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: Amy Baco-Taylor
Affiliation: Florida State University

Permit Category: Research
Proposed Activity Dates: 08/31/2019-09/21/2019
Proposed Method of Entry (Vessel/Plane): Vessel – RV Falkor
Proposed Locations: Necker Ridge, Pioneer Bank, Ridge East of French Frigate Shoals, Twin Banks, Seamounts outside the Monument in the Mid-Pacific Mountains

Estimated number of individuals (including Applicant) to be covered under this permit: 38

Estimated number of days in the Monument: 18

Description of proposed activities: (complete these sentences):

a.) The proposed activity would…

The deep slopes and seamounts of the Northwestern Hawaiian Islands (NWHI), an area dominated by deep-sea octocorals, are the nearest marine reserve to the largely unexplored central and western Pacific (CWP) seamounts targeted for cobalt-rich manganese crust mining. A preliminary survey of the primary feature connecting these regions, Necker Ridge in 2011, revealed patchy communities of benthic megafauna, with crinoids dominating the southern end and octocorals the north (Morgan et al 2015). This difference may be due to environmental parameters or differences in larval supply, i.e. a dominance of crinoids on CWP seamounts. The **goals of our project are twofold, to gain insight into CWP seamount fauna and to test the role of Necker Ridge as a stepping-stone.**

b.) To accomplish this activity we would ….

Through a ship time award from the Schmidt Oceans Foundation using the RV Falkor and the ROV Subastian, we will conduct quantitative image transects and sample benthic megafauna on Necker Ridge and proximate features of the NWHI and the CWP. We will assess the fauna of 3 sets of features – 3 seamounts of the NWHI, the Necker Ridge, and 3 seamounts of the Mid Pacific Mountains (MPM), the most proximal part of the CWP seamounts to Necker. Targeted MPM features will include Horizon Guyot and 2 unnamed seamounts that fall within the same depth range as Necker. All features will be surveyed using replicate transects at the same depths on each feature, targeting hard substrate areas. Voucher specimens of the dominant benthic megafauna will be collected from each feature to aid in identification of the organisms observed in the videos. As a part of these surveys, we will also collect environmental data including CTD, water samples, and oxygen and derive substrate parameters such as substrate type, slope and rugosity from the ROV video. Data will include species abundances, environmental data, current data, DNA sequences, and multibeam; deposited in repositories and summarized in publications. In addition to K-12 and public outreach efforts, university students will derive thesis research from this project.

c.) This activity would help the Monument by …

This research is highly societally relevant as it will inform management for high seas mining areas in the CWP by testing for connectivity to the protected NWHI. It will also provide further information on the deep-sea benthic communities of the PMNM on each of the targeted features as well as quantify changes in aragonite, calcite saturation horizons associated with ocean acidification on these features.

Other information or background:

Section A - Applicant Information

1. Applicant

Name (last, first, middle initial): Baco-Taylor, Amy R

Title: Associate Professor

1a. Intended field Principal Investigator (See instructions for more information):
Amy Baco-Taylor or Brendan Roark

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

[redacted]

Fax:

[redacted]

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

3. Affiliation (institution/agency/organization directly related to the proposed project):
Florida State University

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):
Brendan Roark, Co-PI, Texas A&M University, [redacted]
Nicole Morgan, Student, Florida State University, [redacted]
Baco Lab Student 2 TBD
Baco Lab Student 3 TBD
Roark Lab Student 1 TBD
Roark Lab Student 2 TBD
SOI student at sea TBD
SOI artist at sea TBD
SOI Falkor crew - 29 individuals, see attached.

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
☒ 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:
Necker Ridge, Pioneer Bank, Ridge East of French Frigate Shoals, Twin Banks, Seamounts outside the Monument in the Mid-Pacific Mountains

All locations are <u>outside</u> of State waters

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:*

While our previous survey of Necker Ridge gave us a first-order idea of the fauna of the feature, it did not allow us to fully test whether Necker is a stepping stone, because we only surveyed a small depth range and we do not have samples from the CWP seamounts. Thus the goals of the current project are**, 1) To test the role of Necker Ridge as a stepping-stone and 2) To begin to gain a picture of the CWP seamount fauna.** To accomplish this, we will assess the fauna of 3 sets of features – 3 seamounts of the NWHI, the Necker Ridge, and 3 seamounts of the MPM, the most proximal part of the CWP seamounts to Necker. The specific questions that will be addressed are:

Question 1. Community Structure - How does the species composition, abundance, and diversity of benthic megafauna compare between the seamounts of the three sets of features? Examining the community structure on each of the 3 groups of features using quantitative video transects will be the key to addressing both of our goals. If the fauna of the MPM are significantly different from the fauna of the NWHI, as may be the case given our observations on Necker, then we can reject the Necker stepping stone hypothesis. If on the other hand Necker is acting as a stepping stone, we would instead expect a high degree of species overlap, with very similar communities at a given depth range on Necker, the NWHI seamounts and MPM seamounts.

