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

March 28, 2025

Board of Land
and Natural Resources
Honolulu, Hawaii

Request for Authorization and Approval to Issue a Papahānaumokuākea Marine National Monument Research Permit to Keolohilani Lopes Jr., Department of Natural Resources and Environmental Management, University of Hawai‘i at Mānoa, for Access to State Waters, to Conduct Activities for Monitoring a red nuisance alga, *Chondria tumulosa*, a Research Project at Manawai (Pearl and Hermes Atoll) and Lalo (French Frigate Shoals)

SUMMARY
The Papahānaumokuākea Marine National Monument (Monument) program hereby requests approval from the Board of Land and Natural Resources (BLNR) for issuance of a Monument research permit to Keolohilani H. Lopes Jr., University of Hawai‘i at Mānoa for access and authorization to conduct *Chondria tumulosa* research activities in areas in the Monument under State of Hawai’i jurisdiction.

BACKGROUND LAW

The Board of Land and Natural Resources, by the Department of Land and Natural Resources (DLNR) Divisions of Aquatic Resources & Forestry and Wildlife, permits certain otherwise prohibited or regulated activities on or in its lands and waters, pursuant to Hawaii Revised Statutes (HRS) § 187A-6, 183D-6, and 195D-4; Hawaii Administrative Rules (HAR) § 13-60.5-5, 13-60.5-6, 13-126-9 and 13-126-10, and all other applicable laws and regulations.

DURATION

The permit, as described below, would allow entry for research activities to occur in the Papahānaumokuākea Marine National Monument (Monument), including the Northwestern Hawaiian Islands (NWHI) State Marine Refuge and the Kure Atoll Wildlife Sanctuary including the lands and waters (0-3 nautical miles) surrounding the following to the extent within the jurisdiction of the State of Hawai‘i:

- Manawai (Pearl and Hermes Atoll)
- Lalo (French Frigate Shoals)

The activities covered under this permit would occur over 20 days from May 1, 2025 through November 30, 2025. The timing of entry into the Monument will depend on availability of ship transport, schedules, and weather.

PERSONS COVERED UNDER THIS PERMIT

12 people will be covered under this permit. All persons will be identified prior to departure and their names and affiliations will be shared with the Monument permit coordinators.

Keolohilani H. Lopes Jr., Researcher/Graduate Research Assistant
Serena Mou, (Australian Citizen) Electronic Engineer
Matthew Dunbabin, (Australian Citizen) Electronic Engineer
Anna Baker Mikkelsen, (Danish Citizen), UMS Trained Technician

4 – Researchers, TBD.

4 – Ship Crew (TBD)

INTENDED ACTIVITIES

The applicant proposes to deploy two different types of small Uncrewed Marine Systems (sUMS), FloatyBoat, a surface vehicle, and the RangerBot, a submersible, and an Automated Underwater Covert Camera and Hydrophone. More detailed information about the project, including pictures and diagrams of the sUMS and Automated Underwater Covert Camera and Hydrophone set-up can be found in the application (attached).

sUMS
The sUMS will autonomously map the invasive acting macroalga *Chondria tumulosa*, and collect ancillary images and data (temp, salinity, and eDNA). Both sUMS will be equipped with RGB camera/s, hyperspectral cameras, salinity, and temperature. The FloatyBoat will be equipped with two eDNA profiler types, an active McLane profiler, and a passive (soak) system consisting of filters that will be exposed to the ocean water in situ for 10 – 30 minutes. These sUMS are small and relatively light weight which allows for easy deployment over the side of a small boat. The applicant intends to create the ChondriaBot program which will utilize computer vision technology in the sUMS to identify and map *C. tumulosa*. The extent of *C. tumulosa* is a major gap in knowledge for PMNM resource managers that the ChondriaBot program aims to fill. ChondriaBots systems rely solely on camera systems and other passive imaging technologies and will not directly contact the substrate. Ancillary data collected by these sUMS are salinity, depth, temperature, and eDNA collected on filter paper. The eDNA approach will consist of a passive filtration technique designed by UH graduate researcher, Patrick Nichols. These sUMS are developed by Queensland University of Technology (QUT), where it was rigorously field tested for several years, and adapted for this specific purpose by Mr. Lopes, for the University of Hawai‘i at Mānoa. The ChondriaBot will have an apparatus to keep filter paper submerged during operations. When the operation is complete, the filter papers will be placed in sterile tubes and put on ice. When returning from the day’s operations, all eDNA filter paper samples will be properly stored into a Dewar.

Automated Underwater Covert Camera and Hyrdophones
The applicant proposes to have two Automated Underwater Covert Camera and Hydrophones deployed as part of this research. These units will conduct presence absence videos of marine species and how they relate to the sound scape and disturbances. More specifically, this passive hydrophone/camera will be used to compare the soundscapes between areas with *C. tumulosa* and areas without.

Method
The applicant proposes to conduct research in the nearshore waters at Manawai (est. 7 days) and

Lalo (1 or 2 Days). Specific sites at these two atolls will be determined by opportunity and weather conditions. Each site will be in waters deeper than 30 centimeters (1 foot). The sUMS will either be programmed to run a predetermined route, or a predetermined polygon. The researchers will have the capacity to operate the sUMS for > 8 hours (change of batteries). This project aims to collect data near the fringing reef, where small boats find it too dangerous to access.

All sUMS will be deployed over the side of a small boat. The size and weight of these sUMS allow for a single person to deploy and recover. The sUMS will then autonomously run the program to locate and map C. tumulosa. These sUMS will also collect water quality data and collect an eDNA sample. Direct exposure to the ocean by the sterile filter paper will collect the eDNA samples from which point it will be put into vials and stored. Vessel storage will be on ice or liquid nitrogen and then taken to the expedition vessel to be stored in liquid nitrogen.

The applicant proposes to have two Automated Underwater Covert Camera and Hydrophones deployed for approximately 6 hours per day also deployed over the side of a small boat. Both camera-hydrophones may be deployed at two separate sites each day. The applicant will place the weighted cameras in sandy bottom areas surrounded by reefs targeting areas like spur and grooves or sandy areas between reefs.

ADHERANCE TO FINDINGS CRITERIA, BMPs, AND OTHER SAFETY PROTOCOLS:

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
☒ Swimming, snorkeling, or closed or open circuit SCUBA diving within any Special Preservation Area or Midway Atoll Special Management Area
☒ Anchoring a vessel

Monument Management Plan Strategies

The activities proposed by the applicant directly support the Monument Management Plan (PMNM MMP Vol. 1, 2008), including but not limited to the Alien Species Action Plan strategies AS-7: investigate methods to eventually eradicate aquatic invasive organisms already known to be present in the Monument, and conduct regular surveillance for new invasions and AS-8: conduct and facilitate research designed to answer questions regarding invasive species detection, effects on ecosystem, and alien species prevention, control, and eradication over the life of the plan.

Best Management Practices

To safeguard Monument resources the applicants will abide by all applicable PMNM Best Management Practices (BMPs) while conducting the aforementioned activities within PMNM.

BMP Number	Title	Download
001	Marine Alien Species Inspection Standards for Maritime Vessels	PDF

002	Protocol for Acquiring Avian Blood Samples	PDF
003	Human Hazards to Seabirds Briefing	PDF
004	Best Management Practices for Boat Operations and Diving Activities	PDF
005	Protocols to Reduce Impact to the Laysan Finch	PDF
006	General Storage and Transport Protocols for Collected Samples	PDF
007	Best Management Practices for Terrestrial Biosecurity	PDF
008	Seabird Protocols Necessary for Conducting Trolling Research and Monitoring in Papahānaumokuākea Marine National Monument	PDF
009	Best Practices for Minimizing the Impact of Artificial Light on Sea Turtles	PDF
010	Marine Wildlife Viewing Guidelines	PDF
011	Disease and Introduced Species Prevention Protocol for Permitted Activities in the Marine Environment, Papahānaumokuākea Marine National Monument (Monument)	PDF
012	Precautions for Minimizing Human Impacts on Endangered Land Birds	PDF
015	Nonnative Species Inspection Requirements at Midway Atoll	PDF
016	Best Management Practices for Activities on Nihoa	PDF
017	Best Management Practices for Maritime Heritage Sites	PDF
018	Rodent Prevention and Inspection Standards for Permitted Vessels	PDF
019	Best Management Practices for Activities on Mokumanamana (Necker Island)	PDF
020	Best Management Practices to minimize the spread of nuisance alga	PDF

REVIEW PROCESS

The application was sent out for review and comment to the following scientific and cultural entities: Hawai'i Division of Aquatic Resources, DOFAW, Papahānaumokuākea Marine National Monument (NOAA/NOS), NOAA Pacific Islands Regional Office (NOAA-PIRO); USFWS, Hawaiian and Pacific Islands National Wildlife Refuge Complex Office; the Office of Hawaiian Affairs (OHA) and the PMNM Native Hawaiian Cultural Working Group. The application was reviewed and received questions, comments, and applicant responses as noted below:

Review Questions and Responses:

1. What steps will be taken to ensure the lines associated with the Automated Underwater Covert Camera and Hydrophone devices will not become entanglement hazards for protected species while deployed for "approximately 6 hours per day". (particularly interested in the surface float line)?

