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

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

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: Andrea Kimiko Kealoha
Affiliation: University of Hawaii Maui College

Permit Category: Research
Proposed Activity Dates: June 1- Aug 30, 2021, dependent on the availability of a ship
Proposed Method of Entry (Vessel/Plane): Marine Vessel (TBD)
Proposed Locations: Nihoa, FFS, LIS, LAY, PHA, MID, KUR, Gardner, Maro and Mokumanamana

Estimated number of individuals (including Applicant) to be covered under this permit: 4

Estimated number of days in the Monument: 30

Description of proposed activities: (complete these sentences):

a.) The proposed activity would…
investigate the role of oceanographic phenomena, such as upwelling, in the invasive *Chondria* (i*C*) outbreak at PHA. This project combines hydrographic measurements with stable isotope analysis of coral tissues to understand oceanographic processes that may influence the presence, growth and distribution of i*C* at PHA. While the hydrographic data provide a snapshot of *in situ* oceanographic conditions, coral tissue samples may reflect the integrated signatures of upwelling events over longer times scales, and provide information on nutrient sources and cycling within the ecosystem.

b.) To accomplish this activity, we would ….
conduct handheld CTD casts within and around PHA. Casts will be planned at defined locations and spatial intervals depending on cruise schedule and allotted time for water sampling. Discrete water samples will be collected using a Niskin bottle deployed at 1 m and 5 m. Analyses will include dissolved inorganic nutrients, carbonate chemistry, and Chl *a*. Coral tissue samples for stable isotope analysis will be collected at shallow, consistent depths within and around PHA, and in areas of both high and low i*C* cover. Stable isotope analyses will also be performed on several samples of plankton, particulate organic matter and the seawater end-members. The isotope data collected in this project will complement the algal stable isotope analyses conducted by Spalding.

c.) This activity would help the Monument by …
providing insight into the oceanographic drivers of the i*C* outbreak that has devastated the ecosystem at PHA. For example, CTD casts will generate temperature and salinity profiles that may help to identify locations for upwelling. Similarly, water samples for nutrients, carbonate chemistry and Chl *a* will also help to identify upwelling, as well as provide information on biogeochemical conditions that fuel i*C* presence, growth and distribution. Stable isotopes are useful in providing information about nutrient sources and cycling. Combined, these data will 1) provide valuable insight into the oceanographic processes that influence the presence, growth and distribution of *Chondria* at PHA, and 2) provide recommendations for targeted management and monitoring locations.

Other information or background:

Section A - Applicant Information

1. Applicant

Name (last, first, middle initial): Kealoha, Andrea, K

Title: Director of Water Quality Lab, University of Hawaii Maui College

1a. Intended field Principal Investigator (See instructions for more information):
Arik Dadez, University of Hawaii Maui College, [redacted]

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

Phone: [redacted]

Fax:

Email: [redacted]

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

3. Affiliation (institution/agency/organization directly related to the proposed project):
University of Hawaii Maui College

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):
Heather Spalding, research diver
Taylor Richmond, research diver
TBD, water sampler
TBD, water sampler

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	☒ 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:
We plan to visit PHA. However, other islands/atolls are a possibility depending on research needs of other scientists on the ship. At each island/atoll we visit, we will perform CTD casts, collect water samples, and collect coral tissue samples for isotopic analysis. We will follow best management practices for boat operations and water/biological sampling. Although the i*C* has been identified at PHA, it is a possibility that the alga has spread to other locations. Therefore if we visit other locations that are affected by i*C*, it will be important that we are able to collect data.

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:***
In 2016, NOAA observed a new species of mat-forming red alga at PHA. By 2019, the alga was widespread and documented from 1-19 m on the north, west and east sides. The alga exhibits invasive qualities and the mats overgrow and smother corals and macroalgae, causing mortality. Given its rapid increase in areal coverage, this alga has the potential to significantly alter the PHA ecological structure, as well as the ecology at other islands and atolls within the Hawaiian Archipelago if the alga spreads. However, since this is a new species of alga, little is known about its origin, ecology or growth conditions.

The purpose of the proposed activities is to collect oceanographic data that will provide insight into the factors that contribute to the presence and distribution of *Chondria* at PHA. These data will increase understanding for biogeochemical and oceanographic processes that may explain the presence and proliferation of *Chondria,* enable mapping and prediction of further alga spread across the Hawaiian Archipelago, and assist in the development of a tool for identification of areas for targeted management and increased monitoring of potential outbreaks.

To do this, we will 1) collect 135 water samples (~60 ml) for dissolved inorganic nutrients, 2) collect 135 water samples (~500 ml) for carbonate chemistry analysis, 3) collect 50 samples for chl*a* analysis, 4) collect 60 samples of coral tissue for stable isotope analysis and 5) perform CTD casts for temperature and salinity depth profiles.

*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.

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?
We do not expect CTD casts and water sample collection to impact monument resources or ecological integrity.

