazzi, CD. 2017. Doubling of coastal flooding frequency within decades due to sea-level rise. Scientific Reports 7: 1399.

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

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

Papahānaumokuākea Marine National Monument
Compliance Information Sheet

1. Updated list of personnel to be covered by permit. List all personnel names and their roles here (e.g. John Doe, Diver; Jane Doe, Field Technician, Jerry Doe, Medical Assistant):
Charles Fletcher, Coastal Geologist
Sean Vitousek, Coastal Geologist, Modeler
Haunani Kane, Coastal Geologist
Kammie Dominique Tavares, Costal Geologist
Kristian McDonald, Coastal Geologist, Drone operator
Dr. Jade Delevaux, Coastal Geologist, Geospatial technician
Nathan Eagle, Reporter, Documenter, Writer
Alana Eagle, Videographer

2. Specific Site Location(s): (Attach copies of specific collection locations):
Sandy islets of French Frigate Shoals including Shark Island, Trig Island, East Island, Gin Island and Little Gin Island (Figure 1, Figure 2).

3. Other permits (list and attach documentation of all other related Federal or State permits):
PMNM-2018-015

3a. For each of the permits listed, identify any permit violations or any permit that was suspended, amended, modified or revoked for cause. Explain the circumstances surrounding the violation or permit suspension, amendment, modification or revocation.
none

4. Funding sources (Attach copies of your budget, specific to proposed activities under this permit and include funding sources. See instructions for more information):

5. Time frame:
Activity start: June 2018
Activity completion: May 2019

Dates actively inside the Monument:

From: July 1, 2018
To: July 12, 2018

Describe any limiting factors in declaring specific dates of the proposed activity at the time of application:

Personnel schedule in the Monument:

6. Indicate (with attached documentation) what insurance policies, bonding coverage, and/or financial resources are in place to pay for or reimburse the Monument trustees for the necessary search and rescue, evacuation, and/or removal of any or all persons covered by the permit from the Monument:

7. Check the appropriate box to indicate how personnel will enter the Monument:

☒ Vessel
☐ Aircraft

Provide Vessel and Aircraft information:
M/V Searcher

8. The certifications/inspections (below) must be completed prior to departure for vessels (and associated tenders) entering the Monument. Fill in scheduled date (attach documentation):

☐ Rodent free, Date:
☐ Tender vessel, Date:
☐ Ballast water, Date:
☐ Gear/equipment, Date:
☐ Hull inspection, Date:

9. Vessel information (NOTE: if you are traveling aboard a National Oceanic and Atmospheric Administration vessel, skip this question):
Vessel name:
Vessel owner:
Captain's name:
IMO#:
Vessel ID#:
Flag:
Vessel type:

Call sign:
Embarkation port:
Last port vessel will have been at prior to this embarkation:
Length:
Gross tonnage:
Total ballast water capacity volume (m3):
Total number of ballast water tanks on ship:
Total fuel capacity:
Total number of fuel tanks on ship:
Marine Sanitation Device:
Type:

Explain in detail how you will comply with the regulations regarding discharge in the Monument. Describe in detail. If applicable, attach schematics of the vessel's discharge and treatment systems:

Other fuel/hazardous materials to be carried on board and amounts:

Provide proof of a National Oceanic and Atmospheric Administration (NOAA) Office of Law Enforcement-approved Vessel Monitoring System (VMS). Provide the name and contact information of the contractor responsible for installing the VMS system. Also describe VMS unit name and type:

VMS Email:
Inmarsat ID#:

* Individuals MUST ENSURE that a type-approved VMS unit is installed and that its automatic position reports are being properly received by the NOAA OLE system prior to the issuance of a permit. To make sure your VMS is properly configured for the NOAA OLE system, please contact NOAA OLE at (808) 725-6110 or (808) 725-6100.

* PERMITS WILL NOT BE ISSUED TO INDIVIDUALS ENTERING THE MONUMENT VIA VESSEL UNTIL NOAA OLE HAS CONTACTED THE MONUMENT PERMIT COORDINATOR WITH A 'POSITIVE CHECK' READING.