Question 2. Environment - Can differences in community structure between sites be explained by environmental parameters? If so, which parameters seem to be the most important? We will collect environmental data as part of the video surveys using instruments on the ROV and through CTD casts, water sampling. Important environmental variables we will focus on include temperature, salinity, total alkalinity, substrate types, O_2, nutrient concentrations, and currents. The shallower depth of aragonite saturation in the Pacific (< 600 m) compared with the North Atlantic (> 2000 m) has been suggested as a factor limiting deep-sea scleractinian coral distribution and abundance in the Pacific (Guinotte et al., 2006; Koslow 2007), but little empirical data exists on saturation state relative to deep-sea coral distributions in most parts of the Pacific. In addition the depth of aragonite saturation is shoaling in the Pacific as a result of ocean acidification, potentially further limiting where DSC can grow (Guinotte et al 2006, Thiagarajan et al., 2013). The lower dissolved oxygen in the deep Pacific (Smith and Demopoulos 2003) compared with the Atlantic may further limit DSC abundance and distributions (Davies and Guinotte 2011). Collectively, multiple environmental factors including aragonite/calcite saturation levels, O_2, and surface ocean productivity are likely controls on DSC and other seamount species distributions. Using multivariate statistics, we will incorporate all of the measured environmental parameters to assess which of the parameters are most strongly correlated to the observed community structure on the studied features. The environmental characterization will also contribute to developing paleo proxies for climate reconstruction. More specifically we are interested in developing boron isotopes ($\delta^{11}B$) as a proxy for changes in ocean pH in DSC corals with carbonate skeletons and compound specific carbon and nitrogen isotopes as proxies for nutrient and food web changes in proteinaceous DSC.

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

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

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?

Most of our multibeam efforts will be limited to areas outside the monument as good bathymetry already exists for most of our PMNM sites. While we do not anticipate the multibeam activities will impact marine species in the area, in the case that we need to multibeam within the Monument, we will follow standard mitigation techniques including using a "soft start" or "ramp up" to the maximum noise output of the multibeam (Barlow and Gisner 2006). The main hypothesis with stranding related to anthropogenic noise is that animals will be startled by the noise and swim to the surface too rapidly and thereby experience barotrauma. A slow start up will provide a warning for these species, if present. We will also scan the area for marine mammals before starting the system and wait until any that might be present have left the area before starting the multibeam system. Finally, we are able to host a NOAA observer(s) if the monument chooses to provide one.

The ROV SuBastian does not usually release weights as a part of its operations as it drives down to the seafloor rather than relying on a weight to pull it down. Since we are primarily collecting corals, sponges and crinoids, which are farily light-weight, we do not anticipate a situation where any weights would need to be dropped.

We will also be collecting deep-sea corals at each of the seamounts as outlined in Question 9. We are taking several measures to minimize our impacts to the deep-sea coral communities in the Monument. 1. All samples collected for genetics will be taken as a small subsample of the colony, leaving the remaining colony intact on the seafloor, as in our previous work in the Monument. On each dive we will collect a 1- 4 individuals of each species present, taking species which are representative of the area being observed. We are targeting deeper depth ranges than the occurrence of most precious corals, but some species of Hemicorallium do occur in deeper water. When Hemicorallium is present, we will ideally collect ~25-50 specimens across a range of size classes (small, medium, large), where there are sufficient individuals to do so. Only corals collected for aging and paleo environmental reconstructions will be collected whole. We will follow a similar sampling plan for any abudant sponge species and other large benthic megafauna such as crinoids, which we anticipate will be abundant at some sites.

We will do everything to minimize the number of samples collected within the Monument. We will use our current collection of deep-sea corals as a guide to what samples to collect whole for aging and paleo environmental reconstructions where we only will collect live specimens from locations and depths (in 200 m bins) where we have not already collected live specimens within the monument. At sites within the monument a maximum of 3 whole live samples per species per dive with a maximum number of 6 whole live samples per coralliid and Isididae (bamboo) species per site and a maximum of 20 whole live samples per corallid and Isididae (bamboo) species collected within the monument. A maximum of 2 whole live samples of other species per site would will be collected with a maximum of 10 whole live samples of other species collected within the monument. A maximum of 4 whole live gold or deep-water black corals would be collected from the monument given these species extreme longivity. In our experince it is rare to find to find these long lived species in suffcient quantities so in practice it is rare to collect more than 1 or 2 live specimens. Again samples will only be taken from communities that are sufficiently large (more than 5 individuals within the area). These samples are important to calibrating our paleo-proxies using the collectedwater coumn chemistry and CTD work.

2. We will take as many of our sample for genetics as possible from the colonies collected for aging, to reduce the number of total colonies impacted by our project.

3. We will only take samples from areas where there are more than 5 individuals of a species living in the area. Sampling individuals from a large population will have less of an impact than sampling individuals from less dense populations.

4. Where at all possible we will collect dead deep-sea corals for aging and paleo-environmental reconstructions (remaining skeletons that have already fallen over) in lieu of live collected samples. These samples can be utilized for some of the coralliid sclerochronology work and for the paleoceanographic work (For more detail see question 9) and will result in minimal impact on monument resouces.

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 have designed our sampling efforts to have as minimal impact as possible while still obtaining the data needed to address the question of connectivity among sites. Although this requires sampling of deep-sea corals, sponges and other megafauna, we anticipate that ultimately this work will enhance the Monument because it will provide greater knowledge of the deep-sea community that falls within the Monument's waters, as well as potentially providing evidence as to whether the protection provided by the Monument has any potential to help with management of adjacent high seas areas targeted for cobalt-rich manganese crust mining.