   Response: To ensure that line will not become entanglement hazards we will replace the bottom 1m line (between the weighted temporary mooring and camera) with a stainless-steel cable to eliminate entanglement here. For the line between the camera and the marker float we will ensure the line is taut and appropriate for the depth of each site. The excess line will be placed in a bag to eliminate entanglement hazards.
2. In reference to the "swimming/snorkeling/diving box" being checked: Will sites for the equipment mentioned above be scouted prior to deployment to ensure the weight are placed

in a sandy area?

a. When deploying these units, will they be lowered from the boat above or deployed by divers?
   Response: Each deployment site for the Underwater Covert Camera and Hydrophone will be evaluated from the surface and a snorkeler will confirm the benthic cover as sand and assist in lowering the weighted mooring to bottom. The snorkeler will then adjust the tautness of the line and place the remaining line in the bag which will be secured to the float.

3. Will the applicant be conducting any cultural protocols or offerings in conjunction with their access? If so please describe.
   Response: I will most likely Oli, E Ho Mai as we sail past Niihau and prior to our first day of field operations at both atolls (Lalo and Manawai).
4. Can the applicant describe if they anticipate the small Uncrewed Marine Systems (sUMS) (the FloatyBoat - a surface vehicle and the RangerBot - a submersible) making contact with or coming into close proximity with the benthic environment during testing around O‘ahu (Kaneohe Bay, Maunalua Bay, and Waikiki), either via planned or unplanned interactions during navigation during testing?
   Response: During our field testing the avoidance systems of the robotics work very well. However, we do plan to have mitigation approaches in the unlikely occurrence of contact with the benthos. During our local field test a the robotics have not come into contact with the bottom but if the equipment returns with new scrapes or other evidence of contact we will document these potential ground strikes and clean around the impact area thoroughly to avoid cross contamination between sites.
5. Can the applicant provide a detailed mitigation plan of how the risk of transferring (AIS) / disease / parasites after testing the sUMS around O‘ahu areas and then transporting the sUMS up to the PMNM will be avoided / minimized? This plan should include methods and protocols to minimize AIS or disease movement through gear, supplies and activities of the applicant (see recommendations below).
   Reasoning: Some of the areas on Oahu (Kaneohe Bay, Maunalua Bay, and Waikiki) where it has been described in the application that the two different types of small Uncrewed Marine Systems (sUMS) will be tested before going up into the PMNM, are marine areas with a high prevalence of Aquatic Invasive Species (AIS) / disease / parasites including the following:
   - Algae (*Kappaphycus spp*., *Eucheuma denticulatum*, *Gracilaria salicornia*, *Acanthophora spicifera*, *Hypnea musciformis*, and *Avrainvillea amadelpha/lacerata/erecta*, and *Chondria tumulosa*);
     - *Kappaphycus spp*. & *Eucheuma denticulatum* – mainly present in Kaneohe Bay but also present in small distributions on Windward side and N. Shore
     - *Acanthophora spicifera*, *Gracilaria salicornia*, *Hypnea musciformis*, and *Avrainvillea amadelpha/lacerata/erecta* – distributions on Oahu are island-wide – particularly dense distributions of *Avrainvillea* spp. are in Maunalua Bay (although much has been removed) – *Avrainvillea* also can be prevalent in Waikiki / deeper areas West Side; *Acanthophora spicifera*, *Gracilaria salicornia*, and *Hypnea musciformis* are going to be particularly present in Waikiki, Maunalua Bay, Kaneohe Bay (but present island-wide) Note: DAR has photo-guides of algae if it would be helpful for field ID
     - Chondria: Only known presence of is on Kure, Midway and Pearl & Hermes – just included in this list because it’s a concern overall
   - Majano Anemone (*Anemone manjano*), Orange keyhole sponge (*Mycale*

armata/grandis), Pulsing Xenia (*Unomia stolonifera*), Kenyan Tree (*Capnella sp.*)

- Coral disease (Montipora, Pocillopora, and Porites tissue loss syndrome, Montipora, Pocillopora, and Porites anomalies, Montipora black band, Porites trematodiasis; and
- any other non-native organisms.
- The following are some best practices currently recommended by DAR for the transport of gear / instruments from areas with AIS in the MHI (which can be included in the plan if an alternate method is not being proposed):
    - Visually inspect, disinfect, clean, and dry all gear and equipment between any collection events or deployment of instruments or similar. Disinfecting procedures will include soaking the gear and equipment for a minimum of 10 minutes in a solution containing a chemical disinfecting agent proven to kill live organisms such as diluted bleach (1 part bleach : 20 parts freshwater). Visual inspection should confirm gear, instruments or similar are absent of any algae fragments or basal attachments of invasive algae or other invasive species/disease/parasites.
    - If collection gear cannot be bleached, gear must be thoroughly rinsed with fresh water and sterilized with another viable method, approved by DAR, and dried in the sun for 24 hours before use in an alternate location, or thoroughly rinsed with fresh water and allowed to desiccate for an appropriate amount of time approved by DAR, or alternate sampling gear will be utilized.

Response: Our Oahu based field trials has been rescheduled after I received these comments. To address these concerns we will now conduct all field work in one specific area (Kaneohe, Maunalua, Waikiki) until completed. I will start with working out of Waikiki, then Maunalua, then Kaneohe until all the needed data is collected. Between each survey, all robotics will be cleaned with fresh water thoroughly, and easily removable panels will be disassembled for better access to clean. Between each site (Kaneohe, Maunalua, and Waikiki) each unit will undergo a thorough freshwater rinse and wiped down with a Clorox wipe where accessible and not near sensitive electronics. These equipment will not tolerate a bleach solution soak so to ensure all organisms are no longer viable, we will add a week long (7 day) drying period in the lab which has a dehumidifier which will ensure a complete drying out period for these equipment. Upon return from PMNM, these equipment will remain out of the water for 30 days from the last deployment.

6. Will the Automated Underwater Covert Camera and Hydrophone also be tested in areas around Oahu? If so, can this instrument and methods to disinfect also be included in the AIS plan?

    Response: The Underwater Covert Camera's will not be tested in Hawaiian waters and will be tested in a fresh water tank in Australia prior to deployment.

7. Will Chondria abundance at Manawai be considered in your deployment schedule of sUMS? That is, where possible, will areas with less Chondria abundance be surveyed first to minimize chance for spread of Chondria fragments?

    Response: From my experience, *Chondria tumulosa* is everywhere on Manawai to varying degrees. I do have access to our 2023 expedition *C. tumulosa* cover data. To answer the question, the possibility of the sUMS spreading it to other locations on the atoll improbable for the fact that we have observed *C. tumulosa* 'rafting' and rolling on the benthos, so modes of translocation are occurring naturally with this species. However, to mitigate the potential of the sUMS spreading *C. tumulosa*, we

will clean and rinse the sUMS with sea water from the site before transiting to the second site. We approximate 3 deployments per day in the same general vicinity. The relative close proximity will also reduce the probability of the sUMS spreading *C. tumulosa*.

8. How many sites will you survey at both Lalo and Manawai and how much reef across all sites/location will be mapped?

   Response: We hope to map several acres a day. Our experimental design will have us at one generalized location (e.g. Center East Backreef) every day with subsequent sites located within this area. At this current time, we cannot be certain how much power the new sensor systems (hyperspectrometer, eDNA sampler, and ancillary systems) will draw and will be able to better predict actual survey coverage after testing is completed. The new systems are slated to arrive by the end of 2024 and field testing should be completed by March 2025.

