# Papahānaumokuākea Marine National Monument

SPECIAL OCEAN USE 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:** *Agustines, Ariana S.*
**Affiliation:** *Large Marine Vertebrates Research Institute Philippines*

**Permit Category: Special Ocean Use**
**Proposed Activity Dates:** *Up to ~23 days between August-October 2022*
**Proposed Method of Entry (Vessel/Plane):** *Vessel (E/V Nautilus)*
**Proposed Locations:** *Shallow water (<100m) within original PMNM boundary; TBD - French Frigate Shoal, Maro Reef, Laysan Island. Final locations will be determined based on sea state and weather conditions at the time of the expedition.*

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

*A maximum of twenty-three individuals per expedition - including one or more NGS research teams, citizen scientists, a Native Hawaiian Liaison (identified in coordination with the Monument's Cultural Working Group), and dive support specialists - will be covered by National Geographic Society Expedition Sponsor Program permits.*

*Across all five expeditions a maximum of 107 people will be covered by National Geographic permits.*

**Estimated number of days in the Monument:**

*National Geographic Society will be participating in five expeditions in the Monument over a 72 day period. We anticipate that the duration of this project will be approximately 15 -23 days.*

**Description of proposed activities:** (complete these sentences):

a.) The proposed activity would…

*…provide a quantification of elasmobranch (sharks and rays, hereafter called 'sharks') diversity and relative abundance at three localities within Papahānaumokuākea Marine National*

*Monument (PMNM), and create educational resources for advancing shark conservation through a multi-disciplinary approach combining traditional local knowledge with scientific tools and technology, primarily baited remote underwater video systems (BRUVs) and artificial intelligence (AI) image recognition tool. The data can inform an assessment of the Monument's effectiveness in conserving these globally threatened species as well as provide a comparative analysis with previous studies conducted within the Monument to determine trends and status of shark populations. All of this work will be documented and shared through various outreach products, including live programming broadcast from onboard the Nautilus, which would include imagery and footage gathered underwater, from the surface, and above using a drone. Drone footage will be recorded only over water, never over land, carefully following FAA drone guidelines as well as guidelines from the Monument.*

b.) To accomplish this activity we would ….

*…connect and collaborate with local communities and organizations to help refine research questions aligned with local interest and identify historically significant and culturally relevant sites for sharks. Video footage from BRUVs will allow us to capture the presence and diversity of shark species, count their abundance at different habitat types, and document novel interaction or behavioral displays among species. The AI tool will assist in post-process analysis of the recorded footage, maximizing efficiency in recognition and identification of shark species. Water samples will be taken for eDNA analysis to cross-analyze with BRUV footage and further assist in the presence of shark species. Lastly, outreach products will create learning opportunities about the Monument's environment and cultural significance for audiences worldwide.*

c.) This activity would help the Monument by …

*…improving our understanding of shark populations within PMNM and filling the knowledge gaps in our understanding of how marine protected areas closed off to fishing and other human pressures affect shark diversity and abundance- data which is important for the current and future management of PMNM.*

**Other information or background:**

*The National Geographic Society is a global nonprofit that uses the power of science, exploration, education, and storytelling to illuminate the wonder of our world. For more than 130 years, the Society has identified and funded trailblazing scientists, researchers, conservationists, storytellers, and educators—known as National Geographic Explorers—from around the world who are working to better understand our world and everything in it.*

*To expand this work to help safeguard the world's ocean, the National Geographic Society is partnering with Ocean Exploration Trust from August — October 2022 by leveraging their ship, the E/V Nautilus, to conduct five research expeditions led by National Geographic Explorers in Papahānaumokuākea Marine National Monument. The Society has submitted permit*

*applications for five distinct research projects, which together form the "National Geographic Society Expedition Sponsor Program." Some of the five NGS expeditions will include multiple NGS research teams,and some of the NGS research teams will join multiple expeditions. During the period when the NGS teams are onboard, Ocean Exploration Trust will simultaneously be conducting seafloor mapping surveys funded by NOAA Ocean Exploration, focusing on areas that have not previously been mapped at high resolution.*

*In addition to the identified Explorers who will conduct work on the ship, each expedition will be joined by a number of citizen scientist participants. These individuals will join each expedition and participate in the scientific projects through daily citizen science activities through which they will assist in collecting data and conducting analysis under the guidance of the National Geographic Explorers leading each project. Citizen science activities will include participating in photo documentation and data collection while snorkeling, supporting species identification, participating in educator engagement, and contributing to a digital multimedia mosaic. Different citizen scientists will join each expedition.*

*Each expedition will also be joined by a Native Hawaiian Liaison, identified in collaboration with the Monument's Cultural Working Group. We anticipate that there will be a different Liaison on each of the five expeditions.*

## Section A - Applicant Information

**1. Applicant**

Name (last, first, middle initial): *Agustines, Ariana S.*

Title: *Project Manager, Large Marine Vertebrates Research Institute Philippines*

**1a. Intended field Principal Investigator (See instructions for more information):**

*Agustines, Ariana S.*

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

[redacted]

For students, major professor's name, telephone and email address: *N/A*

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

*Large Marine Vertebrates Research Institute Philippines*

**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):**

*Spencer, Erin - Field Researcher*
*Khalid, Sara - AI Technologist*
*Koller, Kelly - Educator*
*Berglund, Jennifer - Filmmaker & Science Communicator*
*Kinzer, Daniel - Educator*
*TBD - Native Hawaiian Liaison*
*7 to 12 Citizen Scientists for each expedition this project is on. Alex Moen will join one expedition as a citizen scientist.*

*TBD - Dive Safety Officer*
*TBD - Diver Medical Technician*
*TBD - Dive support 1*
*TBD - Dive support 2*

## Section B: Project Information

| **5a. Project location(s):** | | **Ocean Based** | |
|---|---|---|---|
| ☐ Nihoa Island | ☐ Land-based | ☐ Shallow water | ☐ Deep water |
| ☐ Necker Island (Mokumanamana) | ☐ Land-based | ☐ Shallow water | ☐ Deep water |
| **X** French Frigate Shoals | **X** Land-based | **X** Shallow water | ☐ Deep water |
| ☐ Gardner Pinnacles | ☐ Land-based | ☐ Shallow water | ☐ Deep water |
| **X** Maro Reef | **X** Land-based | **X** Shallow water | ☐ Deep water |
| **X** Laysan Island | **X** Land-based | **X** 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 MidwayAtoll 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:

*Shallow water reef (<100 m depth) and sand flats i.e., shallow sandy bottom areas and lagoons which can be potential shark nursery habitats or sanctuaries for juvenile sharks (with some shark species like the tiger shark utilizing such areas as hunting grounds as their primary prey, green turtles, forage in these habitats. Exact deployment of BRUV rigs at the indicated project locations will be dependent on information received from local collaborators, weather and sea state conditions, and availability of small vessels.*

**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
***X Drilling into, dredging, or otherwise altering the submerged lands other than by anchoring a vessel; or constructing, placing, or abandoning any structure, material, or other matter on the submerged lands -*** *Structures being placed on submerged lands are the BRUV rigs.*
***X Anchoring a vessel*** *- Anchoring the E/V Nautilus 5.5-meter RHIB supporting SCUBA/snorkeling operations is not planned but may be required for longer SCUBA/snorkeling dives or in the event of engine failure. If anchoring should be necessary, the team will endeavor to have divers/snorkelers hand place anchors to minimize any potential impact to underwater fauna and substrate.*
☐ Deserting a vessel aground, at anchor, or adrift
☐ Discharging or depositing any material or matter into the Monument
***X Touching coral, living or dead. -*** *May occur during the placement and positioning of the BRUV rigs. They will not be placed on living coral, but dead coral/rubble may need to be manipulated to set the frames down.*
☐ Possessing fishing gear except when stowed and not available for immediate use during passage without interruption through the Monument
***X Attracting any living Monument resource***
☐ Sustenance fishing (Federal waters only, outside of Special Preservation Areas, Ecological Reserves and Special Management Areas)
☐ Subsistence fishing (State waters only)
***X Swimming, snorkeling, or closed or open circuit SCUBA diving within any Special Preservation Area or Midway Atoll Special Management Area***

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

*The purpose of our proposed activity is to assess the diversity, abundance, and structure of shark populations at Papahānaumokuākea Marine National Monument by conducting underwater video surveys that count the number of individuals, different species present, and occurrence of species at the various habitat types. This will be supported by eDNA sampling, which will be taken at each project location to cross-analyze with video observations and assist in the evaluation of ecosystem health. The data collected will be used first and foremost to inform the Monument how effective the established conservation and management initiatives are at protecting local shark populations, and creating engaging educational resources influenced by the local landscape and culture to promote and encourage shark conservation across a wide range of audiences. Secondary will be a comparison of data to monitor and identify any trends from previous studies* relating to any changes in shark status within the Monument, and compare populations at PMNM with other protected areas as well as identify effective management approaches that can be adopted in more desolated fishing grounds.*

**A study conducted by Michelle Heupel in 2017 investigated similar parameters in the Monument as part of a global assessment on the status of reef sharks (Global Fin Print Project). This study will follow similar methodologies i.e., BRUV frame design, habitat types sampled and greater locations, deployment duration and environmental parameters noted, etc. to allow for comparison of data and assessment of changes in output from separate time periods.*

*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 **X No**

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

*The stationary video recording rigs are primarily aimed at documenting shark and ray species; however, due to the non-selectiveness of this method, other protected species of teleost fish and sea turtles may be captured on video as well. Any video or imagery recorded using diver-operated camera systems will not target specific species, but rather the overall underwater environment and the scientific work taking place underwater. Wildlife will not be targeted specifically, but wildlife will be filmed should there be an opportune moment.*

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?