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.
Since the goal is to compare the species composition of benthic fauna on seamounts outside the monument to sites within the Monument, to determine if the Monument has the potential to act as a refuge for targeted high seas sites, there is not an alternative location that we can sample.

d. How does the end value of the activity outweigh its adverse impacts on Monument cultural, natural and historic resources, qualities, and ecological integrity?
We have designed our sampling efforts to have as minimal impact as possible while still obtaining the data needed to address our two scientific goals of gaining insight into CWP seamounts and to test role of Necker Ridge as a stepping stone. This specific work will contribute to the Monument's understanding as well as to the broader scientific, conservation and management communities' understanding of the fauna of cobalt-rich crust seamounts in the targeted mining area, as well as connectivity of the highs seas areas to the PMNM, promoting efficient stewardship of the high seas and island/seamount communities. This increased knowledge will directly help in the conservation and management of not only the PMNM, but other monuments, sanctuaries and ocean resources.

In addition we are making every effort to maximize the utility the samples and data we collect to address research questions beyond our immediate project. For example, we are utilizing both the water samples and most importantly the coral samples collected to address additional questions related to the impacts and consequences of anthropogenic climate change. Examples of these efforts include the total alkalinity water measurements that will help evaluate the impacts of increasing anthropogenic CO_2 and ocean acidification on coral communities within the monument. Every effort is made to fully utilize each sample taken to its maximum benefit as evidence by the paleoceanographic and paleoclimate work and the histology and life cycle work that will be done on the samples collected by the PIs as well as a broader group of researchers and collaborators.

Our previous work demonstrates the value of our comprehensive approach when, despite expectations that deep-sea scleractinian reefs could not exist under the harsh carbonate chemistry conditions of the N Pacific, reefs were recently discovered in the Northwestern Hawaiian Islands (NWHI) and the Emperor Seamount Chain (ESC), with 4 of 7 sites in waters undersaturated with respect to aragonite (aragonite saturation state (Ω_{ar}) range 0.71–1.33) (Baco et al., 2017). These results highlight our ability to make new discoveries within the monument and to put those discoveries into a broader environmental change context. This kind of interdisciplinary work that combines research and exploration in equal parts to define and highlight PMNM natural resources, their qualities, and their ecological importance. It also demonstrates the importance of the PMNM to the surrounding ecosystems

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

The locations of our study sites require extensive transit from Honolulu and between sites. Additionally, both multibeam mapping and ROV video collections require extended time periods to provide high quality data. The duration of the cruise and time at each site is determined by the ship time awarded, not the purpose of the research, which takes longer than one cruise to accomplish because of the vast area of study. To optimize this valuable time on station, data from previous cruises to Necker ridge and other areas of the PMNM have been used to refine the science station locations.

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

Baco-Taylor and Roark have extensive field experience including 20+ years each of work with a variety of submersibles, ROVs and the AUV Sentry. Participating in numerous cruises and serving as Chief Scientist on several occasions, they have collectively led nearly 200 submersible dives, 50+ ROV dives, and 25+ Sentry dives working in deep-sea ecosystems off Hawaii, Alaska, New Zealand, Antarctica, the Bahamas, the Gulf of Mexico, California, and the US East Coast.

Baco-Taylor’s research has largely focused on Hawaiian seamounts and dep-sea coral communities, including extensive explorations and studies of population genomics, ecology, species distributions, reproductive ecology and anthropogenic impacts. Roark has been responsible for all the radiocarbon dating of precious corals in the Hawaiian Islands that has illustrated their extreme longevity (Roark et al., 2009, 2011, Roark and Parrish 2009, Houlbreque et al. 2010) and has done extensive proxy development work in DSC from the Pacific, Atlantic and Gulf of Mexico. Thus, both PIs have the required experience in the field, the lab, and in data analyses to make the proposed project a success. Please see the attached CV's for additional details.

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 ship-time grant from the Schmidt Ocean Institute to Baco-Taylor and Roark. We will be seeking additional funding for the post-cruise work from NSF.

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 plan to use on this cruise are identical to those we have used previously throughout the NWHI and other geographic locations. Both PIs have been working with deep-sea corals for most of their careers (almost 20 years each) and have well-honed sampling approaches intentionally designed to minimize the impact to these long-lived, slow growing coral communities by taking the smallest number of samples and smallest size of samples necessary to address the questions at hand. For population genetics, the publication standard is ideally at least 30 individuals per population (e.g. Hale et al 2012). For the paleo-environmental reconstruction we are doing extensive amounts of work to characterize the modern water column chemistry in order to better calibrate the paleo-proxies using the smallest number of live collected specimens to demonstrate proxy reproducibilities. Very few other groups, if any, put the same emphasis on this aspect of paleo-reconstructions but we understand the value of the specimens and we will do everything to ensure the maximum return on the collections.

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

It is the applicants' understanding that the R.V. Falkor has a VMS as it has previously conducting mapping work in the PMNM.

j. Demonstrate that there are no other factors that would make the issuance of a permit for the activity inappropriate.
We are not aware of any other factors that need to be considered.

8. Procedures/Methods:

Discharge (question 5b): While in the Monument the FALKOR will only have discharges incidental to vessel use such as deck wash, approved marine sanitation device effluent (for sewage and gray water), cooling water, and vessel engine exhaust. All sewage and gray water discharges pass through the approved marine sanitation device. While the FALKOR is within the Monument's Special Preservation Areas and the Midway Atoll Special Management Area the FALKOR will only discharge engine cooling water, weather deck runoff, and vessel engine exhaust. The FALKOR will not discharge sewage and gray water. There is sufficient reserve tank capacity to temporarily store sewage and gray water during the periods when FALKOR is operating within the Monument's Special Preservation Areas and the Midway Atoll Special Management Area.