10. Tender information:

On what workboats (tenders) will personnel, gear and materials be transported within the Monument? List the number of tenders/skiffs aboard and specific types of motors:

Additional Information for Land Based Operations

11. Proposed movement of personnel, gear, materials, and, if applicable, samples:
We anticipate being at FFS between July 2-9th. Each day personnel, gear, materials, and samples will be transported from the Searcher to one of four proposed islands (see Figure 1). BMPs for Boat Operations and special considerations and rules for moving between islands will be followed.

12. Room and board requirements on island:
We do not require room and board on island and instead will stay on the Searcher.

13. Work space needs:
Samples, equipment, and personal gear will be stored on the Searcher. Any analysis of samples while in the monument will occur on the Searcher.

DID YOU INCLUDE THESE?
☐ Map(s) or GPS point(s) of Project Location(s), if applicable
☐ Funding Proposal(s)
☐ Funding and Award Documentation, if already received
☐ Documentation of Insurance, if already received
☐ Documentation of Inspections
☐ Documentation of all required Federal and State Permits or applications for permits

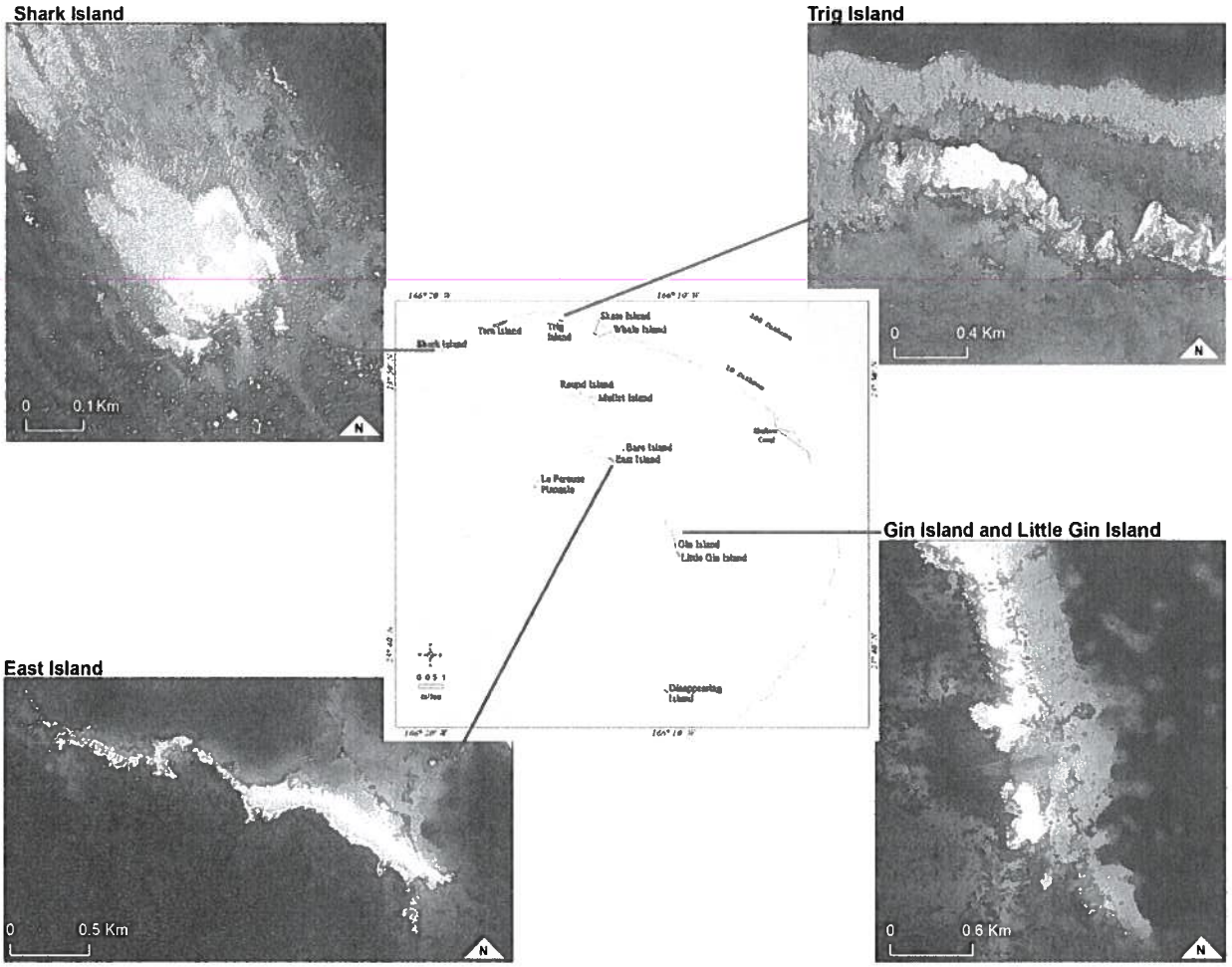

Figure 1. Potential collection sites at French Frigate Shoals.