*BRUVs- the primary research method used- is designed to be non-invasive, non-extractive, and low impact, meeting marine protected areas objectives. Compared to more traditional sampling methods such as underwater visual surveys (UVS), BRUVs sampling method requires no humans to remain in the water, whose presence may alter the behavior of the animals, thereby reducing disturbance to the natural environment. Although bait (approximately 1kg.) will be used as an attractant to target the species of interest, i.e., sharks, individuals will not be physically captured or handled, the purpose solely being for video recordings. The bait effects are short-term and usually persist for an hour from its soak time; thereby limiting the temporal extent of the activity to this time frame. The mesh bag of bait is made of plastic that is durable and not easily prone to tear and secured to a PVC pipe ("bait arm") using zip ties that thread through the pole so it doesn't slip off. The size of the bait bag is large enough to prevent predatory fish from ingesting the bag and/or the enclosed bait. The bait arm is then inserted into a hollowed pipe soldered to part of the BRUV rig to ensure it is firmly attached to the rig frame and doesn't accidentally get dislodged. The bait arm extends from the center of the BRUV frame positioned outside of the camera housing. Similarly, the video rigs are constructed of lightweight frames and their placement and retrieval will be assisted by hand to ensure there will be minimal to no damage to the surrounding habitat. Never in past BRUVs conducted by our team have sharks or other marine animals consumed or detached the baited mesh bags. Water samples from eDNA analysis will be taken in a closed system with no outfall.*


*Photo of deployment of BRUV rigs, as requested. This is the BRUV setup we used as part of the Global Fin Print study. These units will not be the ones we will use on the expedition, but the design will be similar and we will use this model as a template.*

*The use of a remote-operated vehicle for video survey of habitat characterization will be operated by a skilled and trained project member. Responsible use of the device will be employed ensuring the vehicle abides by the same standards as a maritime vessel of similar class and stay the minimum distance away from encountered marine organisms.*

*Camera systems operated by a scuba diver will be conducted with a highly experienced underwater filmmaker and diver, and equipment will never come into contact with any substrate or animal encountered. Further, the diver will take a passive approach to filming any wildlife encountered, allowing wildlife to approach the diver and camera, but never pursuing wildlife underwater.*

*Drone operations will be conducted over water only, and never over land, carefully following FAA and PMNM drone guidelines. Drone footage, which will only serve to provide a birds-eye view of the E/V Nautilus and research operations, will never approach wildlife, and will never be conducted if there are any concerns about weather, wind, or sea conditions. Drone filming will be conducted by a licensed FAA drone pilot using a small, cinematic drone that weighs less than*

*6 pounds. A drone camera assistant will spot the drone to ensure it does not interfere with wildlife, boat operations or surrounding landscapes.*

*Finally, the team will share any data collected as part of this project, and any intellectual property derived from such data, with one or more local collaborators in ways that follow the (1) FAIR (Findable, Accessible, Interoperable, and Reusable); (2) CARE (Collective Benefit, Authority to Control, Responsibility, Ethics) and; (3) Mai Ka Pō Mai (Native Hawaiian Data governance) principles. Any genetic data will be collected in accordance with the Nagoya Protocol on Access and Benefit-sharing.*

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?

*As previously mentioned, the research conducted will utilize video to collect data on presence, quantity, and species composition of sharks and document the surrounding habitat. There will be no activities that intend to diminish the cultural, natural, or historical qualities of the Monument nor compromise its ecological integrity. This data will be useful for monitoring trends in shark populations within the Monument as it is crucial to understand how and to what extent marine protected areas contribute to conserving one of the most highly threatened taxa globally.*

*This project has an opportunity to enhance the Monument's cultural and ecological appreciation by working closely with an indigenous data sovereignty team that will be facilitating sharing of data with local and indigenous stakeholders. The various components of the project will be seeking indigenous perspectives to amplify on our project website and outreach plan, as well as consulting with local members with regards to proper and respectful conduct within the Monument. A major goal of the project is to highlight the importance of indigenous knowledge, perspectives, and leadership. Likewise, the team includes members who are knowledgeable about the cultural, historical, and natural value of Papahānaumokuākea Marine National Monument and will therefore guide all the activities to be carried out within the Monument.*

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.

*No, there is no practical alternative to conducting these activities within the Monument. The data are location dependent necessary to determine the health and status of shark populations of Papahānaumokuākea Marine National Monument in order to assess the efficacy of marine protected areas and use this as a comparison for heavily fished areas as a baseline for optimal habitat health.*

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 scientific value and educational outreach of this project outweighs the temporary and minimal impacts of the sampling methodology. Shark populations are in decline globally and understanding key ecological information such as species diversity, relative abundance and distribution from pristine areas is necessary to develop regulatory frameworks and conservation initiatives elsewhere, especially in more desolate areas. The data collected and to be shared with the local stakeholders can contribute to institutional and traditional knowledge that can assist in furthering shark conservation. The research activities are non-destructive and are suited for the project's proposed habitat type and therefore will not have any adverse impacts on the Monument's natural or ecological resources.*

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

*Due to the reliability, replicability, and ease of deployment of the selected sampling method, BRUVs are useful for large-scale sampling of sharks and rays given a relatively short time period. The use of simultaneous deployments also allows for greater sampling efforts and reduced time in the field. Water samples for eDNA analysis will be taken simultaneously, while BRUVs are deployed, making the duration at each location as efficient as possible. Thus the expedition duration is sufficient time to be able to conduct adequate BRUV and eDNA sampling in the three specified locations and will not need to exceed the allocated time frame.*

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

*The applicant and PI (A. Agustines) is a shark ecologist, marine conservationist, and technical diver with several years of experience working with these species and conducting various types of sampling and survey methodologies, including BRUVs. She is equipped with the knowledge and skills to execute these tasks and train others to assist in the research activities outlined. Large Marine Vertebrates Research Institute Philippines (LAMAVE) is the leading marine conservation nonprofit organization in shark research in the Philippines, having deployed the first national acoustic telemetry network for sharks across the country. LAMAVE has also been identified as one of the Global FinPrint project partners, utilizing BRUVs to sample shark and ray populations across several coral reef systems in the Philippines. This sampling method along with eDNA are non-invasive and low impact- providing for easy deployment and retrieval of equipment and minimal associated hazards for collection and processing of samples.*

g. Provide information demonstrating that you have adequate financial resources available to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.

*The National Geographic Society (NGS), in partnership with Ocean Exploration Trust (OET), are funding teams of Explorers to conduct projects on the E/V Nautilus, one of the world's most*

*sophisticated ocean exploration ships. The funds provided by NGS will cover all expenses related to this project.*

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.

*BRUVs has become increasingly popular for recording large mobile predators over traditional sampling methods that involve extractive fishing procedures (hooking, tagging, release) or inherent sampling bias (variation in angler skill for controlled angling surveys; observer bias and effects of presence of diver for underwater visual surveys). It is best suited to survey a wide range of depths and habitat types without the need for extraction, it is not limited by continual diver presence, and it has the potential to record rare species that may be wide-ranging or elusive. As a non-invasive and non-extractive sampling technique, it is the most appropriate method that meets the Monument's objectives. Similarly, analyzing eDNA through water samples is an effective and non-invasive method to detect the presence of rare or cryptic sharks and other species that might otherwise be difficult to document.*

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

*E/V Nautilus will be obtaining a VMS system in 2022 per the OLE requirements and will have it aboard for the duration of the time the vessel will be in the Monument. The vessel currently utilizes AIS, which it will also retain and have on for the duration of the permitted activities.*

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

*The research activities to be conducted during this expedition include videography/video sampling and seawater collection, and will not cause destruction to the coral reefs or sand flats-the target habitat types. There are no other issues that would make issuance of a permit inappropriate.*

FOR SPECIAL OCEAN USE ACTIVITIES <u>OUTSIDE</u> OF MIDWAY ATOLL SPECIAL MANAGEMENT AREA, ANSWER THE ADDITIONAL THREE FINDINGS BELOW:

k. Explain how your activity will directly benefit the conservation and management of the Monument.

*The data collected will help us gain important ecological information into the occurrence, relative abundance, resource dependency, and community composition of shark populations of Papahānaumokuākea Marine National Monument, which can be used as a benchmark for evaluating the effectiveness of the Monument in achieving its intended conservation goals for protecting these species. That data can be used in conjunction with previous studies in order to*

*determine population trends and status of coastal sharks in areas closed off to human activity, how this has changed from the past, and what future management interventions can focus on for sustaining or improving the Monument objectives.*

l. Explain how the purpose of your activity is for research or education related to the resources or qualities of the Monument.

*Our central purpose is to contribute to knowledge about the diversity, abundance, and structure of shark populations around the Monument. Concurrent and complementary purposes through educational outreach are to elevate Indigenous knowledge about the Monument, and modern scientific and technological methods used to study it.*

m. Does the activity involve the use of a commercial passenger vessel (defined as a vessel that carries individuals who have paid for such carriage)?

*No*

**FOR SPECIAL OCEAN USE ACTIVITIES <u>WITHIN</u> MIDWAY ATOLL SPECIAL MANAGEMENT AREA, ANSWER THE ADDITIONAL TWO FINDINGS BELOW:**

n. Explain how your activity will further the conservation and management of the Monument.

*N/A*

o. How is your activity compatible with the purposes for which the Midway Atoll National Wildlife Refuge was designated?