Methods

Target Sites - The targeted features of interest are listed in Table 1. As outlined in the previous sections, to test for connectivity of the CWP seamounts to the NWHI via Necker Ridge, we will survey 3 features in each of the NWHI and the MPM, as well as 2 sites on Necker Ridge. In choosing sites, consideration was given to the site's proximity to Necker Ridge, depth range, and transit times. We specifically target sites with ridge features on them to assure sampling in similar habitats with regards to sediment and slope. Almost all of the previous sampling of the NWHI has occurred at depths <2000m (the max operating depth of the Pisces submersibles) with most of the samples have been collected at depths <600m, thus we also include sites in the NWHI to assure that we have transects at the same depths on all features to ensure comparable habitats are being studied.

Table 1. Target Features. Geographic positions and approximate depths for the Mid-Pacific Mountains sites derived from earthref.org seamount bathymetry database. MPM site selection may be modified pending multibeam mapping. FFS – French Frigate Shoals. The prioritization of sites will be 1. MPM sites, 2. Deeper depths on the Necker Ridge, and 3. Remaining sites and depths.

Region	Site	Lat N	Long W	Summit Depth
NWHI	Pioneer Bank – S slope ridge	25° 44.49'	173° 26.34'	~400m
NWHI	East FFS – Eastern slope ridge	23° 47.04'	165° 39.42'	~400m
NWHI	Twin Banks - S slope ridge	23° 6.59'	163° 8.96'	~400m
Necker	Necker Ridge	21-24°	164-168°	~1400m
MPM	Horizon Guyot	19° 16.8'	169° 1.2'	~1300m
MPM	MPM3 - unnamed, shallowest seamount close to Necker Ridge	20° 7.8'	170° 36.6'	~1000m
MPM	MPM5 - unnamed	20° 40.8'	170° 41.4'	~1400m

Cruise Plan Overview - To survey these features, we use the ROV SuBastion and RV Falkor. We will use multibeam mapping on the MPM sites and available multibeam data for the remaining sites, to target dive operations to areas with a high probability of harboring deep-sea coral or crinoid communities.

To ensure we are sampling similar habitat types, we will target the same depth range on all features. The minimum depth on Necker Ridge is about 1400m, so we will use that as our shallowest target depth, with survey intervals down to at least 3000m. Transects will be of equal length, along contours, and conducted at the same 4-5 depths on each site. Working within the constraint of 21 days of ship time, and an allowance for time for weather, and transit between stations, we can spend

~36 hours at each seamount feature on each leg. We may sacrifice some of the NWHI sites to allow for more time for mapping the MPM sites.

XBTs - We will use XBTs for multibeam and USBL support. One XBT will be deployed per day of multibeam and ROV operations for a maximum of 25 for the cruise. I've added the text below into procedures and methods section. I don't know the specific brand of XBT they are using so we'd have to get that info from the Falko.

Multibeam and Backscatter - The lack of detailed bathymetric data in the MPM requires multibeam surveys for effective dive planning and safe operation of the ROV. In addition the multibeam data are important to characterizing the habitat (e.g. bottom hardness and slope) and are a part of the environmental data analyses.

As detailed above most of our multibeam efforts will be limited to areas outside the monument as good bathymetry already exists for most of our PMNM sites. While we do not anticipate the multibeam activities will impact marine species in the area, in the case that we need to multibeam within the Monument, we will follow standard mitigation techniques including using a "soft start" or "ramp up" to the maximum noise output of the multibeam (Barlow and Gisner 2006). The main hypothesis with stranding related to anthropogenic noise is that animals will be startled by the noise and swim to the surface too rapidly and thereby experience barotrauma. A slow start up will provide a warning for these species, if present. We will also scan the area for marine mammals before starting the system and wait until any that might be present have left the area before starting the multibeam system. Finally, we are able to host a NOAA observer(s) if the monument chooses to provide one.

RV Falkor multibeam system overview

RV Falkor is equipped with Kongsberg Maritime (KM) EM302 and EM710 multibeam echosounders (MBES). The EM302 is a 30 kHz MBES capable of full ocean depth mapping though it is most optimally used in depths from 1,500 to 3,000 m. The EM302 system is available in a number of transmit/receiver configurations; the system aboard Falkor provides 1°x1° angular resolution, yielding seafloor sounding resolution on the order of 1.7% of oblique range. Though the system is nominally 30 kHz, the full frequency range is 26.5-33.6 kHz.

The EM710 frequency range spans 73-97 kHz; the system aboard RV Falkor is capable of 0.5°x1.0° transmit and receiver angular resolution, respectively. The EM710 system is well suited for continental shelf mapping with maximum coverage being achieved at depths typically between 500 --1,000 m. Maximum depth performance is typically less then 2,000 m. Both systems allow for seafloor mapping over a swath of 140°, giving a roll stabilized coverage up to 5.5 multiples of water depth (5.5 x w.d.). The systems are capable of multiple sector transmission, allowing for pitch/yaw motion stabilization and also multi ping capabilities. The latter functionality doubles the along track sounding density and permits surveying at higher speeds without loss of data density.

For further details on multibeam, please see attached more detailed document provided by SOI.