9. Will you use your camera footage paired with hydrophones to develop a call library for marine species in the Monument that will be publicly available?

   Response: This group is a fierce proponent of open-source data and will make all data publicly available in conjunction with any potential publication. If it is deemed some data are not able to contain publishable data other methods of data accessibility can be discussed. I will read about 'call libraries' and discuss the potential of specifically creating one with our collaborators.

10. Is the "vision technology" used to identify and map Chondria fully automated, or AI? If so, how reliable do you anticipate this may be and what are the primary limitations?

    Response: I would like to state these systems are in its developmental stages and the results will be used in my Ph.D. dissertation. The computer vision Chondria detection runs on AI/Machine Learning and is equipped to make completely autonomous detections. We achieved 86% overall accuracy from the computer model runs of the computer vision algorithm and expect that to hold true for 'real-world' situations. To rigorously test the computer vision system I will review all the video to manually track *C. tumulosa* occurrences against the computer vision detections. This will allow for a quantifiable metric of 'actual (video observed) *C. tumulosa*' vs. computer vision detected *C. tumulosa*. I will also note the location of positive results for the eDNA analysis.

11. This seems to be similar to aerial UAS mapping projects and is a very interesting concept. We are curious what program(s) you are using for post-processing and annotation of your imagery?

    Response: This project is very similar to aerial UAS mapping as well as the current in situ benthos surveys utilized by NOAA with regards to structure from motion techniques. We have multiple sensors that will utilize a variety of software to process each. I will be using Agisoft Metashape to stitch together the overlapping photos from the GoPro camera mounted to the robotics. To process the hyperspectral data I will use a combination of proprietary software from Headwall Photonics and a good portion of the work will utilize Python. There is a high possibility that Python may be needed throughout the entire workflow.

12. Have mapping projects similar to this been conducted in other areas which you are basing your methods off of, or is this a fully novel method of algae mapping?

    Response: This project is novel to the best of my knowledge. This project was purposefully designed to address the issues specific to *Chondria tumulosa*, lack of data with regards to extent of *C. tumulosa*, ability to cover a large area, automated data collection and detection. We are confident we can adapt technologies to serve

the purpose of increasing our knowledge base in these respects.

13. How much ground do these bots cover? Roughly how much of each atoll are you expecting the sUMS to cover when mapping for and identifying Chondria?
    Response: See 8.

ENVIRONMENTAL COMPLIANCE

Are there other relevant/necessary permits or environmental reviews that have or will be issued with regard to this project? (e.g., HRS chapters 183C, 343; MMPA, ESA) Yes ☒ No ☐

If so, please list or explain:

- The Department has made an exemption determination for this permit as necessary for the applicant and team on this project in accordance with Chapter 343, HRS, and Chapter 11-200.1, HAR. See Attachment ("DECLARATION OF EXEMPTION FROM THE PREPARATION OF AN ENVIRONMENTAL ASSESSMENT UNDER THE AUTHORITY OF CHAPTER 343, HRS AND CHAPTER 11-200.1 HAR, FOR A PAPAHĀNAUMOKUĀKEA MARINE NATIONAL MONUMENT RESEARCH PERMIT TO KEOLOHILANI LOPES, UNIVERSITY OF HAWAIʻI AT MĀNOA, FOR ACCESS TO STATE WATERS TO RESEARCH *CHONDRIA TUMULOSA* WITHIN THE WATERS OF THE NORTHWESTERN HAWAIIAN ISLANDS UNDER PERMIT PMNM-2025-002")

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

If so, please summarize past permits:

N/A

Have there been any a) violations: Yes ☐ No ☒
b) late/incomplete post-activity reports: Yes ☐ No ☒

involving any of the applicant agencies or personnel?

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

If yes, please explain.

STAFF OPINION

Department staff are of the opinion that the Lopes permit is justified under HAR chapter 13-60.5 criteria and should be allowed to enter state lands and waters in the Monument as indicated, and to conduct the activities as specified, subject to the Papahānaumokuākea Marine National Monument Research Permit General Conditions, and the indicated special instructions, conditions, and protocols to be observed. Staff recommends that the BLNR approve the application as indicated below.

MONUMENT MANAGEMENT BOARD OPINION

The seven members of the Monument Management Board (MMB) were consulted and are of the opinion that the applicant has met permit procedures and criteria under the findings of Presidential Proclamation 8031, 71 Fed. Reg. 36,443 (2006) as required, and the research activities may be conducted subject to completion of all compliance requirements recommended below. The MMB concurs with any special conditions recommended by DLNR staff. The MMB determined that a Resource Monitor be assigned to this permit. A DAR biologist from the aquatic invasive species program will serve as the Resource Monitor and DAR Program Manager, Edward (Luna) Kekoa, will serve as the assigned MMB member to oversee the Resource Monitor.

RECOMMENDATIONS:

That the Board of Land and Natural Resources

A. Approve the proposed permit for Keolohilani Lopes according to the form of the Application (Attachment 1) and authorize and approve entry to State lands and waters of the Monument.

1. That the BLNR declare that the anticipated actions to be undertaken under this permit will have little or no significant effect on the environment except consistently with the activities covered in the 2008 Final Environmental Assessment (FEA) and FONSI. Any activities not covered in the FEA shall be addressed by the declaration of exemption from the preparation of an environmental assessment (attached).

2. Upon the finding and adoption of the department's analysis by the Board, that the Board review and accept the declaration of exemption for purposes of recordkeeping requirements of chapter 343, HRS, and chapter 11-200.1, HAR.

3. That the permittee provide, as required under the Monument permit general terms and conditions, a summary of their findings under this Monument access, including but not limited to, any initial findings to the DLNR for use at educational institutions and outreach events. Any unexpected results and anomalous encounters should be included in a report or future permit applications to the BLNR to allow proper evaluation of research efforts in future permitting decisions.

4. That all persons covered under this permit shall abide by and obey all Monument permit general conditions and protocols, unless otherwise specifically permitted, exempted, or excluded under the terms and conditions.

5. 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.

6. 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.

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

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

9. Refueling of tenders and all small vessels must be done at the support ships and outside the confines of lagoons or near-shore waters in the State Marine Refuge with the exception of boats utilized in operations that are land-based for extended periods of time.

10. If there is any Hawaiian monk seal or any other protected species in the area when performing any permitted activity shall cease until the animal(s) depart the area, except as permitted for specific management of that species.

11. No fishing is allowed in State Waters except as authorized under State law for subsistence, traditional and customary practices by Native Hawaiians.

12. To mitigate risk of spreading *Chondria tumulosa* within the monument and Main Hawaiian Islands, the permittee will follow the Best Management Practices to Minimize the Spread of nuisance alga (BMP #20).

13. The permittee is required to follow all applicable Federal, State, and County laws with respect to the COVID-19 emergency response that apply at the time of departure and return. In issuance of this permit, the State of Hawaii is not otherwise monitoring or regulating permittee's compliance with COVID-19 laws and is not responsible for the health and safety of crew members, researchers or other occupants of the vessel associated with this permit.

Respectfully submitted,

Brian J. Neilson, Administrator
Division of Aquatic Resources

APPROVED FOR SUBMITTAL

Dawn N. S. Chang, Chairperson
Board of Land and Natural Resources
Attachments:

1) Application
2) Declaration of Exemption ("DE") from the Preparation of an Environmental Assessment under the Authority of Chapter 343, HRS & Chapter 11-200.1 HAR

Papahānaumokuākea Marine National Monument

RESEARCH Permit Application

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

ADDITIONAL IMPORTANT INFORMATION:

- Any or all of the information within this application may be posted to the Monument website informing the public on projects proposed to occur in the Monument.

- In addition to the permit application, the Applicant must either download the Monument Compliance Information Sheet from the Monument website OR request a hard copy from the Monument Permit Coordinator (contact information below). The Monument Compliance Information Sheet must be submitted to the Monument Permit Coordinator after initial application consultation.

- Issuance of a Monument permit is dependent upon the completion and review of the application and Compliance Information Sheet.

INCOMPLETE APPLICATIONS WILL NOT BE CONSIDERED

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

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

Papahānaumokuākea Marine National Monument
Permit Application Cover Sheet

This Permit Application Cover Sheet is intended to provide summary information and status to the public on permit applications for activities proposed to be conducted in the Papahānaumokuākea Marine National Monument. While a permit application has been received, it has not been fully reviewed nor approved by the Monument Management Board to date. The Monument permit process also ensures that all environmental reviews are conducted prior to the issuance of a Monument permit.