*N/A*

**NOTE: If this is a first time Special Ocean Use activity, it will be subject to a pilot project and will be restricted in duration. Special Ocean Use activities proposed <u>outside</u> the Midway Atoll Special Management Area will require public notice of the application and an opportunity to provide comments is given at least 30 days prior to issuing the permit.**

**8. Procedures/Methods:**

*BRUVs rigs are made of lightweight galvanized frames with GoPro camera housing attached by PVC pipe. A small amount (1kg) of fresh fish bait enclosed in a plastic mesh bag will be attached to the BRUVs frame to attract predatory fish, particularly targeted shark species, to the camera. The attraction is short-term with bait effects dissipating within 1 hour of soak time of the BRUV deployment. Deployment of BRUV rigs will be done using SCUBA for shallow depths (<40 m) and the use of ropes and brightly colored inflatable surface floats and retrieved via hand-hauling for deeper depths (>40 m) at different habitat types (coral reef and sand). BRUV rigs will be set*

*down on the bottom substrate with the frame being weighed down by free weights. Deployment will only proceed with favorable sea state conditions for example, in minimal to mild/moderate currents. Multiple deployments will occur simultaneously and several BRUVs will be unattended while the other rigs are being deployed. The procedure generally follows:*

- *Each day, deployment times will be split into three categories: morning, midday, and afternoon sets*
- *For each set, ~4-5 rig units will be deployed at one greater location throughout the different indicated habitat types*
- *After a soak time of 60 minutes for each unit, begin retrieval of the BRUVs*
- *Upon retrieval of the units, prepare for the next redeployment set- swap out for new cameras, SD cards, etc.*

*BRUV rigs will be in the water for ~70 minutes to ensure a minimum of 60 minutes recorded footage, with a few minutes upon deployment to allow the bait plume to dissipate into the surrounding water column. After deployment of the BRUV unit, it will be left unattended at the location (in order to deploy the rest of the units) until retrieval 70 min later.*
*Additional team members and citizen scientists will collect both surface and in-water environmental data before BRUV deployment and assist with the deployments.. Deployments will be done from small boats in selected shark habitats, with specific locations dependent on bottom substrate, current, depth, and visibility. Approximately 180 deployments will be conducted in total, ~60 at each sample location. As the data is all recorded via video camera, this non-extractive approach minimizes direct impact to individuals and causes minimal damage to the benthic environment. At each BRUV location we will take up to three 4 liter samples at staged depths for eDNA analysis to cross-analyze with BRUV data and assist in evaluating ecosystem health. Samples will be filtered and stored in the onboard freezer. Upon disembarkation, the samples will be delivered to the University of Hawaii at Mānoa for analysis and sample disposal will follow standard operating procedure protocols of the University*

*Habitat characterization will be documented through the use of a minimally-invasive, remotely operated vehicle (ROV), which will conduct daily assessment surveys of the environment, natural shark presence and behavior around the BRUV sampling sites.*

*We will also leverage a new, powerful tool that will allow for rapid, real-time post-processing analysis of the BRUV and ROV footage--an AI tool adapted from a deep-learning shark classifier model under development at Oxford University in collaboration with the SharkPulse platform, which can accurately and non-invasively identify marine wildlife species through self-learning based on image and video data alone. The tool combines deep-learning based image recognition technology, and big, real-world datasets to automatically detect and identify different shark species and genres.*

*Storytelling aspects of the project will emphasize the value of Indigenous knowledge as well as the modern scientific and technological methods used to study it expressed through the creation of a website and StoryMap featuring local perspectives on sharks, live-streamed programming, social media, and content disseminated through the e-magazine, An Hour in the Deep. Live, formally-produced, ship-to-shore learning sessions will be conducted with Indigenous experts on*

*the Hawaiian Islands who will interpret imagery and stories captured throughout various expeditions to the Monument. All programs will be recorded and made available to the Ocean Exploration Trust (OET), the National Geographic Society (NGS), the Indigenous experts and their communities, and posted on our project's StoryMap. Because the research activities involve compelling use of technology (BRUVs, ROV, and AI), we will also provide a behind the scenes, in action storyline of the expedition, published through Instagram and TikTok.*

*The StoryMap will additionally provide the foundation for our educational outreach. We will seek out local partner schools and teachers through National Geographic Education online communities, so students can explore their connectedness to the ocean regardless of their geographic location. We will also create an educator toolkit to supplement the StoryMap that includes information on the Monument, a field guide for IDing shark species, information about the expedition's technology, and a guide for applying the expedition's framework to their local area. Partner institutions will be encouraged to embark on their own culturally-driven scientific inquiry exploring the connectedness in their community. Project team educators Kelly and Daniel will support teachers throughout the school year post-expedition.*

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

**9. Provide proof of general liability insurance, or indicate that you will be posting an equivalent bond against claims arising out of activities conducted under the permit:**

*Ocean Exploration Trust is insured for General Liability through American Casualty Company/Hylant-Cleveland (will be renewed in July), Hull & Machinery through Lloyd's Insurance Co S.A. & Beazley/Leviathan, and Protection & Indemnity through BML/QBE. Ocean ExplorationTrust's general liability limits include a general aggregate limit ($2M), a products/completed operations aggregate limit ($2M), bodily injury/property damage per occurrence limit ($1M), personal injury ($1M), fire damage liability ($1M) and medical payments ($5K).*

**10. If applicable, describe how you are collaborating with others in any way to reduce duplicative activities in the Monument or elsewhere?**

*This project from the onset will be collaborating with an indigenous data sovereignty team that aims to enhance data sharing among the local research institutions (i.e., University of Hawaii), stakeholders, communities, and others that are interested in acquiring the collected data. It is the intention for this project to share the results with Papahānaumokuākea Marine National Monument for reviewing management objectives and strategies. As we believe that data should be available and accessible by anyone, all data and results will be open-access unless there is sufficient reason or request not to release data.*

**11. List all specialized gear and materials to be used in this activity:**

- *Baited Remote Underwater Video (BRUV) rigs:*
    - *Frames*
    - *GoPro cameras*
    - *Camera housing*
    - *Bait arms and mesh bag*
    - *Weights*
    - *Line*
    - *Surface floats*
- *Scuba diving gear:*
    - *Buoyancy control device (BCD)*
    - *Regulator*
    - *Mask*
    - *Snorkel*
    - *Fins*
    - *Weights*
    - *Aluminum 12L tank*
- *Trident remote operated vehicle (ROV)*
- *Camera equipment to be used during diving operations:*
    - *Mirrorless camera system with underwater housing and lighting.*
    - *Several GoPro systems with housings and lighting*
    - *Drone (DJI Mavic Pro)*

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

*N/A*

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

*N/A*

**14. List all Applicant's publications directly related to the proposed project:**
*Miranda, J., Yates, N., Agustines, A., Enolva, N., Labaja, J., Legaspi, C., McCoy, E., Ponzo, A., Snow, S., and Araujo, G. (2021) Donsol: an important reproductive habitat for the world's largest fish Rhincodon typus? Journal of Fish Biology. DOI: 10.1111/jfb.14610*

*Araujo, G., Agustines, A., Tracey, B., Snow, S., Labaja, J., and Ponzo, A. (2019) Photo-ID and telemetry highlight a global whale shark hotspot in Palawan, Philippines. Nature Scientific Reports. DOI: 10.1030/s41598-019-53718-w*

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.

Ariana S. Agustines_____01 Feb 2022_____
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?**
X Applicant CV/Resume/Biography
X Intended field Principal Investigator CV/Resume/Biography
X Electronic and Hard Copy of Application with Signature
☐ Statement of information you wish to be kept confidential
☐ Material Safety Data Sheets for Hazardous Materials

# Papahānaumokuākea Marine National Monument

SPECIAL OCEAN USE 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:** *Justin Dunnavant, PhD*
**Affiliation:** *Assistant Professor of Anthropology and Archeology, University of California, Los Angeles*

**Permit Category: Special Ocean Use**
**Proposed Activity Dates:** *Up to ~23 days between August and October 2022*
**Proposed Method of Entry (Vessel/Plane):** *Vessel (E/V Nautilus)*
**Proposed Locations:** *Shallow water (<100m) within original PMNM boundary; French Frigate Shoals, Maro Reef.*

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

*A maximum of twenty-three individuals per expedition - including one or more NGS research teams, citizen scientists, a Native Hawaiian Liaison (identified in coordination with the Monument's Cultural Working Group), and dive support specialists - will be covered by National Geographic Society Expedition Sponsor Program permits.*

*Across all five expeditions a maximum of 107 people will be covered by National Geographic permits.*

**Estimated number of days in the Monument:**

*The five National Geographic Society expeditions will take place over a 72 day period. We anticipate that the duration of this project will be approximately 15 -23 days.*

**Description of proposed activities:** (complete these sentences):

a.) The proposed activity would…

*…document cultural heritage sites within the Papahānaumokuākea Marine National Monument (PMNM) using the latest in 3D photogrammetric technology. Our diverse team of archaeologists, underwater photographers, and educators will bring this project to life in a*

*manner that ensures the highest level of scientific rigor, compelling educational materials, and data sovereignty in alignment with Hawaiian views.*

b.) To accomplish this activity we would…

*… create 3D virtual recreations of key heritage sites to raise awareness of the PMNM's cultural significance and create curriculum that can be implemented in local and national classrooms across primary and post-secondary education.*

c.) This activity would help the Monument by…

*… bringing awareness to the rich history of the Monument documenting the various cultural heritage sites. Within the PMNM there are material artifacts and cultural sites that span millennia and speak to histories across Asia, North America and Hawaii. This project is particularly important because it provides local Hawaiians and the wider community with access to a cultural landmark that few people are able to visit. We intend for this project to excite further research and inquiry into PMNM and Hawaii's vast submerged cultural resources.*