ROV – The ROV has forward-looking HD cameras, which allow the arborescent, nearly 2-dimensional sea-fan-like octocorals, antipatharians, zoanthids, and scleractinians that occur in this region (e.g. Baco 2007) to be visualized and better identified. We will target the ROV surveys to areas with high relief and hard substrate, to increase the probability of finding high density suspension feeding megafaunal communities such as corals, sponges and crinoids.

The goal of the ROV video transects will be to obtain data on megafaunal species identifications (with collected specimens as vouchers), distributions, and to quantify abundance and diversity. We will conduct equal-length, replicate transects along contours, at a minimum of 4-5 depths, using the same depths on each feature. During transects, the HD video camera will be in a fixed position and zoom, with lasers in the field of view.

The goal of sampling with the ROV will be to obtain vouchers specimens for validation of identifications of the most abundant megafaunal taxa observed in the video. For each collected specimen we will record location and depth, determine the size *in situ* and acquire still and video imagery to the finest possible detail, e.g. to polyp level for corals to aid in identifications. All collected samples will be preserved for genetic as well as morphologic study as outlined below. The PI has conducted the same type of sampling of benthic megafauna for genetics (e.g. Baco and Shank 2005, Baco et al 2006, Baco and Cairns 2012) using submersibles and the ROV Jason II. In a high-density coral area, as many as 45 coral subsamples can be collected in ~7 hrs. of bottom time.

For paleoceanographic studies, a small number of whole deep-sea coral specimens will also be collected. Once shipboard, tissue samples are taking prior to cleaning and drying of the DSC skeletons following standard procedures (e.g. Roark et al., 2006). (see Section 3g Collaborative).

CTD and Water sampling - At least one CTD cast (additional sensors dissolved oxygen, pH, fluorometer, turbidity, and PAR) will be made at each site with bottle samples taken at standard depths to fully characterize the entire water column. Water samples for nutrients (50 ml), radiocarbon for characterizing water masses and for paleo-ventilation work and total alkalinity (250 ml each) to characterize the carbonate saturation state will be taken following standard protocols and analyzed at Texas A&M. The remaining water from each 10 L niskin will be filtered for POM.

Laboratory Sample Processing

i. ROV Video Transects - Imaging transects will be processed to derive data to address **Question 1**. During video analysis, all taxa will be identified to lowest possible unit, referencing collected voucher specimens for identification (next section). Because the corals and other megafauna in this region generally occur as discreet upright units, rather than expansive colonial forms, we will do our enumeration as counts of individuals or individual colonies, rather than using a percent cover or point count method. Previous experience has shown that this method works well for the abundances typically found on Hawaiian seamounts (Long and Baco 2014, Morgan et al 2015). Substrate parameters including substrate type, rugosity, etc. will also be quantified from transects using a random point count method in ImageJ (NIH).

Community patterns for megafauna data derived from the image analyses will be analyzed using statistical approaches similar to those used previously in the Baco-Taylor lab (e.g. Baco-Taylor 2002, Clark et al. 2011, Long and Baco 2014, Morgan et al 2015). Data from each video transect will be used for community-level multivariate analyses in the statistical package PRIMER (Primer-E Ltd.) with the add-on package PERMANOVA. Abundance data will be square root transformed and then Bray-Curtis similarity matrices will be computed (Clarke and Gorey 2006) prior to running multivariate analyses. Multivariate statistical routines (MDS, CLUSTER, SIMPER) will be used to identify and describe communities found on each transect and to compare between transects and between seamounts. Univariate measures will also be calculated and similarly tested, including standard diversity indices, abundance, density, etc. (Warwick and Clarke 1998, 2001).

Transects and environmental data from the ROV will be used to address **Question 2.** Geographic location, depth of sampling, substrate parameters, water chemistry, distance between sites, CTD and oxygen, and other environmental parameters will be included in a DISTLM analysis (Anderson et al. 2008), after controlling for correlated variables using draftsmen plots, to build a model of the parameters most strongly correlated to community structure on these features (e.g. as in O'Hara et al. 2010, Long and Baco 2014, Morgan et al 2015).

ii. Morphological and Genetic Identification of Collected Specimens - Specimen identifications will be used to aid in addressing **Question 1**. In addition to simply giving names to species observed in the video, a more critical issue for evaluating our hypothesis is whether the specimens at each location are the same species. To identify specimens and to verify that specimens are in fact the same species, we will use a combination of both morphological and molecular techniques.

Morphological - Collected voucher specimens will be given nominal IDs onboard ship and then transferred to expert taxonomists for further morphological identifications. Based on previous sampling we anticipate octocorals, sponges and crinoids will be the dominant taxa. Dr. Stephen Cairns, Curator of Cnidarians at the Smithsonian Institution will be the key taxonomist for coral identifications. Les Watling of the University of Hawaii is a specialist in Chrysogorgiid and Isidid octocorals and will assist with these families, which are the dominant families on Necker Ridge. Henry Reiswig of the Royal British Columbia Museum is the leading expert on deep-sea sponges, has been working on revising the taxonomy of the Hawaiian Ridge deep-sea sponge fauna and will identify the sponges we collect. Charles Messing of Nova Southeastern University is a world expert on crinoids and will assist with crinoid identifications. Should other taxa be abundant, they will also be sampled and the appropriate morphological taxonomic experts will be contacted.