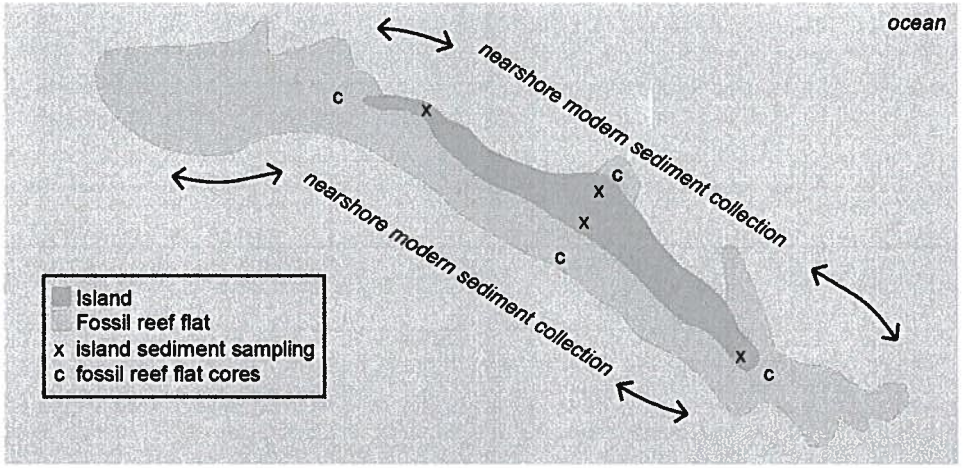

Figure 2. Generalized island sampling layout. The number of island sediment sampling sites and fossil reef flat coring sites will vary based upon island size and accessibility. In total we propose to sample 12 island sediment sites (trench

and/or bucket auger), and 12 fossil reef coring sites on 2-3 islands. Reef flat cores will be extracted from the fossil reef flat, below the high water mark.

DAVID Y. IGE
GOVERNOR OF HAWAI'I

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

ROBERT MASUDA
FIRST DEPUTY

JEFFREY PEARSON P.E.
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

STATE OF HAWAI'I
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAI'I 96809

June 22, 2018

TO: Division of Aquatic Resources File

THROUGH: Suzanne D. Case, Chairperson

FROM: Maria Carnevale
Papahānaumokuākea Marine National Monument

DECLARATION OF EXEMPTION FROM THE PREPARATION OF AN ENVIRONMENTAL ASSESSMENT UNDER THE AUTHORITY OF CHAPTER 343, HRS AND CHAPTER 11-200 HAR, FOR PAPAHĀNAUMOKUĀKEA MARINE NATIONAL MONUMENT RESEARCH PERMIT
TO
DR.CHARLES FLETCHER, UNIVERSITY OF HAWAI'I, DEPARTMENT OF GEOLOGY AND GEOPHYSICS, SCHOOL OF OCEAN AND EARTH SCIENCE AND TECHNOLOGY,
FOR
ACCESS TO STATE WATERS TO ASSESS THE EFFECTS OF SEA LEVEL RISE ON LOW LYING ATOLLS UNDER PERMIT PMNM-2018-018

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. Charles Fletcher, University of Hawai'i, for Access to State Waters to Conduct Research Activities to Assess the Effects of Sea Level Rise on Low Lying Atolls.

Permit Number: PMNM-2018-018

Project Description:

The applicant proposes to assess the impacts of past and present sea-level rise upon low lying islands to improve understanding of how future sea-level rise will impact essential habitats for priority species (e.g. sea turtles, monk seals, and various seabirds). The applicant proposes to use an unmanned aircraft system (UAS) (DJI Phantom), bucket augers, and coral cores to conduct sea level rise research. Up to eight (8) individuals including the applicant and resource monitor would access the Monument aboard the M/V Searcher (separately permitted under permit number PMNM-2018-015) for up to 13 days. Currently proposed activity dates are June 30th-July 12th. Proposed locations

include up to 3 of the following islands within French Frigate Shoals: East, Trig, Gin, Little Gin, and Shark Island.