**Other information or background**:

*The National Geographic Society is a global nonprofit that uses the power of science, exploration, education, and storytelling to illuminate the wonder of our world. For more than 130 years, the Society has identified and funded trailblazing scientists, researchers, conservationists, storytellers, and educators—known as National Geographic Explorers—from around the world who are working to better understand our world and everything in it.*

*To expand this work to help safeguard the world's ocean, the National Geographic Society is partnering with Ocean Exploration Trust from August — October 2022 by leveraging their ship, the E/V Nautilus, to conduct five research expeditions led by National Geographic Explorers in Papahānaumokuākea Marine National Monument. The Society has submitted permit applications for five distinct research projects, which together form the "National Geographic Society Expedition Sponsor Program." Some of the five NGS expeditions will include multiple NGS research teams,and some of the NGS research teams will join multiple expeditions. During the period when the NGS teams are onboard, Ocean Exploration Trust will simultaneously be conducting seafloor mapping surveys funded by NOAA Ocean Exploration, focusing on areas that have not previously been mapped at high resolution.*

*In addition to the identified Explorers who will conduct work on the ship, each expedition will be joined by a number of citizen scientist participants. These individuals will join each expedition and participate in the scientific projects through daily citizen science activities through which they will assist in collecting data and conducting analysis under the guidance of the National Geographic Explorers leading each project. Citizen science activities will include participating in photo documentation and data collection while snorkeling, supporting species identification,*

*participating in educator engagement, and contributing to a digital multimedia mosaic. Different citizen scientists will join each expedition.*

*Each expedition will also be joined by a Native Hawaiian Liaison, identified in collaboration with the Monument's Cultural Working Group. We anticipate that there will be a different Liaison on each of the five expeditions.*

## Section A - Applicant Information

**1. Applicant**

Name (last, first, middle initial): *Dunnavant, Justin P.*

Title: *Assistant Professor of Anthropology, University of California, Los Angeles*

**1a. Intended field Principal Investigator (See instructions for more information):**

*Dunnavant, Justin P.*

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

[redacted]

For students, major professor's name, telephone and email address: *N/A*

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

*University of California, Los Angeles*

**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):**

*Raupp, Jason T. - Maritime Archeologist, Diver*
*Adler, Jennifer - Photographer/Videographer, Diver*
*Glickley, Ashleigh - Educator*
*Sruthi Gurudev, Educator/Journalist*

*TBD - Native Hawaiian Liaison*
*7 to 12 Citizen Scientists for each expedition this project is on. Kaitlin Yarnall will join one expedition as a citizen scientist.*

*TBD - Dive Safety Officer*
*TBD - Diver Medical Technician*
*TBD - Dive support 1*
*TBD - Dive support 2*

## Section B: Project Information

**5a. Project location(s):**

| | | Ocean Based | |
|---|---|---|---|
| ☐ Nihoa Island | ☐ Land-based | ☐ Shallow water | ☐ Deep water |
| ☐ Necker Island (Mokumanamana) | ☐ Land-based | ☐ Shallow water | ☐ Deep water |
| **X** French Frigate Shoals | ☐ Land-based | **X** Shallow water | ☐ Deep water |
| ☐ Gardner Pinnacles | ☐ Land-based | ☐ Shallow water | ☐ Deep water |
| **X** Maro Reef | ☐ Land-based | **X** Shallow water | ☐ Deep water |
| ☐ 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:

*Filming and 3D photogrammetry will take place in shallow water at shipwrecks in French Frigate Shoals (Two Brothers and Churchill) and Maro Reef (USNS Mission San Miguel).*

**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
**X *Anchoring a vessel -*** *Anchoring the E/V Nautilus 5.5-meter RHIB supporting SCUBA/snorkeling operations is not planned but may be required for longer SCUBA/snorkeling dives or in the event of engine failure. If anchoring should be necessary, the team will endeavor to have divers/snorkelers hand place anchors to minimize any potential impact to underwater fauna and substrate.*
☐ 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)
***X Swimming, snorkeling, or closed or open circuit SCUBA diving within any Special Preservation Area or Midway Atoll Special Management Area***

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

*According to the most recent Maritime Heritage Research, Education, and Management Plan (2011), there are an estimated 126 potential wrecks in PMNM—only 20 historic maritime heritage sites have been confirmed and only a few have been documented with photogrammetry. These sites include 19th century British and American whalers, WWII plane crashes, and terrestrial sites of Hawaiian occupation dating back to 1450 (Kikiloi 2010). In November 2021, it was announced that part of PMNM may be designated as a National Marine Sanctuary, which would require additional surveys and a renewed management plan. As the largest protected area in the Sanctuary System - larger than all other sanctuaries combined - our understanding of the cultural heritage resources is limited by the size and accessibility of the Monument. This project proposes to use the latest in photogrammetry and 360° underwater video to document and allow the public to experience significant heritage sites within PMNM. In collaboration with our data sovereignty specialist and our educators, the data gathered from the expedition will be used to: 1. Inform the NOAA sanctuary management plan, 2. Develop curriculum for primary and post-secondary schools, and 3. Allow the public to experience the cultural heritage that lies within the PMNM.*

*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 **X 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?

*The cultural, natural, and historic resources and ecological integrity will be undisturbed while we conduct our proposed activities at the site. No artifacts or material culture should be moved, or removed from the seafloor. We will be focused on a photography component as well as an education/storytelling component that will not disrupt any of the resources of the Monument. In areas where diving activity is deemed too disruptive to a site, underwater drone photography and video will be used.*

*The team will share any data collected as part of this project, and any intellectual property derived from such data, with one or more local collaborators in ways that follow the (1) FAIR (Findable, Accessible, Interoperable, and Reusable); (2) CARE (Collective Benefit, Authority to Control, Responsibility, Ethics) and; (3) Mai Ka Pō Mai (Native Hawaiian Data governance) principles.*

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?

*Based on the BMPS for Maritime Heritage Sites, no artifacts or material culture should be moved, or removed from the seafloor. There are no long term negative consequences to the Monument. All work and data collection will be educational and used to advocate for the preservation of the marine sanctuary. There are no tangible effects to the Monument, all documentation efforts are intended to contribute to future intellectual and educational efforts of the PMNM's rich cultural heritage sites for wider audiences. The work will provide photo and video documentation of key heritage sites, in perpetuity. We do not anticipate any physical indirect, secondary, or cumulative effects to the site or heritage.*

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.

*Our focus is to document the unique marine heritage sites located within the Monument, therefore there is no practicable alternative.*

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 proposed activities do not have any adverse impacts on the Monument as all activities are not invasive. Natural and historic resources will merely be photographed to create educational material. The result of our project will document marine heritage sites that are integral in the*

*history of the Monument, and will bring the history of such sites to primary and post-secondary students throughout the United States.*

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

*The duration of the activity provides the necessary time to travel to the proposed locations of the wrecks, document the wrecks, and share findings with students via live broadcasts.*

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

*This project will be led by Dr. Justin Dunnavant. As an Assistant Professor of Anthropology and Archaeology at the University of California, Los Angeles, Dr. Dunnavant has been conducting archaeology for more than 15 years. Over the last six years, as an American Academy of Underwater Sciences-accredited (AAUS) Scientific Scuba Diver, he has assisted the National Park Service, the Smithsonian's Slave Wrecks Project, Diving With a Purpose, and SEARCH, Inc. in the search, documentation, and interpretation of shipwrecks throughout Africa, the United States and the Caribbean. In addition to his academic expertise, Dr. Dunnavant is also a Board Member of the National Marine Sanctuary Foundation (https://marinesanctuary.org), which supports the National Marine Sanctuary System, one of which is the Papahānaumokuākea Marine National Monument. As the sole maritime archaeologist on the Board, Dunnavant is leading the Foundation's efforts to foreground submerged heritage resources within the sanctuary system, thus placing the proposed project in alignment with the organization's strategic plan. Finally, Dr. Dunnavant was a former postdoctoral fellow at Vanderbilt University's Spatial Analysis Research Lab where he used photogrammetry and LiDAR to document heritage sites in St. Croix, US Virgin Islands. The data gathered from this project will be used by Dr. Dunnavant to create a photogrammetry workshop that highlights Hawaii submerged heritage and teaches the latest methods in the field.*

g. Provide information demonstrating that you have adequate financial resources available to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.

*The National Geographic Society (NGS), in partnership with Ocean Exploration Trust (OET), are funding teams of Explorers to conduct projects on the E/V Nautilus, one of the world's most sophisticated ocean exploration ships. The funds provided by NGS will cover all expenses related to this project.*

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

*Our non-invasive methods of 3D photogrammetry and 360° video will not have negative impacts on the Monument. No artifacts or material culture will be moved or removed from the seafloor. We will dive safely and carefully so we do not disturb the shipwrecks.*

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

*E/V Nautilus will be obtaining a VMS system in 2022 per the OLE requirements and will have it aboard for the duration of the time the vessel will be in the Monument. The vessel currently utilizes AIS, which it will also retain and have on for the duration of the permitted activities.*

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

*The scope of work, timeline, non-invasive methodology, and intention behind this project is designed to bring awareness to the rich history of PMNM documenting the various cultural heritage sites without disturbance or damage.*

FOR SPECIAL OCEAN USE ACTIVITIES <u>OUTSIDE</u> OF MIDWAY ATOLL SPECIAL MANAGEMENT AREA, ANSWER THE ADDITIONAL THREE FINDINGS BELOW:

k. Explain how your activity will directly benefit the conservation and management of the Monument.

*Photo and video documentation of cultural heritage sites with the Monument is difficult due to the size and the remoteness of the PMNM. Our activities will provide updated photo, video and 3D photogrammetric images of key heritage sites for assessment and potential incorporation into the plans for a National Marine Sanctuary designation.*

l. Explain how the purpose of your activity is for research or education related to the resources or qualities of the Monument.