Summary Information

Applicant Name: Keolohilani H. Lopes Jr.
Affiliation: University of Hawai‘i at Mānoa

Permit Category: Research
Proposed Activity Dates: May 2025 – November 2025
Proposed Method of Entry (Vessel/Plane): Charter (Searcher or Equivalent)
Proposed Locations: Manawai and Lalo.

Estimated number of individuals (including Applicant) to be covered under this permit: 12

Estimated number of days in the Monument: 20

Description of proposed activities: (complete these sentences):

a.) The proposed activity would…

deploy two different types of small Uncrewed Marine Systems (sUMS), FloatyBoat (8a) a surface vehicle, and the RangerBot (8b) submersible and an Automated Underwater Covert Camera and Hydrophone (8d). The sUMS will autonomously map the invasive acting macroalga *Chondria tumulosa*, and collect ancillary images and data (temp, salinity, and eDNA). Both sUMS will be equipped with RGB camera/s, hyperspectral cameras, salinity, and temperature. The floaty boat will be equipped with two eDNA profiler types. An active McLane profiler (8c), and a passive (soak) system consisting of filters that will be exposed to the ocean water in situ for 10 – 30 minutes. These sUMS are small and relatively light weight which allows for easy deployment over the side of a small boat. We will have two Automated Underwater Covert Camera and Hydrophone will be deployed for approximately 6 hours per day. We may deploy both camera hydrophones at two separate sites each day. We will set these weighted cameras in sandy bottom areas surrounded by reefs. We will target areas like spur and grooves or sandy areas between reefs. These cameras will be deployed at the start of the day and retrieved at the end of the field day. This unit will conduct presence absence videos of marine species and how they relate to the sound scape and disturbances. More specifically, this passive hydrophone/camera will be used to compare the soundscapes between areas with *C. tumulosa* and areas without.

This project would consist of one expedition of ~20 days at sea (DAS) which will stop at Lalo on the way into the monument and conduct surveys for 1 to 2 days. We plan to proceed to Manawai for ~7 days of research, after which we will return directly to Honolulu. We estimate a total of 9 days of research with 11 days of transit (20 DAS).

b.) To accomplish this activity, we would ….
deploy sUMS from small boats in the areas of interest. We will also set the hydrophones out in the beginning of the day and retrieve them at the end of the day.

c.) This activity would help the Monument by …
providing comprehensive maps of *C. tumulosa* location throughout Manawai in addition to oceanographic, eDNA, and soundscape data which will aid in the management of PMNM, specifically the management of *C. tumulosa*. More generally speaking, this project will employ new technologies for data collection.

Other information or background:
These systems will be field tested in Kaneohe Bay, Maunalua Bay, and Waikiki on Oahu. Testing of these equipment will consist of instrument calibration and developing data processing techniques for these novel systems. Preventing the spread of alien invasive species (AIS) are our primary concern and we will follow BMP 20 guidelines to sterilize the marine systems. We will keep the sUMS dry for 30 days prior of the expedition. On day 1 of this 30-day dry period the units will be thoroughly rinsed in fresh water and wiped with Clorox disinfecting wipes, let sit for 5 minutes, then rinsed in fresh water and dried. These units will remain on the UH campus in Sherman Lab Rm 238 which consists of no algae, no plant material, or other potential contaminants for PMNM.

Section A - Applicant Information

1. Applicant

Name (last, first, middle initial): Lopes Jr., Keolohilani, H.

Title: Mr.

1a. Intended field Principal Investigator (See instructions for more information):
Keolohilani H. Lopes Jr.

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

Keolohilani Lopes Jr.
Department of Natural Resources and Environmental Management

[redacted]

Phone: [redacted]

Fax: [redacted]

Email: [redacted]

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

Tomoaki Miura, [redacted]

3. Affiliation (institution/agency/organization directly related to the proposed project):
University of Hawai'i at Mānoa, Department of Natural Resource and Environmental Management

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):
Keolohilani H. Lopes Jr., Researcher/Graduate Research Assistant
Serena Mou, (Australian Citizen) Electronic Engineer
Matthew Dunbabin, (Australian Citizen) Electronic Engineer
Anna Baker Mikkelsen, (Danish Citizen), UMS Trained Technician

4 – Researchers, TBD.

4 – Ship Crew (TBD)

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
☒ French Frigate Shoals	☐ Land-based	☒ 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	This Shallow water	☐ Deep water
☐ Monument Expansion Area			
☐ 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:
The primary location of interest is Manawai and our 'control' site is Lalo. We intend to deploy these sUMS in the shallow water of both the backreef and forereef where *C. tumulosa* is thought to be. We will deploy sUMS at Lalo to collect some data from *C. tumulosa* free sites, system checks and calibrations.

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

☒ Removing, moving, taking, harvesting, possessing, injuring, disturbing, or damaging any living or nonliving Monument resource
☐ Drilling into, dredging, or otherwise altering the submerged lands other than by anchoring a vessel; or constructing, placing, or abandoning any structure, material, or other matter on the submerged lands
☒ Anchoring a vessel
☐ Deserting a vessel aground, at anchor, or adrift
☐ Discharging or depositing any material or matter into the Monument
☐ Touching coral, living or dead
☐ Possessing fishing gear except when stowed and not available for immediate use during passage without interruption through the Monument
☐ Attracting any living Monument resource

☐ Sustenance fishing (Federal waters only, outside of Special Preservation Areas, Ecological Reserves and Special Management Areas)
☐ Subsistence fishing (State waters only)
☒ Swimming, snorkeling, or closed or open circuit SCUBA diving within any Special Preservation Area or Midway Atoll Special Management Area

6. Purpose/Need/Scope *State purpose of proposed activities:*
The ChondriaBot program will utilize computer vision technology in small autonomous uncrewed marine systems to identify and map *C. tumulosa*. The extent of *C. tumulosa* is a major gap in knowledge for PMNM resource managers that the ChondriaBot program aims to fill. ChondriaBots systems rely solely on camera systems and other passive imaging technologies and will not directly contact the substrate. The project consists of two types of sUMS named FloatyBoat (8a) and a submersible called the RangerBot (8b), see 'Procedures and Methods' section for specifications. Ancillary data collected by these sUMS are salinity, depth, temperature, and eDNA collected on filter paper. Our eDNA approach will consist of a passive filtration technique designed by UH graduate researcher, Patrick Nichols. These sUMS are developed by Queensland University of Technology (QUT) and adapted for this specific purpose by Mr. Lopes, for the University of Hawai'i at Mānoa. The ChondriaBot will have an apparatus to keep filter paper submerged during operations. When the operation is complete, the filter papers will be placed in sterile tubes and put on ice. When returning from the day's operations, all eDNA filter paper samples will be properly stored into a Dewar.

The ChondriaBot and RangerBot locomotion and autonomy have been rigorously field tested for several years by QUT.

*Considering the purpose of the proposed activities, do you intend to film / photograph federally protected species beyond the protocols provided in PMNM Best Management Practices (https://www.papahanaumokuakea.gov/permit/bestmanagement.html)? Yes ☐ No ☒

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

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?

Parameters for the sUMS can be preprogrammed to avoid culturally sensitive sites as well as natural and historic areas of higher sensitivity. These sUMS are non-impact in design and will not come in contact with any natural resources of PMNM.

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?
This project is noninvasive and non-destructive and will collect data to manage *C. tumulosa* and it can enhance the qualities of PMNM by digitally capturing images for perpetuity.