Genetic Specimen Identifications – Pending further funding, We will use DNA barcoding methods on all collected specimens to verify that putative morphological species found at more than one site are really the same species (e.g. as in Baco et al. 1999). Barcoding methods are widely in use by marine ecologists and are recently being applied to deep-sea species (e.g. Smith et al. 2004, Thoma et al. 2009, van der Haam et al. 2009, McFadden et al. 2011, Baco and Cairns 2012). Rather than replacing morphological taxonomy, barcoding provides a strong tool to provide clearer taxonomic lines particularly in difficult octocoral groups (e.g. McFadden et al. 2006, 2009, 2011, Baco and Cairns 2012).
DNA will be extracted from all specimens using Qiagen DNeasy kits. Genes will be amplified using standard polymerase chain reaction (PCR) and sequencing protocols (Hillis et al., 1996; Palumbi, 1996). For octocorals we will use 3 mitochondrial (mt) gene regions; the barcoding region of COI and adjacent intergenic spacer (amplified together using 1 primer pair) in combination with the MutS gene, and ND2 (McFadden et al. 2011, Baco and Cairns 2012). For both sponges and crinoids the mitochondrial COI gene is used (Ward et al 2008, Eleaume et al 2011, Vargas et al 2012). Sequencing will be run at Florida State University. Sequences will be cleaned and aligned using Sequencher software. Comparisons to identify haplotypes will be completed using Sequencher and uncorrected p-distances in PAUP (with any pairwise distance value >0 considered different haplotypes). Identity of species across sites will be based on comparison of haplotypes across sites in the same manner. We define haplotypes within each marker as sequences having at least 1 nucleotide difference or a gap difference from all other haplotypes for that marker.

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:
Octocorals
Scleractinian Corals
Black Corals
Other corals and sponges as observed
Crinoids

Scientific name:
Hemicorallium (formerly Corallium) spp.
Isididae
Octocorallia
Possibly Solenosmilia sp or Dendrophyllia sp
Antipatharians
Crinoidea

& size of specimens:
- For morphological and genetics collections, small fragment from 1-4 individuals of each of the abundant species in a given dive. If Hemicorallium sp are observed we will collect 10-50 individuals to add to ongoing population genomic studies of the Coralliidae family. No more than 90 individuals of Coralliidae per each location below. Likely <10 individuals of any other species observed per seamount.

For age and growth rates and paleo-environemental study, collections will be made across a relative range of sizes, small, medium, large for each species (e.g. relative sizes are different for each species) from sites within the monument. We will primarily focus on medium size samples, as small sample have more limited utility for our work and larger samples are older and likely more important to coral reproduction Taking Hemicorallium laauense and Pleurocorallium secundum samples as an example the following heights would be representative of small (<10 cm), medium (10-20 cm), and large (> 20 cm height) samples.

- Maximum 16 whole live individuals each of Hemicorallium spp and Pleurocorallium secundum.
- Maximum 16 whole live Isididae samples
- Maximum 6 whole live Kulumanamana haumeeae (formerly Gerardia sp).
- Maximum 16 whole live colonial scleractinian.
- Maximum 16 whole live miscelaneous other corals

For Leiopathes no more than 1 live whole samples per each location below.
For other corals and sponges - no more than 3-5 whole individuals per species per dive
For dead samples (deep-sea coral skeletons that have already fallen over) no more than 25 individuals each of Hemicorallium Laauense and Pleurocorallium secundum taken from within the monument. No more than 16 individuals each of the Kulumanamana haumeeae (formerly Gerardia sp)., colonial scleractinian, Isididae, and miscelaneous other corals taken from within the monument.

Collection location:
Necker Ridge North end
Necker Ridge South end
Twin Banks

Ridge East of French Frigate Shoals
Pioneer Bank
Sites outside the Monument in the Mid Pacific Mountains

☒ Whole Organism ☒ Partial Organism

9b. What will be done with the specimens after the project has ended?
Samples will remain archived in the PI labs at Florida State University and Texas A&M University or Smithsonian indefinitely for future use as outlined in #10 below

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

• General site/location for collections:
na

• 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 onbaord the Falkor to Honolulu, where they will be shipped to Florida State University or Texas A&M University. Water samples will be housed in the laboratory of Dr. Brendan Roark at Texas A&M University where most of the water sample analyses will be conducted. The one exception is the radiocarbon water samples which will be analyzed at the Center for Accelerator Masspectrometry Lawrense Livermore National Laboratory with unused material being returned to Texas A&M University. Coral samples collected for aging and paleo-environemental studies will be dried and archived in the laboratory of Dr. Roark in the Geography Department at Texas A&M University. Each sample is curated with individual accession numbers and appropriate metadata to facililate sharing samples with other researchers. Currently more that 100 deep-sea coral specimens from around the world are archived in the laboratory. Excess material not needed for geochemical, age and growth rate studies are made available for others researchers to utilize and incorporate into their research.

For radiocarbon water samples CO2 will be extracted from water samples at Texas A&M University (TAMU), and taken to the Center for Accelerator Masspectrometry Lawrense Livermore National Laboratory (CAMS-LLNL) to be processed for AMS 14C dating by B Roark or one of his graduate students. For age dating corals, 5-10 mg samples will be milled at TAMU from the deep-coral specimens and the resulting powder will processed for AMS 14C dating by B Roark or one of his graduate students. This work is done under a long standing (~20 years) collaboration between B. Roark and Tom Guilderson at CAMS-LLNL. For the remaining geochemistry B. Roark is the director of the Stable Isotope Geosciences facilty which is capable of doing all the stable isotope measurements and he is a PI in the Ken Williams Radiogenic Facility which is capable of doing all the trace elements analyses.
Coral samples for genetics will be housed in the laboratory of Dr. Baco-Taylor at FSU and will be stored at -80 C or in ethanol. After subsampling at sea, larger specimens not used for aging, after subsampling for genetics, will be shipped directly to the Smithsonian Natural History Museum when we reach port, to be added to their invertebrates collection archive.