*The educational purpose of our activity will be to write a curriculum for primary and post-secondary students based on the Hawaii and Kentucky educational standards. This curriculum will include modules on article writing, which will be published in project member Sruthi Gurudev's e-magazine "An Hour in the Deep," as well as modules based on 360° cameras and VR headsets, which will be distributed to select classrooms. Our target learners will include three to five partner schools in Kentucky, Hawaii, and other states in the U.S. with five 5th grade classrooms including approximately 150 students. The curriculum will be implemented in the 2022/2023 school year and conducted in manner in alignment with Kanaka cultural educational practices (Goodyear-Ka'ōpua 2013).*

m. Does the activity involve the use of a commercial passenger vessel (defined as a vessel that carries individuals who have paid for such carriage)?

*No*

FOR SPECIAL OCEAN USE ACTIVITIES WITHIN MIDWAY ATOLL SPECIAL MANAGEMENT AREA, ANSWER THE ADDITIONAL TWO FINDINGS BELOW:

n. Explain how your activity will further the conservation and management of the Monument.

*N/A*

o. How is your activity compatible with the purposes for which the Midway Atoll National Wildlife Refuge was designated?

*N/A*

**NOTE: If this is a first time Special Ocean Use activity, it will be subject to a pilot project and will be restricted in duration. Special Ocean Use activities proposed outside the Midway Atoll Special Management Area will require public notice of the application and an opportunity to provide comments is given at least 30 days prior to issuing the permit.**

**8. Procedures/Methods:**

*During the 16-day voyage within PMNM, we will use underwater cameras and 360° cameras to produce high-quality video and photographs of key cultural heritage sites. Due to the sensitivity of light, water, and weather conditions, photo documentation of the sites will be an iterative process, requiring numerous dives and various camera operators (Drap 2012; Raoult et al. 2016). The cameras will be provided by the research team.*

*We will also photograph our activities underwater and above water on the ship in order to share with classrooms and broadcast live to students in Hawaii and the continental U.S. Our live broadcasts will occur aboard the E/V Nautilus and will detail our methods as well as our various professional experiences as underwater photographers, archaeologists, educators, and data specialists. Team members and citizen scientists will aid in the photo documentation and data collection of both the site and team activities via snorkeling.*

*'An Hour in the Deep' E-Magazine will publish journalistic and multimedia pieces for youth worldwide to tune in and understand the activities undertaken at Papahanaumokuakea Marine National Monument. There will be an additional website created with a "digital mosaic" made*

*up of multimedia tiles that will collect information from all those aboard on the ship to create a beautiful "collective snapshot" from a cultural, scientific, historical, artistic perspective.*

*After the completion of the voyage, the photogrammetric models will be rendered at UCLA due to the computing power needed for rendering the large data files. The photographs will be color-corrected, lens-distortion corrected, and imported into Agisoft Metashape software to render them into 3D images. Computational software will be provided as in-kind service by UCLA.*

**9. Provide proof of general liability insurance, or indicate that you will be posting an equivalent bond against claims arising out of activities conducted under the permit:**

*Ocean Exploration Trust is insured for General Liability through American Casualty Company/Hylant-Cleveland (will be renewed in July), Hull & Machinery through Lloyd's Insurance Co S.A. & Beazley/Leviathan, and Protection & Indemnity through BML/QBE. Ocean ExplorationTrust's general liability limits include a general aggregate limit ($2M), a products/completed operations aggregate limit ($2M), bodily injury/property damage per occurrence limit ($1M), personal injury ($1M), fire damage liability ($1M) and medical payments ($5K).*

**10. If applicable, describe how you are collaborating with others in any way to reduce duplicative activities in the Monument or elsewhere?**

*We have talked to other researchers and marine archaeologists involved in other shipwreck-related projects in the Monument to understand what has been done in the past and what is planned for the future so that our project is relevant but not replicating other work.*

*Additionally, this project from the onset will be collaborating with an indigenous data sovereignty team that aims to enhance data sharing among the local research institutions (i.e., University of Hawaii), stakeholders, communities, and others that are interested in acquiring the collected data. It is the intention for this project to relay the results with Papahānaumokuākea Marine National Monument for reviewing management objectives and strategies. As we believe that data should be available and accessible by anyone, all data and results will be open-access unless there is sufficient reason or request not to release data.*

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

- *Scuba gear (open circuit)*
- *360 camera (GoPro MAX)*
- *Photogrammetry cameras*

- *Underwater camera (DSLR)*
- *VR headsets (Oculus Quest, or similar)*
- *Underwater ROV for filming (Qysea FIFISH V6 Underwater ROV, or similar)*

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

*None*

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

*None*

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

*2018 Raupp, Jason T. "Maritime Archaeology of the Pacific Ocean." Substantive Entry in Encyclopedia of Global Archaeology (Second Edition), Claire Smith and Jo Smith, editors. Springer Press, NY.*

*2017 Roth, Madeline, Jason T. Raupp, Kelly Keogh and Bert Ho. "Exploring the Sunken Military Heritage of Midway Atoll." In Proceedings of the Asian Academy for Heritage Management Asia-Pacific Regional Conference on Underwater Cultural Heritage, Nov 26-Dec 2, 2017. Volume 1:123-140.*

*2016 Price, Melissa, Jason T. Raupp, Kelly Keogh, and John Burns. "Managing a Sigh of Relief: The Wreck of USNS Mission San Miguel." Bulletin of the Australasian Institute for Maritime Archaeology 40:17-26.*

*2015 Raupp, Jason T. '"Thus Ends This Day's Work": Industrial Perspectives on early 19th Century American Whaleships Wrecked in the Northwestern Hawaiian Islands.' Ph.D. Dissertation, Flinders University.*

*2010 Raupp, Jason T. and Kelly Gleason. "Submerged Whaling Heritage in Papahānaumokuākea Marine National Monument." Bulletin of the Australasian Institute for Maritime Archaeology 34:67-76.*

*2010 Gleason, Kelly and Jason T. Raupp. "Lost and Found in Papahānaumokuākea Marine National Monument: The Possible Wreck Site of the Nantucket Whaleship Two Brothers." Historic Nantucket Magazine 60 (3):13-17.*

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.

January 31, 2022

Signature Date

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

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

**DID YOU INCLUDE THESE?**

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

# Papahānaumokuākea Marine National Monument

SPECIAL OCEAN USE 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:** *Hoffmann-Kuhnt, Dr. Matthias*
**Affiliation:** *Acoustic Research Laboratory, National University of Singapore*

**Permit Category: Special Ocean Use**
**Proposed Activity Dates:** *Up to ~23 days between August-October 2022*
**Proposed Method of Entry (Vessel/Plane):** *Vessel (E/V Nautilus)*
**Proposed Locations:** *Shallow water (<100m) within original PMNM boundary; TBD - Nihoa Island, Necker island (Mokumanamana), French Frigate Shoals, Gardner Pinnacles, Maro Reef, Laysan Island. Final locations will be determined based on sea state and weather conditions at the time of the expedition.*

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

*A maximum of twenty-three individuals per expedition - including one or more NGS research teams, citizen scientists, a Native Hawaiian Liaison (identified in coordination with the Monument's Cultural Working Group), and dive support specialists - will be covered by National Geographic Society Expedition Sponsor Program permits.*

*Across all five expeditions a maximum of 107 people will be covered by National Geographic permits.*

**Estimated number of days in the Monument:**

*National Geographic Society will be participating in five expeditions in the Monument over a 72 day period. We anticipate that the duration of this project will be approximately 15 -23 days.*

**Description of proposed activities:** (complete these sentences):

a.) The proposed activity would…

*In partnership with Ocean Exploration Trust and National Geographic Society, we will conduct acoustic recordings of the underwater soundscape of PMNM in the possible presence of*

*cetaceans as well as vocalizing fish in both shallow and open water to gather baseline information about the soundscape of the Monument with new technology that combines synchronized audio and high resolution video.*

b.) To accomplish this activity we would ….

*Our team's project is designed to be non-invasive and passive and is characterized by in-water recordings in the presence of cetaceans conducted by a swimmer/snorkeler or deployed overboard and tethered to a smaller vessel. As a procedure we would locate a possibly interesting species (i.e. spinner dolphins or any other vocalizing animals) and once we would have assessed their behavior, if suitable, would deploy a snorkeler/swimmer with the recording equipment. The snorkeler would then record the animals without disturbing their behavior for anywhere from a couple of minutes to several tens of minutes. The snorkeler would then return to the small boat and we would look for another possibility to record different animals. This process would continue as long as vocalizing animals would be present or until the recording unit would run out of battery power. Eventually the small boat would return to the main vessel and in the evening the data would be analyzed and processed and the unit would be re-charged overnight. Identification of individuals can be conducted visually, and the vocalizations can then be assigned to any animals visible on the video recording. At no time will specimens or physical samples be collected.*

c.) This activity would help the Monument by …

*The research conducted and data collected as part of this project will help us better understand the soundscape of PMNM and how it impacts marine mammals. As the largest conservation area in the country, the Monument provides an opportunity to gather baseline underwater synchronized acoustic and video data of this region, and the marine mammals that rely on it for survival, for the first time. Data gathered under this permit can shed insight on whether marine managed areas foster a healthier underwater soundscape, and serve as a baseline for comparison to unmanaged, heavily trafficked regions that experience more anthropogenic noise pollution.*