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.
Chondria tumulosa is a problem plaguing PMNM. It is currently isolated within PMNM boundaries and only located at the Northern most atolls within PMNM. This project will extend our knowledge of the extent of *C. tumulosa* at Manawai by surveying areas inaccessible by other traditional survey methods. These robotic systems are designed to work in both shallow and deep areas which will allow for more expansive and detailed data that is currently state-of-the-art. The data collected will result in detailed benthic maps at relatively large scales, larger than conventional SCUBA surveys allow.

d. How does the end value of the activity outweigh its adverse impacts on Monument cultural, natural, and historic resources, qualities, and ecological integrity?
There are no adverse impacts of this study and this research will provide valuable data that can be used for the management of PMNM. Ancillary data like salinity, temperature, turbidity, and eDNA will also provide high resolution data for archives and to researchers.

e. Explain how the duration of the activity is no longer than necessary to achieve its stated purpose.
This project is intended to be the final step in our proof of concept of these sUMS. We will be able to survey 3 to 4 sites a day which will generate enough data to determine the ‘successes of these systems to identify and map *C. tumulosa*. Upon successful completion it is our intention to upscale this program and continue surveys in future years.

f. Provide information demonstrating that you are qualified to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.
I am a trained PMNM resource monitor and a former affiliate of PMNM for 6 years and have been conducting research in PMNM for nearly 12 years. I have also been trained in the use of these sUMS. I will use this experience and expertise to avoid and mitigate potential issues as well as have safeguards in place for any potential situation.

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.
We currently have an FloatyBoat (8a) and are expected to receive our submersible by the end of 2024. The equipment for this project has been fully funded. Funding for the expedition will be requested after the successful completion of our local field trials. Funders are fully committed to this project and the grantors are supportive of the additional expedition funding (~$250,000 est.).

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.
This project will be collecting two primary data types 1) images and electronic sensor data (benthic photos, hyperspectral imagery data, temperature data, salinity data). 2) eDNA filter paper/cotton swabs. The eDNA collected will be by an active method where water is pumped through the filter in situ through the McLane eDNA profiler machine, from which the eDNA filter paper will be retrieved and eventually frozen. The passive method of eDNA collection will consist of exposing a filter to the ocean water with no active pumping. A filter soak directly in the ocean. These eDNA filters will be retrieved and eventually frozen at the end of the day. No sea water will be collected. All eDNA sampling will be conducted in situ and samples will be in the form of eDNA filter paper.

i. Has your vessel been outfitted with a mobile transceiver unit approved by OLE and complies with the requirements of Presidential Proclamation 8031?
The R/V Searcher regularly deploys into PMNM and is compliant.

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 the activities inappropriate.

8. Procedures/Methods:

a) FloatyBoat –

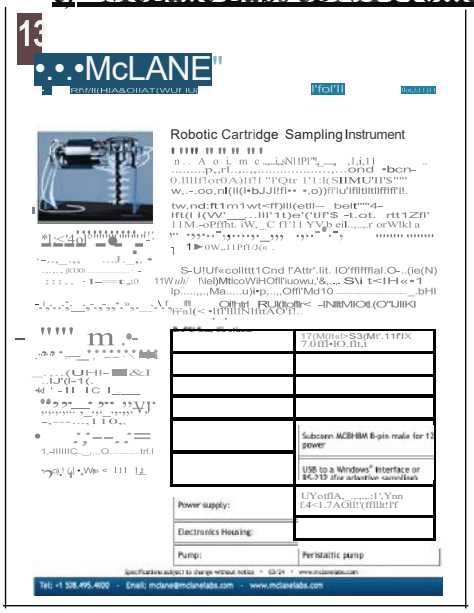
Dimensions (m) Length x Width	1.95m x 1.1m
Height above waterline	0.45m
Draft, with fins	0.24m
Weight (kg)	~16kg

Endurance (h)	2 hours
Smvev Speed	2 *mis*
Operational Envelope (tested)	Winds, max 36 knots

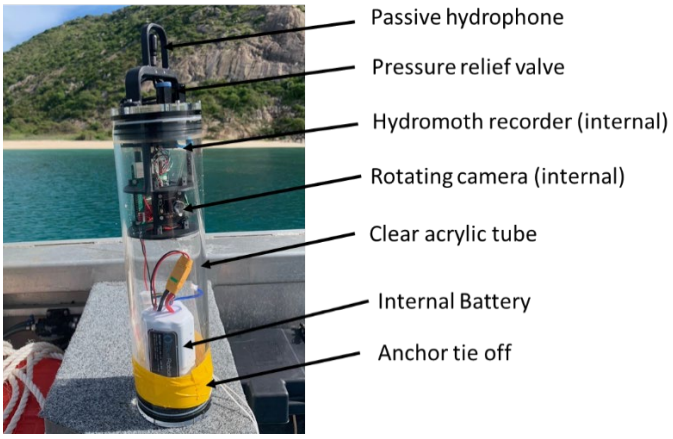
b) RangerBot –

Dimensions (m) Length x Width x Height	0.75 x 0.44 x 0.33
Weight (kg)	16k
Endurance (h)	6 hours
Survey Speed	0.3-0.6 *mis*
Operational Envelope (tested)	Winds, max 36 knots

c) McLane Labs eDNA Profiler (Internally mounted on sUMS)



d) Automated Underwater Covert Camera and Sound Recorder



Acrylic tube length	400 mm
Overall length (without anchoring rope)	~500 mm
Diameter	115 mm
Weight	~ 2.7 kg
Buoyancy	~ 1.5 kg
Battery	14.8V 15.6 Ah Lithium Ion
Onboard computer/storage	Raspberry Pi
Camera	USB camera (configurable 1080p and 4k)
Recording time	Fully customizable (typically record 1 min every 10 min, or 2 min every 15min.

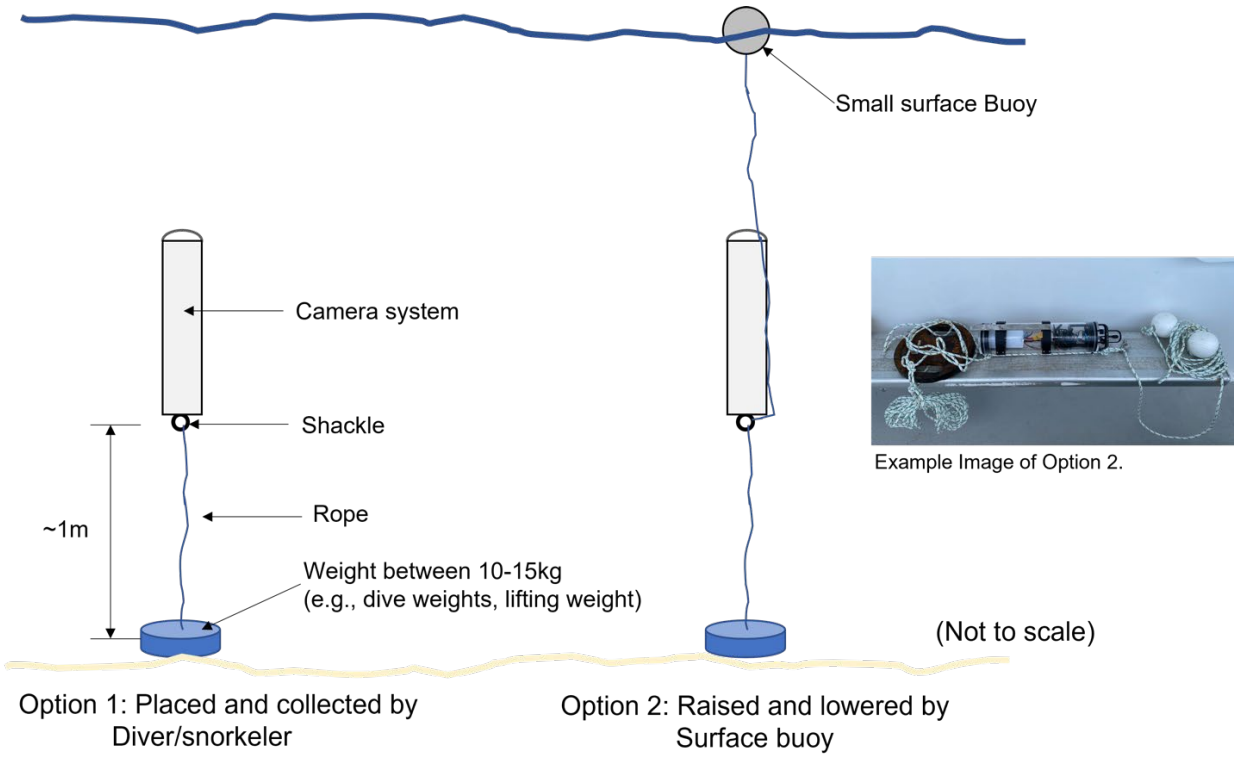


Figure c: Automated Underwater Covert Camera and Hydrophone (Weights will be adjusted with ocean conditions)

Research will be conducted at Manawai (est. 7 days) and Lalo (1 or 2 Days). Specific sites at these two atolls will be determined by opportunity and weather conditions. Each site will be in waters deeper than 30 centimeters (1 foot). The sUMS will either be programmed to run a predetermined route, or a predetermined polygon. We have the capacity to operate the sUMS for > 8 hours (change of batteries). This project aims to collect data near the fringing reef, where small boats find it too dangerous to access.