Baco-Taylor Lab:
[redacted]

Roark Lab:
[redacted]

Center for Accelerator Masspectrometry Lawrense Livermore National Laboratory:
Tom Guilderson
[redacted]

Smithsonian Institution:
Stephen D. Cairns
[redacted]

[redacted]

11. Describe collaborative activities to share samples, reduce duplicative sampling, or duplicative research:
This is a collaborative effort between 2 scientists A. Baco-Taylor and B. Roark, who have previously worked together in the Hawaiian Archipelago. They are sharing this project and associated specimens to prevent duplication of effort and duplication of sampling. A. Baco-Taylor is also incorporating previously collected samples and data from the NWHI and Necker into the analyses to minimize sampling effort. Roark is utilizing data and samples collected in the NWHI and Hawaiian Islands during previous projects to avoid having to collect additional samples to bolster this study

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

12b. List all Hazardous Materials you propose to take to and use within the Monument:
2-5 ml mercuric chloride to poison water samples
95-100% non-denatured ethanol
10% buffered foramlin
Borax
RNA Later

13. Describe any fixed installations and instrumentation proposed to be set in the Monument:
None

14. Provide a time line for sample analysis, data analysis, write-up and publication of information:
2-3yrs
We anticipate at least 3 publications developing from this project. There will also be presentations at scientific meetings to present these findings. We would be happy to work with the Monument if specific outreach products are desired related to the findings of the cruise.
Time line for aging studies and geochemistry analyses of water samples is that 80% of the analytical work will be completed in the year after the cruise. In year 2 the remaining 20% of the analytical work will be completed and the results of the aging study incorporated into the genetics and coral survey work.

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

Baco, A.R., *N.B. Morgan, and E. B Roark. Observations of Vulnerable Marine Ecosystems and Significant Adverse Impacts on High Seas Seamounts of the Northwestern Hawaiian Ridge and Emperor Seamount Chain. Submitted 04/2019 to Marine Policy.

Baco, A.R., E. B Roark, *N.B. Morgan. Amid Fields of Rubble, Scars, and Lost Gear, Signs of Recovery Observed on Seamounts on 30-40 year Time Scales. Submitted 1/2019 to Science Advances. In Review.

*Morgan, N.B. and A.R. Baco. Observation of a High Abundance Aggregation of the Deep-sea Urchin Chaetodiadema pallidum (Agassiz and Clark 1907) on Mokumanamana. Submitted 12/2018 to Deep-Sea Research I. In review.

*Mejia-Mercado, B., B. Mundy and A.R. Baco. Variation in the structure of the deep-sea fish assemblages on Necker Island, Northwestern Hawaiian Islands. Submitted 1/2019 to Deep-Sea Research I. In Review.

Baco, A.R., *N.B. Morgan, E.B. Roark, M. Silva, K. Shamberger, K.M., Miller, K. 2017. Defying dissolution, discovery of deep-sea scleractinian coral reefs in the North Pacific. Scientific Reports. 7: 5436 | DOI:10.1038/s41598-017-05492-w

Baco, A.R., R. Etter, P. Beerli, P. Ribeiro, S. von der Heyden, and B. Kinlan. 2016. A synthesis of genetic connectivity in deep-sea fauna and implications for marine reserve design. Molecular Ecology 25: 3276-3298. doi: 10.1111/mec.13689.

Morrison, C.L., Baco, A.R., Nizinski, M.S., Coykendall, D.K., Demopoulos, A.W.J., Cho, W., Shank, T.M. 2015. Population Connectivity of Deep-Sea Corals. In: Hourigan TF, Etnoyer PJ, Cairns SD, Tsao C-F (eds) State of Deep-Sea Coral and Sponge Ecosystems of the United States. NOAA Technical Memorandum. NOAA, Silver Spring, MD. p 12-1 to 12-30

Parrish, F., A.R. Baco, C. Kelley, and H. Reiswig. 2015. State of Deep Coral and Sponge Ecosystems of the United States Pacific Islands Region: 2015. In: Hourigan TF, Etnoyer PJ, Cairns SD, Tsao C-F (eds) State of Deep-Sea Coral and Sponge Ecosystems of the United States. NOAA Technical Memorandum. NOAA, Silver Spring, MD. p 7-1 to 7-38.

*Morgan, N.B., S. Cairns, H. Reiswig, A.R. Baco. 2015. Benthic megafaunal community structure of cobalt-rich manganese crusts on Necker Ridge, North Pacific Ocean. Deep-Sea Research I. 104: 92-105. doi: 10.1016/j.dsr.2015.07.003.

*Figueroa, D. and A.R. Baco. 2014. Octocoral mitochondrial genomes provide insights into the phylogenetic history of gene order rearrangements, order reversals, and also into the use of mitochondrial genomes for cnidarian phylogenetics. Genome Biology and Evolution doi:10.1093/gbe/evu286

*Figueroa, D. and A.R. Baco. 2014. Complete mitochondrial genomes elucidate the phylogenetic relationships of the deep-sea octocoral Families Coralliidae and Paragorgiidae. Deep-Sea Research II, doi:10.1016/j.dsr2.2013.06.001.