**Other information or background**:

*The National Geographic Society is a global nonprofit that uses the power of science, exploration, education, and storytelling to illuminate the wonder of our world. For more than 130 years, the Society has identified and funded trailblazing scientists, researchers, conservationists, storytellers, and educators—known as National Geographic Explorers—from around the world who are working to better understand our world and everything in it.*

*To expand this work to help safeguard the world's ocean, the National Geographic Society is partnering with Ocean Exploration Trust from August — October 2022 by leveraging their ship, the E/V Nautilus, to conduct five research expeditions led by National Geographic Explorers in Papahānaumokuākea Marine National Monument. The Society has submitted permit applications for five distinct research projects, which together form the "National Geographic*

*Society Expedition Sponsor Program." Some of the five NGS expeditions will include multiple NGS research teams,and some of the NGS research teams will join multiple expeditions. During the period when the NGS teams are onboard, Ocean Exploration Trust will simultaneously be conducting seafloor mapping surveys funded by NOAA Ocean Exploration, focusing on areas that have not previously been mapped at high resolution.*

*In addition to the identified Explorers who will conduct work on the ship, each expedition will be joined by a number of citizen scientist participants. These individuals will join each expedition and participate in the scientific projects through daily citizen science activities through which they will assist in collecting data and conducting analysis under the guidance of the National Geographic Explorers leading each project. Citizen science activities will include participating in photo documentation and data collection while snorkeling, supporting species identification, participating in educator engagement, and contributing to a digital multimedia mosaic. Different citizen scientists will join each expedition.*

*Each expedition will also be joined by a Native Hawaiian Liaison, identified in collaboration with the Monument's Cultural Working Group. We anticipate that there will be a different Liaison on each of the five expeditions.*

## Section A - Applicant Information

**1. Applicant**

Name (last, first, middle initial): *Hoffmann-Kuhnt, Matthias*

Title: *Dr. Rer Nat*

**1a. Intended field Principal Investigator (See instructions for more information):**

*Hoffmann-Kuhnt, Matthias*

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

[redacted]

For students, major professor's name, telephone and email address: *N/A*

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

*Acoustic Research Laboratory, National University of Singapore*

**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):**

*Carissa Cabrera - Education Specialist*
*Abel Ho - Research Technician*
*TBD - Native Hawaiian Liaison*
*7 to 12 Citizen Scientists for each expedition this project is on. Shannon Bartlett will join one expedition as a citizen scientist.*

## Section B: Project Information

| **5a. Project location(s):** | | **Ocean Based** | |
|---|---|---|---|
| **X** Nihoa Island | ☐ Land-based | **X** Shallow water | ☐ Deep water |
| **X** Necker Island (Mokumanamana) | ☐ Land-based | **X** Shallow water | ☐ Deep water |
| **X** French Frigate Shoals | ☐ Land-based | **X** Shallow water | ☐ Deep water |
| **X** Gardner Pinnacles | ☐ Land-based | **X** Shallow water | ☐ Deep water |
| **X** Maro Reef | ☐ Land-based | **X** Shallow water | ☐ Deep water |
| **X** Laysan Island | ☐ Land-based | **X** 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:

*Shallow water (<100m) within original PMNM boundary; TBD - Nihoa Island, Necker island (Mokumanamana), French Frigate Shoals, Gardner Pinnacles, Maro Reef, Laysan Island. Final locations will be determined based on sea state and weather conditions at the time of the expedition.*

**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
***X Anchoring a vessel*** *- Anchoring the E/V Nautilus 5.5-meter RHIB supporting SCUBA/snorkeling operations is not planned but may be required for longer SCUBA/snorkeling dives or in the event of engine failure. If anchoring should be necessary, the team will endeavor to have divers/snorkelers hand place anchors to minimize any potential impact to underwater fauna and substrate.*
☐ 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)
***X Swimming, snorkeling, or closed or open circuit SCUBA diving within any Special Preservation Area or Midway Atoll Special Management Area***

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

*The purpose of the proposed activity is to gather baseline soundscape data on the Monument in the context of marine mammals, specifically cetaceans. Since the Monument is a marine managed area, it does not face the same pressures of anthropogenic disturbance and noise pollution as other regions around the Hawaiian archipelago. This undisturbed environment provides an opportunity to gather data on the vocalizations, communication, and sounds produced and utilized by cetaceans. Due to the unpredictable nature of cetacean movement, we will be opportunistically gathering the sound data along and throughout the OET route as marine mammals are identified by our crew. We will be gathering all data through swimming/snorkeling offshore of the island and atolls. Sound recordings will be gathered by casting the apparatus off the side of the boat (entirely noninvasive) or by a swimmer/snorkeler operator in the water. The collection mechanism will be decided based on the behavior of the animal, the ocean conditions at the time, and the feasibility of obtaining a recording.*

*We will be utilizing advanced underwater video technology that can identify the specific individual animal responsible for a sound. The system consists of four hydrophones with a frequency range of about 100 Hz to 200 kHz, a data acquisition card with onboard computer and data storage, a set of custom built amplifiers, a Z-cam video camera capable of recording at 6K resolution, and a superwide angle lens with 175 degrees of FOV. The whole system is contained in a custom built underwater housing with the camera being at one end of the underwater housing and three of the four hydrophones forming an equilateral triangle with the camera in its center. The fourth hydrophone is placed outside the plane of the other hydrophones to resolve any forward/backwards ambiguity for the location of any soundsource. The acoustic and video data are exactly synchronized - this allows us later to calculate in post-processing the exact location of any sound recorded and then mark that location on the video for each frame.*

*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)? **X Yes** ☐ No

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

*While we do not intend to record federally protected species beyond the Monument's best practices, we will be opportunistically targeting marine mammals, specifically cetaceans, found within the Monument and may encounter marine animals closer than 100 meters. We will always aim to abide by the listed protocols. Based on known species in the area, we may encounter any of the following marine mammals:*

- *False Killer Whale*
- *Sperm Whale*
- *Short-finned pilot whale*
- *Spinner dolphin*
- *Cuvier's beaked whale*

- *Spotted dolphin*
- *Bottlenose dolphin*
- *Striped dolphin*
- *Pygmy killer whales*
- *Fraser's dolphin*

*An experienced marine mammal scientist would deploy the equipment by snorkeling. Citizen scientists would not enter the water in the presence of marine mammals. If there are certain species for which the Monument would prefer that even experienced marine mammal scientists not be in the water then we can try to record by releasing the equipment overboard from a small boat– however, the chances of obtaining a good recording that would also allow a visual identification are much less since the orientation of the device is much more difficult, if not impossible to control.*

For a list of terrestrial species protected under the Endangered Species Act visit:
http://www.fws.gov/endangered/
For a list of marine species protected under the Endangered Species Act visit:
http://www.nmfs.noaa.gov/pr/species/esa/
For information about species protected under the Marine Mammal Protection Act visit:
http://www.nmfs.noaa.gov/pr/laws/mmpa/

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

The Findings are as follows:

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

*The proposed activity (recording the sound scape of the Monument in various locations) will have minimal impact on the resources found in the region. The research consists exclusively of non-invasive recordings, and the associated equipment will be operated by a swimmer/snorkeler. After acoustic and visual data collection, the swimmer/snorkeler will return to the vessel. During recording activities, the swimmer/snorkeler will not touch any benthic habitat, such as coral reef. It is important to note our research activities do not include any sample collection, and our activities do not place the habitat at risk of adverse effects.*

*The team will share any data collected as part of this project, and any intellectual property derived from such data, with one or more local collaborators in ways that follow the (1) FAIR (Findable, Accessible, Interoperable, and Reusable); (2) CARE (Collective Benefit, Authority to Control, Responsibility, Ethics) and; (3) Mai Ka Pō Mai (Native Hawaiian Data governance) principles.*

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?

*The activities under this permit will include noninvasive recording by a core team of swimmers. The recordings are purely passive and do not have any effect on the wildlife. We will only be there to observe and record (acoustically and visually) the natural behavior of the animals. If we would feel that we would affect the natural behavior we would discontinue the recording.*

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.

*The project is critical to improving our understanding of PMNM because the soundscape of this protected area has not been evaluated before, and soundscape data provides a scalable tool for understanding the health of the Monument. There is no practical alternative to the proposed work because the purpose is to a) document the soundscape of various places in the Monument, and share this with scientists, resource managers, and the public to enable understanding the monument in new ways- and b) to record vocalizing marine animals and their interactions with each other to help inform management of PMNM.*

*Additionally, PMNM offers a unique and rare opportunity to better understand how MPAs cultivate a different environment for marine mammals, and other species that play key roles in the Monument's biodiversity. As vessel traffic (leisure and commercial traffic) is very limited in the Monument this will provide an unparalleled reference of what a healthy and intact soundscape should sound like - and can then serve as a reference point for comparison with recordings of other areas with high recreational and commercial vessel traffic, while also serving as baseline data for PMNM.*

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

*Sound is one of the most important sensory channels for aquatic life - from fish fry finding the reef based on the noise activity to active communication between marine mammals to navigate, find food and interact with each other. Given the fact that the Monument is the largest protected Marine Sanctuary in the US it makes it rather difficult to monitor and manage considering the vast areas that are to be covered. The data that will be obtained through the soundscape recordings are a scalable and representative tool for the understanding of the health and integrity of the Monument - thus creating an important baseline that can be integrated in a broader management strategy. Additionally, obtaining sound scape data on these rich and diverse ecologies will lead to better understanding of the importance of sound for aquatic animals and the impact that sound pollution has on their ability to forage, navigate and communicate. This outweighs any possible adverse impact that might be temporarily created by the presence of the vessel and the swimmer/snorkeler in the water.*

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

*The duration of the recordings will be determined by the presence of vocalizing animals and their behavior. Since we want to record the natural acoustic behavior, if we felt that our presence would affect the behavior of the animals we would end the recording and return to the vessel. Total recordings per day is also limited to the battery life of the unit (charging has to take place in the vessel overnight)*

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

*I have more than 25 years of animal behavior research experience with wild animals in regions as diverse as the humpback whales in Maui, the Dominican Republic and South Africa, spotted and bottlenose dolphins in the Bahamas, and other species. I am confident that based on my experience I will be able to make responsible judgements and to mitigate any potential impact.*

g. Provide information demonstrating that you have adequate financial resources available to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.