All sUMS will be deployed over the side of any small boat. The size and weight of these sUMS allow for a single person to deploy and recover. The sUMS will then autonomously run the program to locate and map *C. tumulosa*. These sUMS will also collect water quality data and collect an eDNA sample. Direct exposure to the ocean by the sterile filter paper will collect the eDNA samples from which point it will be put into vials and stored. Vessel storage will be on ice or liquid nitrogen and then taken to the expedition vessel to be stored in liquid nitrogen.

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

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

We propose the collection of eDNA samples at each site.

Common name:
Environmental DNA

Scientific name:
N/A

& size of specimens:
Approximately 300 total samples.

Collection location:
Manawai and Lalo.

☐ Whole Organism ☒ Partial Organism

9b. What will be done with the specimens after the project has ended?
All eDNA filter paper samples collected will be sent to UH Manoa Lab Services for analysis and the filter paper are destroyed during processing and disposed of by the UH Manoa Lab Services.

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

• General site/location for collections:
Subsurface water ~ 1' below the sUMS

• 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?
The samples will leave the monument with the eDNA filters contained individually in a sealed sample vial, and stored within in a Dewar filled with liquid nitrogen.

11. Describe collaborative activities to share samples, reduce duplicative sampling, or duplicative research:
All eDNA work will be processed by the Marko Lab at UH Manoa and data will be shared with PMNM and other collaborators after data has been cleaned and analyzed. This work and data will be shared with PMNM and all researchers studying *C. tumulosa* where relevant.

12a. List all specialized gear and materials to be used in this activity:
Two types of customized sUMS will be used, ChondriaBot and RangerBot and the sensor packages will be utilized as described above. We will also conduct daily deployments of the Automated Underwater Covert Camera and Hydrophone system.

12b. List all Hazardous Materials you propose to take to and use within the Monument:
Lithium-Ion Batteries, Clorox Bleach (sanitize gear between atolls), and a Dewar of Liquid Nitrogen.

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

14. Provide a time line for sample analysis, data analysis, write-up and publication of information:
1 year for data analysis and 2 years for publication/s.

15. List all Applicants' publications directly related to the proposed project:
Lopes, K. H. Jr, Miura, T., Hauk, B., Kosaki, R., Leonard, J., & Hunter, C. (2023). Rapid expansion of the invasive-like red macroalga, *Chondria tumulosa* (Rhodophyta), on the coral reefs of the Papahānaumokuākea Marine National Monument. *Journal of Phycology*, 59, 1107–1111. https://doi.org/10.1111/jpy.13369

Fraiola, K.M.S., Miura, T., Martinez, J., **Lopes, K.H.**, Amidon, F., Torres-Pérez, J., Spalding, H.L., Williams, T., So, K., Sachs, E., Kosaki, R.K., 2023. Using commercial high-resolution satellite imagery to monitor a nuisance macroalga in the largest marine protected area in the USA. Coral Reefs 42, 253–259. https://doi.org/10.1007/s00338-022-02336-6

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

JOSH GREEN, M.D.
GOVERNOR | KE KIA'ĀINA

SYLVIA LUKE
LIEUTENANT GOVERNOR | KA HOPE KIA'ĀINA

STATE OF HAWAIʻI | KA MOKUʻĀINA ʻO HAWAIʻI
DEPARTMENT OF LAND AND NATURAL RESOURCES
1151 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

DAWN N.S. CHANG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RYAN K.P. KANAKAʻOLE
FIRST DEPUTY

CIARA W. K. KAHAHANE
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

March 28, 2025

TO: Division of Aquatic Resources File

THROUGH: Dawn N. S. Chang, Chairperson

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

SUBJECT:

DECLARATION OF EXEMPTION FROM THE PREPARATION OF AN ENVIRONMENTAL ASSESSMENT UNDER THE AUTHORITY OF CHAPTER 343, HRS AND CHAPTER 11-200.1 HAR, FOR A PAPAHĀNAUMOKUĀKEA MARINE NATIONAL MONUMENT RESEARCH PERMIT TO KEOLOHILANI LOPES, UNIVERSITY OF HAWAIʻI AT MĀNOA, FOR ACCESS TO STATE WATERS TO CONDUCT *CHONDRIA TUMULOSA* RESEARCH UNDER PERMIT PMNM-2025-002.

The following permitted activities are found to be exempted from preparation of an environmental assessment under the authority of Chapter 343, Hawaii Revised Statutes (HRS) and Chapter 11-200.1, Hawaii Administrative Rules (HAR):

Project Title: Papahānaumokuākea Marine National Monument Research Permit to Keolohilani Lopes to Conduct Research Activities for a *Chondria Tumulosa* Research Project

Permit Number: PMNM-2025-002

Project Description:
The permit, as described below, would allow entry for research activities to occur in the Papahānaumokuākea Marine National Monument (Monument), including the Northwestern Hawaiian Islands (NWHI) State Marine Refuge and the Kure Atoll Wildlife Sanctuary including the lands and waters (0-3 nautical miles) surrounding the following to the extent within the jurisdiction of the State of Hawai'i:

- Manawai (Pearl and Hermes Atoll)
- Lalo (French Frigate Shoals)

The activities covered under this permit would occur over 20 days from May 1, 2025 through November 30, 2025. The timing of entry into the Monument will depend on availability of ship transport, schedules, and weather.

INTENDED ACTIVITIES:

The applicant proposes to deploy two different types of small Uncrewed Marine Systems (sUMS), FloatyBoat, a surface vehicle, and the RangerBot, a submersible, and two (2) Automated Underwater Covert Camera and Hydrophone units.

sUMS

The sUMS will autonomously map the invasive acting macroalga *Chondria tumulosa*, and collect ancillary images and data (temp, salinity, and eDNA). Both sUMS will be equipped with RGB camera/s, hyperspectral cameras, salinity, and temperature. The FloatyBoat will be equipped with two eDNA profiler types, an active McLane profiler, and a passive (soak) system consisting of filters that will be exposed to the ocean water in situ for 10 – 30 minutes. These sUMS are small and relatively light weight which allows for easy deployment over the side of a small boat. The applicant intends to create the ChondriaBot program which will utilize computer vision technology in the sUMS to identify and map *C. tumulosa*. The extent of *C. tumulosa* is a major gap in knowledge for Monument resource managers that the ChondriaBot program aims to fill. ChondriaBots systems rely solely on camera systems and other passive imaging technologies and will not directly contact the substrate. Ancillary data collected by these sUMS are salinity, depth, temperature, and eDNA collected on filter paper. The eDNA approach will consist of a passive filtration technique designed by UH graduate researcher, Patrick Nichols. These sUMS are developed by Queensland University of Technology (QUT), where it was rigorously field tested for several years, and adapted for this specific purpose by Mr. Lopes, for the University of Hawai‘i at Mānoa. The ChondriaBot will have an apparatus to keep filter paper submerged during operations. When the operation is complete, the filter papers will be placed in sterile tubes and put on ice. When returning from the day’s operations, all eDNA filter paper samples will be properly stored into a Dewar.

Automated Underwater Covert Camera and Hyrdophones

The applicant proposes to have two Automated Underwater Covert Camera and Hydrophones deployed as part of this research. These units will conduct presence absence videos of marine species and how they relate to the sound scape and disturbances. More specifically, this passive hydrophone/camera will be used to compare the soundscapes between areas with *C. tumulosa* and areas without.

Method

The applicant proposes to conduct research in the nearshore waters at Manawai (est. 7 days) and Lalo (1 or 2 Days). Specific sites at these two atolls will be determined by opportunity and weather conditions. Each site will be in waters deeper than 30 centimeters (1 foot). The sUMS will either be programmed to run a predetermined route, or a predetermined polygon. The researchers will have

the capacity to operate the sUMS for > 8 hours (change of batteries). This project aims to collect data near the fringing reef, where small boats find it too dangerous to access.