We will be collecting coral tissue samples for stable isotope analysis, and will limit the number of samples to 60 at most. Coral fragments (2-3 cm^2) will be taken as a small subsample of the colony, leaving the remainder of the colony intact. Collection will be done by carefully removing an upward portion coral fragment using hammer and chisel. Apical regions of corals are sites of active growth and therefore recover quickly relative to other areas of the coral. Species types and locations will be chosen to accompany the algal team collection, which means that our collections will be limited to only those needed to fulfill the goal of our grant. Collection equipment will be inspected and disinfected between sampling areas to mitigate the spread of invasive species. Best efforts will be made to ensure that sample collection does not disturb marine life or resources in the surrounding environment.

Other than corals, we will not touch any cultural or historical resources/artifacts within the monument.

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?

We will collect a small subsample of the coral colony in order to limit disturbance. The information this research provides will far outweigh the disturbance associated with coral collection since managers will be more informed to respond to the current alga outbreak that is decimating the coral reef ecosystem, as well as potential future outbreaks across the archipelago.

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 the activity within the Monument. The i*C* is located at PHA, and so we must understand the oceanographic and biogeochemical processes at PHA that contribute to the presence of this *Chondria.* Furthermore, the information we gather may help to predict or prevent the spread of i*C* to other locations throughout the Monument and remaining Hawaiian Islands.

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 implications and value of this research far outweighs the adverse impact on Monument resources and ecological integrity. The PHA ecosystem has been

devastated by the *Chondria* outbreak, and the other islands/atolls of the Hawaiian Archipelago may already be affected as well. The information generated by the requested activities will help scientists and managers better understand the oceanographic conditions under which this alga grows, and may help to predict and/or prevent the spread of i*C* within the Monument and across the Hawaiian Archipelago.

e. Explain how the duration of the activity is no longer than necessary to achieve its stated purpose.
The fieldwork component of this research will be performed under the minimal time required to achieve the goal and objectives of the grant. Collaborators on the grant (but under a separate permit request) will be on the same research cruise. These scientists possess extensive information on algal distribution collected during previous cruises and we will use that data to refine coral and alga collection locations. Water sampling and CTD casts will be conducted efficiently to maximize spatial resolution and minimize activity duration. Prior to the research cruise we are completing a comprehensive oceanographic analysis on all available data, and that will help to inform the water sampling plan as well.

f. Provide information demonstrating that you are qualified to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.
Dr. Andrea Kealoha is a professor at UH Maui College and is the Director of the Water Quality Lab. She is an expert in coral reefs and biogeochemical processes, and recently published an article on upwelling as a cause of the mortality event in the Flower Garden Banks National Marine Sanctuary. Andrea has participated in two previous research cruises to the Monument, both of which involved CTD operations and water sample collection similar to the activities proposed in the permit request. She has also conducted field operations in the FGBNMS, and as a former Nancy Foster scholar, has visited multiple national marine sanctuaries. Hence, she is sensitive to and respectful of the cultural, natural and historical importance of these ecosystems.

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.
This project is supported by a NFWF grant to PI A. Sherwood. Kealoha is a co-PI on the grant and sufficient funds have been dedicated to the oceanographic component described in this request.

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 we will use in this study have been used previously throughout the NWHI and at other locations by Dr. Kealoha and other scientists. In the current project, we will use a compact CTD and single niskin for chemistry profiles. This will be less intrusive than the large shipboard rosette and niskin bottles typically used. The data generated by profiling will provide information on the oceanography of PHA, including the depth

structure of various parameters, physical and biogeochemical processes, and long-term trends.
Stable isotopes provide useful information about sources of nutrients, biogeochemical cycling and trophic structure within an ecosystem. We will collect coral tissue samples for $\delta^{13}C$ and $\delta^{15}N$ to understand nutritional input from allocththonous sources. For example, studies suggest that corals acquire more energy through heterotrophy when particulate nutrients are available (e.g., during upwelling). This increased heterotrophy would be reflected in the isotopic signature of coral tissue samples. Thus, by collecting coral tissue samples from multiple locations around the atoll, we may be able to identify specific locations for increased inputs of particulate nutrients.These data also compliment and will be compared to the algae stable isotope data collected by H. Spalding.
To ensure robustness of the data, species of corals that are known to enhance heterotrophic behavior during periods of increased organic matter input will be collected (e.g., *Pocillopora* and *Montipora*).

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 vessel will be equipped with the appropriate mobile transceiver unit.

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 this permit inappropriate.

8. Procedures/Methods:
1) CTD casts: Casts will be conducted using a Castaway CTD by Sontek, which is a hand-held CTD designed for coastal profiling to depths of 100 m. Sensors include pressure, temperature and salinity, and the CTD is equipped with a GPS. We will perform casts around the atoll (east, west, north and south) and at multiple locations down to ~ 100 m.

2) Water sampling: With each CTD cast, we will also lower a 2.5 L niskin by hand. The niskin will be tripped at 1 m, and 5 m at select locations. From each 2.5 L cast we will collect water samples for dissolved inorganic nutrients (60 ml), total alkalinity and dissolved inorganic carbon (500 ml) and chl *a* (120 ml).