*The National Geographic Society (NGS), in partnership with Ocean Exploration Trust (OET), are funding teams of Explorers to conduct projects on the E/V Nautilus, one of the world's most sophisticated ocean exploration ships. The funds provided by NGS will cover all expenses related to this project.*

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.

*As stated earlier, the methods applied for the project are purely passive - we only observe the natural status and possible interaction of the animals*

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

*E/V Nautilus will be obtaining a VMS system in 2022 per the OLE requirements and will have it aboard for the duration of the time the vessel will be in the Monument. The vessel currently utilizes AIS, which it will also retain and have on for the duration of the permitted activities.*

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

*The scope of work, timeline, non-invasive methodology, and intention behind this project is designed to maximize our knowledge and understanding of the PMNM's underwater soundscape without disturbance or damage.*

FOR SPECIAL OCEAN USE ACTIVITIES OUTSIDE OF MIDWAY ATOLL SPECIAL MANAGEMENT AREA, ANSWER THE ADDITIONAL THREE FINDINGS BELOW:

k. Explain how your activity will directly benefit the conservation and management of the Monument.

*We still understand very little regarding the underwater soundscape, despite how much further sound travels and how many marine species depend on it for survival. Further, noise pollution remains a threat to the survivability of marine mammals, specifically cetaceans, that depend upon sound to communicate. With new technology able to pinpoint sound sources in underwater recordings, we have an opportunity to discover insights on the use of underwater sounds by cetaceans. PMNM provides a unique opportunity to record and observe this soundscape in a marine managed area with little to no vessel noise. PMNM can thus serve as a baseline of a healthy, natural, and intact underwater soundscape to compare other regions within Hawai'i to.*

l. Explain how the purpose of your activity is for research or education related to the resources or qualities of the Monument.

*The purpose of these activities is to expand our knowledge and understanding of the ecological quality of the Monument, and to develop and share invaluable and unique educational resources focused on the Monument's soundscape with students in Hawai'i and beyond.*

*This project, and the Monument, will allow us to develop and share a story about the importance of a healthy underwater soundscape, how marine megafauna rely on sound for survival, and how noise pollution can disrupt that sound. Without the protected and non-trafficked qualities of Monument, we would be unable to gather this information. Further, insights from this federally managed area will help to inform conservation of other regions which are subject to higher levels of noise pollution.*

m. Does the activity involve the use of a commercial passenger vessel (defined as a vessel that carries individuals who have paid for such carriage)?

*No*

FOR SPECIAL OCEAN USE ACTIVITIES WITHIN MIDWAY ATOLL SPECIAL MANAGEMENT AREA, ANSWER THE ADDITIONAL TWO FINDINGS BELOW:

k. Explain how your activity will further the conservation and management of the Monument.

*N/A*

l. How is your activity compatible with the purposes for which the Midway Atoll National Wildlife Refuge was designated?

*N/A*

**NOTE: If this is a first time Special Ocean Use activity, it will be subject to a pilot project and will be restricted in duration. Special Ocean Use activities proposed <u>outside</u> the Midway Atoll Special Management Area will require public notice of the application and an opportunity to provide comments is given at least 30 days prior to issuing the permit.**

**8. Procedures/Methods:**

*The following procedure will be used for marine mammal recordings:*

*Once a promising site (possibly at a reef or in the open ocean) with vocalizing animals has been determined, the zodiac with the snorkeler(s), citizen science observers, and the equipment would approach the site. Based on the behavior of the animals we would then decide whether to enter the water. If we decide to enter the water, the equipment would be switched on, and a swimmer/snorkeler would operate the equipment in the water and record the behavior and vocalizations of the animals. Equipment would always be deployed by an experienced marine mammal scientist. When the animals leave the visible range of the camera the swimmer/snorkeler would return to the zodiac and hand the equipment back to the people in the zodiac and exit the water. After that a new set of recordings might be done with different animals. This procedure would continue throughout the day to collect as many recordings as possible or until the system has run out of battery power, at which point we would return to the main research vessel. The data would be downloaded and analyzed in the evenings and the system would be recharged.*

*Encounters with marine mammals can either be opportunistic (i.e. the equipment is already deployed and marine mammals approach the snorkeler or pass through the area) or planned - that is to say that observers on the ship or the smaller vessel would try to locate marine mammals before deploying the snorkeler with the equipment in the water. The best data is collected when the marine mammal is also visible on camera - so approximately 10 m away from the system. The smaller boat would stay further away from the animal so as not to disturb its behavior but remain close enough to ensure the safety of the person in the water.*

*Only experienced marine mammal scientists would be entering the water - not any of the citizen scientists. Operating the equipment and gauging the behavior of marine mammals takes a lot of experience, especially as we don't want to disturb the behavior of the animals. The citizen scientists will help with observations, record keeping and data analysis and animal spotting. The purpose of having a snorkeler in the water is to ensure that the equipment is running correctly and more importantly to aim the system in the direction of the marine mammals - which could change rapidly over the course of the recordings - and while acoustic recordings will still be*

*possible if the animals are not longer visible in the field of view of the camera a definitive identification of the vocalizing animal is not longer possible.*

*Since the goal is to record the natural behavior of the animals, the snorkeler will always attempt to not influence the behavior - but it is possible that some animals may react to the presence of the person in the water. No snorkeler or small vessel will pursue the animals if they decide to leave or move on to another area - that might affect the behavior and thus nullify the goal of observing the natural behavior of the animals without external interference.*

*We are currently in negotiation with permit holders for a NMFS Protected Species Permit to be part of the expedition. Dr Adam Pack from the University of Hawaii in Hilo has already agreed that we could operate under his NMFS marine mammal permit (permit number 19655) and we would have him be part of the expedition. He is currently applying for a new 5 year permit and will be applying for an extension of his existing permit to cover the dates of this expedition until the new permit is in effect. He has held marine mammal research permits for several decades, conducting research in Hawaii and Alaska on a variety of marine mammal species such as humpback whales, spinner dolphins and many other species.*

*The following procedures would be used for soundscape recordings…*

*The same equipment would be used to record high-bandwidth soundscape data. In contrast to the recordings of marine mammals for which only experienced marine mammal scientists would enter the water, for soundscape recordings the citizen scientists could also enter the water to operate the equipment under supervision of experienced personnel.*

*For each reef recording two people (one citizen scientist and one experienced marine mammal researcher) would enter the water. The equipment would be operated by the citizen scientist and he/she would learn and gain experience on how to record reef sounds while swimming with the equipment. The team would try to minimize any noise-producing movements while directing the equipment towards the reef. We would record in fixed length segments of 10 min - then move to a different spot on the reef and start another recording. How many soundscape recordings will be done will depend on the local conditions including the size and depth of the reef, currents and wave conditions as well the battery life of the equipment. Once the recordings are finished the two snorkelers would return to the small boat and and a new location would be selected. The data would then be downloaded and a preliminary analysis would be performed in the evening.*

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

**9. Provide proof of general liability insurance, or indicate that you will be posting an equivalent bond against claims arising out of activities conducted under the permit:**

*Ocean Exploration Trust is insured for General Liability through American Casualty Company/Hylant-Cleveland (will be renewed in July), Hull & Machinery through Lloyd's*

*Insurance Co S.A. & Beazley/Leviathan, and Protection & Indemnity through BML/QBE. Ocean ExplorationTrust's general liability limits include a general aggregate limit ($2M), a products/completed operations aggregate limit ($2M), bodily injury/property damage per occurrence limit ($1M), personal injury ($1M), fire damage liability ($1M) and medical payments ($5K).*

**10. If applicable, describe how you are collaborating with others in any way to reduce duplicative activities in the Monument or elsewhere?**

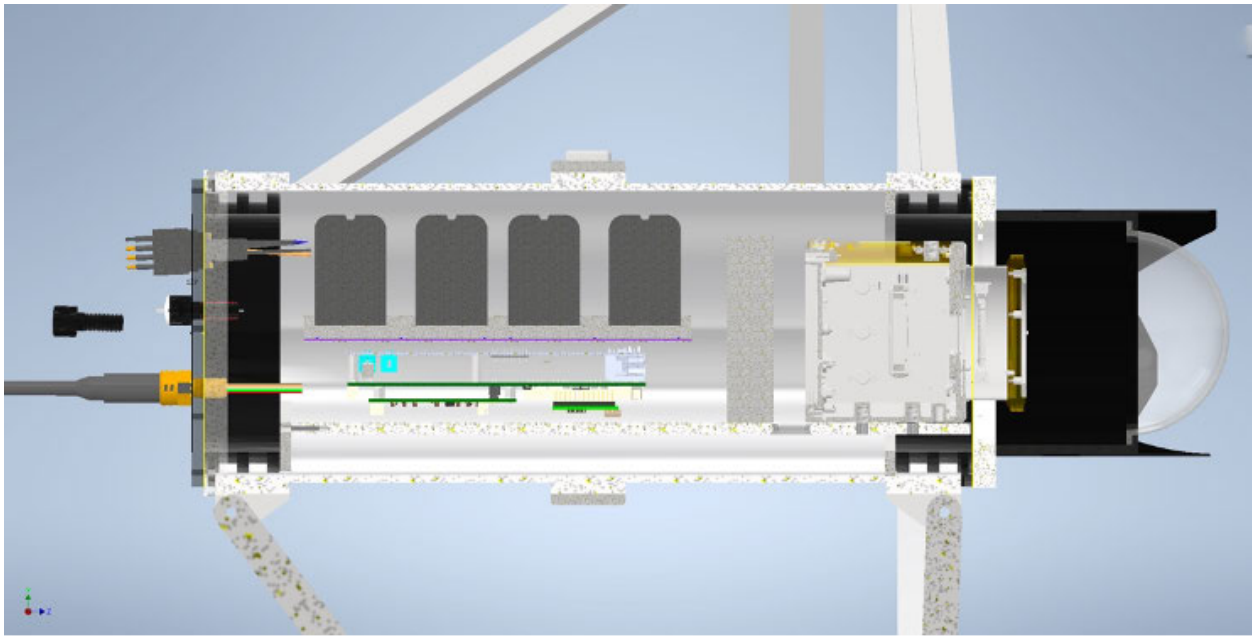
*We are using custom-built equipment, which has not been previously used in the Monument. Additionally, we are not aware of any past soundscape studies that cover the same frequency range and include video in the Monument, so this will not be duplicative.*