Activities will be carried out from a small boat launched from M/V Searcher as well as on land. Modern sediment will be sampled along the seafloor (120, 2 tbsp. size samples) and comparisons will be made to island sediment to quantify how sediment source and type have changed over time. To interpret historical reef habitat and accretionary response to changes in sea-level the applicant will recover short cores (12 total: 1 m long, and 5-8 cm diameter) from the surrounding fossil reef platform using a small hand held drill. At each island the applicant would assess the interior stratigraphic architecture (layering of sediment) by recovering sediment from a maximum of 12 sites total. Sediment recovered from the interior of the island will be strategically sampled in small quantities (120 samples total, approx. 2 tbsp. /sample) collected from within 12 x 1m^3 trenches. The island surface will subsequently be restored to an undisturbed state by infilling sites with previously extracted sediment and best efforts will be made to avoid existing vegetation, and critical habitat for birds, turtles, and monk seals.

The applicant proposes to operate a UAS over each island that they collect samples from. Predictive modeling of island habitat response to future sea-level requires the acquisition of high-resolution topographic (land) and bathymetric (shallow seafloor) elevation data. The applicant will derive digital elevation maps (DEMs) of each island from UAS imagery and Structure-from-Motion. Real Time Kinematic Global Positioning System (RTK-GPS) control points will also be collected at the time of the UAS survey to ensure that each DEM is adequately georeferenced. A vertical datum will be derived from RTK-GPS control points and a local short-term tide gauge that will be installed for the duration of field work at each island and removed before they depart. The DEM will be used to assess past changes in island habitat documented in historical imagery and their predictive model will simulate island response to future sea-level rise.

The activity would provide manager's insight into how sea-level rise and perturbations to the island's shape and nearshore bathymetry at FFS 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 FFS 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).

Consulted Parties:
The permit application was sent out for review and comment to the following scientific and cultural entities: Hawai'i Division of Aquatic Resources, Hawai'i 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 since April 2, 2018, 2018, 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 HAR § 11-200-8, including the criteria used to determine significance under HAR § 11-200-12, 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; including the tagging of the subject sharks and fishes, collection of tissue biopsies, and recovery and redeployment of underwater acoustic receivers; have been evaluated as a single action. As a preliminary matter, multiple or phased actions, such as when a group of actions are part of a larger undertaking, or when an individual project is precedent to or represents a commitment to a larger project, must be grouped together and evaluated as a single action. HAR § 11-200-7. This proposed activities are not a precedent to a later planned activity within PMNM.

2. The Exemption Class for Scientific Research with no Serious or Major Environmental Disturbance Appears to Apply. Chapter 343, HRS, and § 11-200-8, HAR, provide for a list of classes of actions exempt from environmental assessment requirements. HAR §11-200-8.A.5. exempts the class of actions which 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." The proposed UAS and fossil reef coring activities here appear to fall squarely under the exemption class #5, exempt item #1 and #7 as described under the Department of Land and Natural Resources exemption list published on June 5, 2015. This exemption class has been interpreted to include "#1. Conduct surveys or collect data on existing environmental conditions (e.g, noise, air quality, water flow, water quality, etc.) and #7. Conduct subsurface investigations (borings) provided the average surface area disturbed is less than one square foot and the implementing division consults with the State Historic Preservation Division on exempting such borings or investigations" such as those being proposed. 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.

To safeguard Monument resources 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).

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.

A though review and adherence to DAR prescribed condition has occurred as part of the permit process. Significant cumulative impacts are not anticipated as a result of this activity, and numerous safeguards further ensure that the potential 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 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 that would occur as a result of these activities.

These activities would be conducted from the M/V SEARCHER (Proposed under this application). Interactions with sharks at FFS are also anticipated with monk seal recovery activities conducted from the NOAA monk seal field camp. There are no other known proposed projects that would be undertaken with respect to sharks at FFS during this time.

Though the potential permits may occur in the same area, each project differs logistically and targets interaction with different resources. Therefore, 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 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 conservation and management 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.