*Long, D. and A.R. Baco. 2014. Rapid change with depth in megabenthic structure-forming communities in the Makapu'u deep-sea coral bed. Deep-Sea Research II, doi:10.1016/j.dsr2.2013.05.032.

Schlacher, T., A.R. Baco, A. Rowden, T. O'Hara, M. Clark, C. Kelley, and J. Dower. 2014. Seamount benthos in a cobalt-rich crust region of the central Pacific: conservation challenges for future seabed mining. Diversity and Distributions 20(5): 491-502. doi: 10.1111/ddi.12142

Sinniger, F., O. Ocana, and A. Baco. 2013. Diversity of Zoanthids (Anthozoa: Hexacorallia) on Hawaiian Seamounts: Description of the Hawaiian Gold Coral and Additional Zoanthids. PLoS ONE 8(1): e52607. doi:10.1371/journal.pone.0052607

Baco, A.R. and S.D. Cairns. 2012. Comparing molecular variation to morphological species designations in the deep-sea coral genus Narella reveals new insights into seamount coral ranges. PLoS ONE 7(9): e45555. doi:10.1371/journal.pone.0045555

Yesson, C., M. Taylor, D. Tittensor, A. Davies, J. Guinotte, A.R. Baco, J. Black, J. Hall-Spencer, A. Rogers. 2012. Global habitat suitability of cold water octocorals. Journal of Biogeography 39(7): 1278-1292.

Clark, M.R., C. Kelley, A.R. Baco, A. Rowden. 2011. Fauna of cobalt-rich ferromanganese crust seamounts. International Seabed Authority Tech Study No. 8

Herrera, S., A.R. Baco, and J.A. Sanchez. 2010. Molecular systematics of the bubblegum corals (Paragorgiidae, Octocorallia): phylogenetic relationships with Sibogagorgia and description of a new deep-sea species. Molecular Phylogenetics and Evolution. 55(1): 123-135.

Tittensor, D.P., A.R. Baco, P. Brewin, M.R. Clark, M. Consalvey, J. Hall-Spencer, A.A. Rowden, T. Schlacher, K. Stocks and A.D. Rogers. 2009. Predicting global habitat suitability for stony corals on seamounts. Journal of Biogeography 36: 1111–1128.

Baco, A.R. 2007. Exploration for deep-sea corals on North Pacific seamounts and islands. Invited for special volume of Oceanography 20(4): 58-67.

Waller, R.G., and A.R. Baco. 2007. Reproductive morphology of three species of deep-water precious corals from the Hawaiian Archipelago: Gerardia sp., Corallium secundum and Corallium lauuense. Bulletin of Marine Science. 81(3): 533-542.

Parrish, F.A., and A.R. Baco. 2007. Chapter 4: State of Deep Coral Ecosystems in the United States Western Pacific Region: Hawaii and the United States Pacific Islands. pp. 155-194. In: S.E. Lumsden, T.F. Hourigan, A.W. Bruckner G. and Dorr (eds.) The State of Deep Coral Ecosystems of the United States. NOAA Technical Memorandum CRCP-3. Silver Spring MD 365 pp.

Rogers, A.D., Baco, A., Griffiths, H., Hart, T. and Hall-Spencer, J.M. 2007. Corals on Seamounts. Chapter 8 in Pitcher, T.J., Morato, T., Hart, P.J.B., Clark, M.R., Haggan, N. and Santos, R.S. (eds) Seamounts: Ecology, Conservation and Management. Fish and Aquatic Resources Series, Blackwell, Oxford, UK. pp 141-169.

Baco, A.R., A.M. Clark, and T.M. Shank. 2006. Six microsatellite loci from the deep-sea coral Corallium lauuense (Octocorallia: Coralliidae) from the islands and seamounts of the Hawaiian archipelago. Molecular Ecology Notes 6: 147-149.

Etnoyer P.J., S.D. Cairns, J.A. Sanchez, J.K. Reed , J.V. Lopez, W.W. Schroder, S.D. Brooke, L. Watling, A. Baco-Taylor, G.C. Williams, A. Lindner, S.C. France, and A.W. Bruckner. 2006. Deep-Sea Coral Collection Protocols. NOAA Technical Memorandum NMFS-OPR-28, Silver Spring, MD. 53 pp.

Baco, A.R. and T.M. Shank. 2005. Population genetic structure of the Hawaiian precious coral Corallium lauuense (Octocorallia: Coralliidae) using microsatellites. In Cold-Water Corals and Ecosystems (eds. A. Freiwald, JM Roberts), Springer-Verlag Berlin Heidelberg, Germany pp. 663-678.

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Robinson, L.F., *Adkins, J.F., *Frank, N., *Gagnon, A.C., *Prouty N.G., *Roark E.B., and *van de Flirdt, T., (2013). The geochemistry of deep-sea coral skeletons: A review of vital effects and applications for paleoceanography. Deep-Sea Res. II, http://dx.doi.org/10.1016/j.dsr2.2013.06.005. *listed alphabetically.

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Roark, E.B., Guilderson, T.P., Dunbar, R.B., and Ingram, B.L., 2006. Radiocarbon based ages and growth rates: Hawaiian deep-sea corals. Marine Ecology Progress Series. 327:1-14. (Feature Article)

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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