3) Coral tissue: Coral fragment samples will be collected near the locations that alga samples are collected. Those locations are TBD. We will collect several species of scleractinian corals, with the majority being *Pocillopora* if available since these are known to exhibit heterotrophic feeding. Coral fragments will be 2-3 cm^2 in size and collected from the upper portion of the coral using hammer and chisel. Fragments will be placed in whirl paks with seawater, and on ice until the boat returns to the wetlab on the ship.

4) Sample processing:

TA/DIC- Immediately after water collection into bottles, samples are preserved with 100 µl mercuric chloride to prevent further biological processes. The cap is sealed with Apeizon grease to prevent air-sea gas exchange.
Chl *a*- Filter 120 ml seawater using 10% HCl pre-rinsed syringe and combusted 25 mm GFF filters (pore size 0.2 or 0.7). Wrap filters in foil and store on ice until they can be frozen on the ship at -20°C.
Nutrients- Stored on ice until they can be frozen on the ship at -20°C
Coral tissue- Once on the ship, coral fragments will be airbrushed to remove tissue and stored in Falcon tubes in a -80°C freezer.

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):

Common name:
Scleractinian corals

Scientific name:
e.g., *Pocillopora* and *Montipora*

& size of specimens:
Small fragments (2-3 cm^2) with no more than 60 collected at PHR and no more than 30 at other locations.

Collection location:
PHR primarily, but other locations may include Nihoa, Necker, FFS, Garner, Lis, Laysan, Midway, Maro, Kure

☐ Whole Organism ☒ Partial Organism

9b. What will be done with the specimens after the project has ended?
Upon completion of analysis, coral skeletons may be returned to PMNM under the guidnce of the cultural working group. Coral fragments may also be made available to other scientists upon approval from PMNM .

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

• General site/location for collections:
PHA, potentially other island/atolls listed

• Is it an open or closed system? ☐ Open ☐ Closed
na

• Is there an outfall? ☐ Yes ☐ No
na

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

• Will organisms be released?
na

10. If applicable, how will the collected samples or specimens be transported out of the Monument?
All samples will be transported back to Honolulu on the marine vessel, then will be shipped back to UH Maui College, Texas A&M University, or delivered to UH Manoa for analysis.

11. Describe collaborative activities to share samples, reduce duplicative sampling, or duplicative research:
The results of this analysis will be made publically available, and provided to PMNM. Additionally, we are collaborating with NOAA partners to learn about sites that have been sampled in the past, which will help to inform sampling in this work and minimize duplicate locations. We are collaborating with Dr. Chris Wall to analyze his coral tissue samples from PMNM, which were collected in 2015. These samples will minimize collection at atolls other than PHR, and will also provide a baseline of isotopic data from coral tissues prior to the i*C* outbreak.

12a. List all specialized gear and materials to be used in this activity:
SCUBA gear for coral tissue collection
Castaway handheld CTD
Niskin (2.5 L)
YSI Proplus multiparameter sonde

12b. List all Hazardous Materials you propose to take to and use within the Monument:
2- 5 mls of mercuric chloride to preserve carbonate chemistry samples

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

14. Provide a time line for sample analysis, data analysis, write-up and publication of information:
Sample and data analyses, and write-up/publication will be completed within 2 yrs of sample collection

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

Kealoha AK, Shamberger KEF, DiMarco S, Thyng K, Hetland R, Manzello DP, Slowey N, Enochs I. (2020) Surface water CO_2 variability in the Gulf of Mexico (1996-2017). *Scientific Reports.* 10(12279): doi.org/10.1038/s41598-020-68924-0

Doo SS, **Kealoha AK**, Andersson A, Cohen A, Hicks TL, Johnson ZI, Long MH, McElhany P, Mollica N, Shamberger KEF, Silbiger N, Takeshita Y, Busch DS. (2020) The challenges of detecting and attributing ocean acidification impacts on marine ecosystems. *Frontiers in Marine Science.* https://doi.org/10.1093/icesjms/fsaa094

Kealoha AK, Doyle SM, Shamberger KEF, Sylvan JB, Hetland RD, DiMarco SF (2019) Localized hypoxia may have caused coral reef mortality at the Flower Garden Banks. *Coral Reefs.* 39(1):119-132

Kealoha AK, Shamberger KEF, Reid EC, Davis KA, Lentz SJ, Brainard RE, Oliver TA, Rappe MS, Roark EB, Rii YM (2019) Heterotrophy of oceanic particulate organic matter elevates net ecosystem calcification. *Geophysical Research Letters.* 46(16): doi.org/10.1029/2019GL083726

Kealoha AK, Mackenzie FT, Kosaki RK, Alin SR, Winn CD (2017) Carbon system dynamics of a pristine coral reef ecosystem: French Frigate Shoals. *Aquatic Geochemistry.* 23:75-88

Kealoha AK, Kahng SE, Mackenzie FT, Alin SR, Kosaki RK, Brainard RE, Winn CD (2015) Latitudinal trends and drivers in the CO_2-carbonic acid system of Papahānaumokuākea Marine National Monument. *Aquatic Geochemistry.* 21:535-553

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 2/1/21

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