All sUMS will be deployed over the side of a small boat. The size and weight of these sUMS allow for a single person to deploy and recover. The sUMS will then autonomously run the program to locate and map C. tumulosa. These sUMS will also collect water quality data and collect an eDNA sample. Direct exposure to the ocean by the sterile filter paper will collect the eDNA samples from which point it will be put into vials and stored. Vessel storage will be on ice or liquid nitrogen and then taken to the expedition vessel to be stored in liquid nitrogen.

The applicant proposes to have two Automated Underwater Covert Camera and Hydrophones deployed for approximately 6 hours per day also deployed over the side of a small boat. Both camera-hydrophones may be deployed at two separate sites each day. The applicant will place the weighted cameras in sandy bottom areas surrounded by reefs targeting areas like spur and grooves or sandy areas between reefs.

More detailed information about the project, including pictures and diagrams of the sUMS and Automated Underwater Covert Camera and Hydrophone set-up can be found in the application.

ADHERANCE TO FINDINGS CRITERIA, BMPs, AND OTHER SAFETY PROTOCOLS:

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
☒ Swimming, snorkeling, or closed or open circuit SCUBA diving within any Special Preservation Area or Midway Atoll Special Management Area
☒ Anchoring a vessel

<u>Monument Management Plan Strategies</u>

The activities proposed by the applicant directly support the Monument Management Plan (PMNM MMP Vol. 1, 2008), including but not limited to the Alien Species Action Plan strategies AS-7: investigate methods to eventually eradicate aquatic invasive organisms already known to be present in the Monument, and conduct regular surveillance for new invasions and AS-8: conduct and facilitate research designed to answer questions regarding invasive species detection, effects on ecosystem, and alien species prevention, control, and eradication over the life of the plan.

<u>Best Management Practices</u>

To safeguard Monument resources the permittee will abide by all applicable Monument Best Management Practices (BMPs) while conducting the activities within the Monument.

BMP Number	Title	Download
001	Marine Alien Species Inspection Standards for Maritime Vessels	PDF
002	Protocol for Acquiring Avian Blood Samples	PDF
003	Human Hazards to Seabirds Briefing	PDF
004	Best Management Practices for Boat Operations and Diving Activities	PDF
005	Protocols to Reduce Impact to the Laysan Finch	PDF
006	General Storage and Transport Protocols for Collected Samples	PDF
007	Best Management Practices for Terrestrial Biosecurity	PDF
008	Seabird Protocols Necessary for Conducting Trolling Research and Monitoring in Papahānaumokuākea Marine National Monument	PDF
009	Best Practices for Minimizing the Impact of Artificial Light on Sea Turtles	PDF
010	Marine Wildlife Viewing Guidelines	PDF
011	Disease and Introduced Species Prevention Protocol for Permitted Activities in the Marine Environment, Papahānaumokuākea Marine National Monument (Monument)	PDF
012	Precautions for Minimizing Human Impacts on Endangered Land Birds	PDF
015	Nonnative Species Inspection Requirements at Midway Atoll	PDF
016	Best Management Practices for Activities on Nihoa	PDF
017	Best Management Practices for Maritime Heritage Sites	PDF
018	Rodent Prevention and Inspection Standards for Permitted Vessels	PDF
019	Best Management Practices for Activities on Mokumanamana (Necker Island)	PDF
020	Best Management Practices to minimize the spread of nuisance alga	PDF

REVIEW PROCESS

The application was sent out for review and comment to the following scientific and cultural entities (for review of activities in which the entities are not themselves an applicant): Hawai'i Division of Aquatic Resources, DOFAW, Papahānaumokuākea Marine National Monument (NOAA/NOS), NOAA Pacific Islands Regional Office (NOAA-PIRO); USFWS, Hawaiian and Pacific Islands National Wildlife Refuge Complex Office; the Office of Hawaiian Affairs (OHA) and the Monument Native Hawaiian Cultural Working Group.

For two weeks the 2025 application was reviewed and received questions, comments and applicant responses as noted below:

Review Questions and Responses:

1. What steps will be taken to ensure the lines associated with the Automated Underwater Covert Camera and Hydrophone devices will not become entanglement hazards for protected species while deployed for "approximately 6 hours per day". (particularly interested in the surface float line)?

   Response: To ensure that line will not become entanglement hazards we will replace the bottom 1m line (between the weighted temporary mooring and camera) with a stainless-steel cable to eliminate entanglement here. For the line between the camera and the marker float we will ensure the line is taut and appropriate for the depth of each site. The excess line will be placed in a bag to eliminate entanglement hazards.
2. In reference to the "swimming/snorkeling/diving box" being checked: Will sites for the equipment mentioned above be scouted prior to deployment to ensure the weight are placed in a sandy area?
   a. When deploying these units, will they be lowered from the boat above or deployed by divers?

      Response: Each deployment site for the Underwater Covert Camera and Hydrophone will be evaluated from the surface and a snorkeler will confirm the benthic cover as sand and assist in lowering the weighted mooring to bottom. The snorkeler will then adjust the tautness of the line and place the remaining line in the bag which will be secured to the float.
3. Will the applicant be conducting any cultural protocols or offerings in conjunction with their access? If so please describe.

   Response: I will most likely Oli, E Ho Mai as we sail past Niihau and prior to our first day of field operations at both atolls (Lalo and Manawai).
4. Can the applicant describe if they anticipate the small Uncrewed Marine Systems (sUMS) (the FloatyBoat - a surface vehicle and the RangerBot - a submersible) making contact with or coming into close proximity with the benthic environment during testing around O‘ahu (Kaneohe Bay, Maunalua Bay, and Waikiki), either via planned or unplanned interactions during navigation during testing?

   Response: During our field testing the avoidance systems of the robotics work very well. However, we do plan to have mitigation approaches in the unlikely occurrence of contact with the benthos. During our local field test a the robotics have not come into contact with the bottom but if the equipment returns with new scrapes or other evidence of contact we will document these potential ground strikes and clean around the impact area thoroughly to avoid cross contamination between sites.
5. Can the applicant provide a detailed mitigation plan of how the risk of transferring (AIS) / disease / parasites after testing the sUMS around O‘ahu areas and then transporting the sUMS up to the PMNM will be avoided / minimized? This plan should include methods and protocols to minimize AIS or disease movement through gear, supplies and activities of the applicant (see recommendations below).

   Reasoning: Some of the areas on Oahu (Kaneohe Bay, Maunalua Bay, and Waikiki) where it has been described in the application that the two different types of small Uncrewed Marine Systems (sUMS) will be tested before going up into the PMNM, are marine areas with a high prevalence of Aquatic Invasive Species (AIS) / disease / parasites including the following:

- Algae (*Kappaphycus spp*., *Eucheuma denticulatum*, *Gracilaria salicornia*, *Acanthophora spicifera*, *Hypnea musciformis*, and *Avrainvillea amadelpha/lacerata/erecta*, and *Chondria tumulosa*);
    - *Kappaphycus spp*. & *Eucheuma denticulatum* – mainly present in Kaneohe Bay but also present in small distributions on Windward side and N. Shore
    - *Acanthophora spicifera*, *Gracilaria salicornia*, *Hypnea musciformis*, and *Avrainvillea amadelpha/lacerata/erecta* – distributions on Oahu are island-wide – particularly dense distributions of *Avrainvillea* spp. are in Maunalua Bay (although much has been removed) – *Avrainvillea* also can be prevalent in Waikiki / deeper areas West Side; *Acanthophora spicifera*, *Gracilaria salicornia*, and *Hypnea musciformis* are going to be particularly present in Waikiki, Maunalua Bay, Kaneohe Bay (but present island-wide) Note: DAR has photo-guides of algae if it would be helpful for field ID
    - Chondria: Only known presence of is on Kure, Midway and Pearl & Hermes – just included in this list because it's a concern overall
- Majano Anemone (*Anemone manjano*), Orange keyhole sponge (*Mycale armata/grandis*), Pulsing Xenia (*Unomia stolonifera*), Kenyan Tree (*Capnella sp*.)
- Coral disease (Montipora, Pocillopora, and Porites tissue loss syndrome, Montipora, Pocillopora, and Porites anomalies, Montipora black band, Porites trematodiasis; and
- any other non-native organisms.
- The following are some best practices currently recommended by DAR for the transport of gear / instruments from areas with AIS in the MHI (which can be included in the plan if an alternate method is not being proposed):
    - Visually inspect, disinfect, clean, and dry all gear and equipment between any collection events or deployment of instruments or similar. Disinfecting procedures will include soaking the gear and equipment for a minimum of 10 minutes in a solution containing a chemical disinfecting agent proven to kill live organisms such as diluted bleach (1 part bleach : 20 parts freshwater). Visual inspection should confirm gear, instruments or similar are absent of any algae fragments or basal attachments of invasive algae or other invasive species/disease/parasites.
    - If collection gear cannot be bleached, gear must be thoroughly rinsed with fresh water and sterilized with another viable method, approved by DAR, and dried in the sun for 24 hours before use in an alternate location, or thoroughly rinsed with fresh water and allowed to desiccate for an appropriate amount of time approved by DAR, or alternate sampling gear will be utilized.

Response: Our Oahu based field trials has been rescheduled after I received these comments. To address these concerns we will now conduct all field work in one specific area (Kaneohe, Maunalua, Waikiki) until completed. I will start with working out of Waikiki, then Maunalua, then Kaneohe until all the needed data is collected. Between each survey, all robotics will be cleaned with fresh water thoroughly, and easily removable panels will be disassembled for better access to clean. Between each site (Kaneohe, Maunalua, and Waikiki) each unit will undergo a thorough freshwater rinse and wiped down with a Clorox wipe where accessible and

not near sensitive electronics. These equipment will not tolerate a bleach solution soak so to ensure all organisms are no longer viable, we will add a week long (7 day) drying period in the lab which has a dehumidifier which will ensure a complete drying out period for these equipment. Upon return from PMNM, these equipment will remain out of the water for 30 days from the last deployment.

6. Will the Automated Underwater Covert Camera and Hydrophone also be tested in areas around Oahu? If so, can this instrument and methods to disinfect also be included in the AIS plan?

   Response: The Underwater Covert Camera's will not be tested in Hawaiian waters and will be tested in a fresh water tank in Australia prior to deployment.

7. Will Chondria abundance at Manawai be considered in your deployment schedule of sUMS? That is, where possible, will areas with less Chondria abundance be surveyed first to minimize chance for spread of Chondria fragments?

   Response: From my experience, *Chondria tumulosa* is everywhere on Manawai to varying degrees. I do have access to our 2023 expedition *C. tumulosa* cover data. To answer the question, the possibility of the sUMS spreading it to other locations on the atoll improbable for the fact that we have observed *C. tumulosa* 'rafting' and rolling on the benthos, so modes of translocation are occurring naturally with this species. However, to mitigate the potential of the sUMS spreading *C. tumulosa*, we will clean and rinse the sUMS with sea water from the site before transiting to the second site. We approximate 3 deployments per day in the same general vicinity. The relative close proximity will also reduce the probability of the sUMS spreading *C. tumulosa*.

8. How many sites will you survey at both Lalo and Manawai and how much reef across all sites/location will be mapped?

   Response: We hope to map several acres a day. Our experimental design will have us at one generalized location (e.g. Center East Backreef) every day with subsequent sites located within this area. At this current time, we cannot be certain how much power the new sensor systems (hyperspectrometer, eDNA sampler, and ancillary systems) will draw and will be able to better predict actual survey coverage after testing is completed. The new systems are slated to arrive by the end of 2024 and field testing should be completed by March 2025.

9. Will you use your camera footage paired with hydrophones to develop a call library for marine species in the Monument that will be publicly available?

   Response: This group is a fierce proponent of open-source data and will make all data publicly available in conjunction with any potential publication. If it is deemed some data are not able to contain publishable data other methods of data accessibility can be discussed. I will read about 'call libraries' and discuss the potential of specifically creating one with our collaborators.

10. Is the "vision technology" used to identify and map Chondria fully automated, or AI? If so, how reliable do you anticipate this may be and what are the primary limitations?

    Response: I would like to state these systems are in its developmental stages and the results will be used in my Ph.D. dissertation. The computer vision Chondria detection runs on AI/Machine Learning and is equipped to make completely

autonomous detections. We achieved 86% overall accuracy from the computer model runs of the computer vision algorithm and expect that to hold true for 'real-world' situations. To rigorously test the computer vision system I will review all the video to manually track *C. tumulosa* occurrences against the computer vision detections. This will allow for a quantifiable metric of 'actual (video observed) *C. tumulosa*' vs. computer vision detected *C. tumulosa*. I will also note the location of positive results for the eDNA analysis.

11. This seems to be similar to aerial UAS mapping projects and is a very interesting concept. We are curious what program(s) you are using for post-processing and annotation of your imagery?

    Response: This project is very similar to aerial UAS mapping as well as the current in situ benthos surveys utilized by NOAA with regards to structure from motion techniques. We have multiple sensors that will utilize a variety of software to process each. I will be using Agisoft Metashape to stitch together the overlapping photos from the GoPro camera mounted to the robotics. To process the hyperspectral data I will use a combination of proprietary software from Headwall Photonics and a good portion of the work will utilize Python. There is a high possibility that Python may be needed throughout the entire workflow.

12. Have mapping projects similar to this been conducted in other areas which you are basing your methods off of, or is this a fully novel method of algae mapping?

    Response: This project is novel to the best of my knowledge. This project was purposefully designed to address the issues specific to *Chondria tumulosa*, lack of data with regards to extent of *C. tumulosa*, ability to cover a large area, automated data collection and detection. We are confident we can adapt technologies to serve the purpose of increasing our knowledge base in these respects.

13. How much ground do these bots cover? Roughly how much of each atoll are you expecting the sUMS to cover when mapping for and identifying Chondria?

    Response: See 8.

ENVIRONMENTAL COMPLIANCE

NEPA / HEPA: (check-one)

☒ Categorical Exclusion / Exempt Class: 5
☐ EA
☐ EIS

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

- ESA Federal Consultation
- EFH Federal Consultation

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

If so, please summarize past permits:

N/A

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 ☒

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

Exemption Determination: After reviewing §11-200.1-15, HAR, including the criteria used to determine significance under §11-200.1-13, HAR, DLNR has concluded that the activities under this permit would have minimal or no significant effect on the environment and that issuance of the permit is categorically exempt from the requirement to prepare an environmental assessment based on the following analysis:

1. All activities associated with this permit have been evaluated as a single action. The activities are for a single project that potentially spans 20 days but with only one entry into the Monument. Therefore, the activities associated with this permit are treated as one single action with one Monument permit.

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

The proposed activities here appear to fall squarely under the general exemption type identified under HAR §11-200.1-16 (a) (1) and §11-200.1-16 (a) (2), as described under the revised 2020 DLNR Exemption List (Concurred on by the Environmental Council on November 10, 2020), under the general exemption type #5 (Part 1), items #13, #15, and #16, and (Part 2), item #4, which

includes, respectively, “research that the Department declares is designed specifically to monitor, conserve, or enhance native species or native species' habitat,” “game and non-game wildlife surveys, vegetation and rare plant surveys, aquatic life surveys, inventory studies, new transect lines, photographing, recording, sampling, collection, culture, and captive propagation,” “research to identify, monitor, control, or eradicate introduced species,” and “experimental management actions that the Department declares are designed specifically to monitor, conserve, or enhance native species or native species’ habitat.”

The permittee and team would follow Monument Best Management Practices (BMPs) to mitigate threats activities could have on protected species and the surrounding environment.

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

3. Cumulative Impacts of Actions in the Same Place and Impacts with Respect to the Potentially Particularly Sensitive Environment Will Not be Significant. Even where a categorical exemption appears to include a proposed action, the action cannot be declared exempt if “the cumulative impact of planned successive actions in the same place, over time, is significant, or when an action that is normally insignificant in its impact on the environment may be significant in a particularly sensitive environment.” §11-200.1-15 (d), HAR. 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. §11-200.1-13, HAR.

The parameters for the sUMS can be preprogrammed to avoid culturally sensitive sites as well as natural and historic areas of higher sensitivity. These sUMS are non-impact in design and and are expected to stay within the water column and not have contact with any natural resources of the Monument. At this time there are no planned successive actions related to this project.

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 have a Minimal or No Significant Effect on the Environment. Any foreseeable impacts from the proposed activity will probably be minimal, and further mitigated by general and specific conditions attached to the permit. Specifically, all research activities covered by this permit will be carried out with strict safeguards for the natural, historic, and cultural resources of the Monument as required by Presidential Proclamation 8031 and other applicable laws.

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 11-200.1 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.