*This project from the onset will be collaborating with an indigenous data sovereignty team that aims to enhance data sharing among the local research institutions (i.e., University of Hawaii), stakeholders, communities, and others that are interested in acquiring the collected data. It is the intention for this project to relay the results with Papahānaumokuākea Marine National Monument for reviewing management objectives and strategies. As we believe that data should be available and accessible by anyone, all data and results will be open-access unless there is sufficient reason or request not to release data.*

**11. List all specialized gear and materials to be used in this activity:**

We will be using a custom-built data acquisition system that consists of 4 hydrophones, a high-resolution video camera, a data acquisition board and some control electronics all hosed in a custom aluminum housing - except for the hydrophones which will be mounted on a frame forming a equilateral triangle with the camera in the center. This device is battery powered and operated by a swimmer/snorkeler.

Below are some photos and and drawings of the equipment:



- Cross section of the recorder housing with the camera in the front and the electronics and batteries behind it – controls are in the back.

○ The system completely assembled and ready for deployment with electronic and camera housing in the center and three arms forming an equilateral triangle with 4 hydrophones (3 in a plane with the camera and one behind)

o The system being tested at our test pool at the laboratory.

The setup is manually operated – the system can be started up before being deployed but each recording is started and stopped manually. Different length of array arms can be mounted to adjust the system to higher or lower frequencies.he photos shown here are from the largest array setup with a separation of 120cm between hydrophones used to record species with lower frequency vocalizations (i.e. humpback whales) - for recordings of smaller marine mammals with high frequency vocalizations a system with smaller array (i.e 60 cm or less between hydrophones) would be used.

Contingency Plans.

Although deployment by a snorkeler will generate far superior data, we can additionally deploy the equipment without entering the water. It is possible to deploy the system over the side of the small vessel via system of ropes in instances where a snorkeler would not be able to enter the water, and several different orientations of deployment would be possible - but any deployment

via ropes would dramatically reduce the ability to point the system in the direction of the animals since the system would then freely rotate and be at the mercy of currents, wave and winds.

If we need to deploy directly off the small boat, the system would be attached to a surface marker buoy (SMB) The system would be pointing directly down with the hydrophones about 50 cm below the surface. Any animals passing under the the system would be recorded. The SMB would provide the necessary buoyancy to keep the system at the desired depth while separating it from the vessel to avoid creating any unwanted noise.

We can also deploy the system from the SMB at a second orientation, in which the system would be at a depth of 20m and the camera would be pointing up. This orientation would allow us to record any animals passing over the top of the camera - here the system would also be tethered to the vessel. A final deployment option horizontally deploying the system via the ropes to point at animals that might pass at the surface. However, the chances of keeping the orientation consistent throughout the recoding are low since currents, waves and wind would constantly affect the positioning. For these reasons it is highly preferable to instead have a marine mammal researcher deploy the equipment while snorkeling, as described in the Procedures/Methods section.

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

*None*

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

*None*

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

*Matthias Hoffmann-Kuhnt., Ho, A., Herzing, D., & Chitre, M. (2018). Whistling By – Issues with Identifying Moving Vocalising Dolphins. In: 8th International Workshop on Detection, Classification, Localization, and Density Estimation of marine mammals using passive acoustics. France.*

*Hoffman-Kuhnt, M., & Herzing, D. (2016). Whose Line Sound is it Anyway? Identifying the Vocalizer on Underwater Video by Localizing with a Hydrophone Array. Animal Behavior and Cognition, 3(4), 288-298.*

*Hoffmann-Kuhnt, M, P. J. Seekings and M. A. Chitre, "ASPOD – Acoustic Source Position Overlay Device - real-time visual and acoustic localization of marine mammals". Program of the 18th Biennial Conference on the Biology of Marine Mammals (2009). Quebec: Marine Mammal Society. (18th Biennial Conference on the Biology of Marine Mammals, 10 - 16 Oct 2009, Convention Center, Quebec, Canada)*

*Potter, J R, A. A. Pack, J. Reidenberg, M. Hoffmann-Kuhnt, P. J. Seekings, M. A. Chitre, T. B. Koay and L. M. Herman, "Humpback whale song source location in the head, source levels and directionality from in-situ rebreather diver recordings". Proceedings of the 17th Biennial conference on the biology of marine mammals, ed. Peter Best and Marthan Bester, comp. Michelle du Toit (2007): 504. San Francisco: Society for Marine Mammals. (17th Biennial conference on the biology of marine mammals, 29 Nov - 3 Dec 2007, Cape Town International Convention Centre, Cape Town, South Africa) (Oral Presentation with associated 14-minute video screened separately).*

*Hoffmann-Kuhnt, M, J. R. Potter, A. A. Pack, T. B. Koay, M. Deakos, L. M. Herman and C. Durville, "Up close and personal: recording humpback whale song at close ranges (10-50m)". Oceans 2003 Marine Technology and Ocean Science Conference (MTS/IEEE) (2003) (Oceans 2003 Marine Technology and Ocean Science Conference (MTS/IEEE), 22 - 26 Sep 2003, San Diego, United States)*

*Potter, J. R., A. Pack, M. Hoffmann-Kuhnt, T. B. Koay, P. J. Seekings and M. A. Chitre, "A Synchronised Acoustic Array, Rangefinder & Video System With Examples From 'Singing' Humpback Whales (Megaptera Noveangliae)". Proceedings of the 21st conference of the European Cetacean Society, Donsotia - San Sebastian, ed. Peter Evans, comp. ECS (2007). Oxford: ECS. (European Ceatacean Society 21st Annual Conference, 23 - 25 Apr 2007, Kursaal, Donostia-San Sebastian, Spain) (Short paper version of an oral presentation and a video presentation given at the conference.).*

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.

February 1, 2022

Signature Date

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

NOAA/Inouye Regional Center
NOS/ONMS/PMNM/Attn: Permit Coordinator
1845 Wasp Blvd, Building 176

Honolulu, HI 96818
FAX: (808) 455-3093

**DID YOU INCLUDE THESE?**

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

# Papahānaumokuākea Marine National Monument

SPECIAL OCEAN USE 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:** *Leonardo*, *Teresa*
**Affiliation**: *National Geographic Society*

**Permit Category: Special Ocean Use**
**Proposed Activity Dates:** *Up to ~23 days between August-October 2022*
**Proposed Method of Entry (Vessel/Plane):** *Vessel (E/V Nautilus)*
**Proposed Locations:** *Shallow water (<100m) within original PMNM boundary; TBD - French Frigate Shoals, Gardner Pinnacles, Maro Reef, Laysan Island. Final locations will be determined based on sea state and weather conditions at the time of the expedition.*

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

*A maximum of twenty-three individuals per expedition - including one or more NGS research teams, citizen scientists, a Native Hawaiian Liaison (identified in coordination with the Monument's Cultural Working Group), and dive support specialists - will be covered by National Geographic Society Expedition Sponsor Program permits.*

*Across all five expeditions a maximum of 107 people will be covered by National Geographic permits.*

**Estimated number of days in the Monument:**

*National Geographic Society will be participating in five expeditions in the Monument over a 72 day period. We anticipate that the duration of this project will be approximately 15 -23 days.*

**Description of proposed activities:** (complete these sentences):

a.) The proposed activity would…

*… support effective management of the Papahānaumokuākea Marine National Monument (PMNM) through an investigation of three components that are critical to an understanding of change under current and future climate regimes: baseline habitat and fish surveys, carbonate budgets, and genomics of* Montipora capitata*, a coral that has shown an ability to thrive under higher temperatures and lower pH conditions. A parallel goal is to provide*

*opportunities for knowledge sharing to enhance an understanding of PMNM, and the changes it faces. Materials will be designed (especially for and with Hawaiian partners) to highlight the value of marine and cultural resources in order to protect Hawaiian heritage. Our goal is to understand the unique natural and cultural characteristics of the PMNM, document this journey through ArcGIS multimedia storytelling, and engage with youth to train the next generation of explorers and PMNM guardians.*

b.) To accomplish this activity we would ….

*…focus on achieving six objectives:*

*Obj 1 - To characterize the coral reef habitat, and fish abundance and diversity of the PMNM through reef surveys (using standard methods and photo quadrats).*

*Obj 2 - To estimate current carbonate budgets (a critical ecosystem service for wave attenuation and shoreline protection) of the PMNM using underwater photogrammetry and coral sampling (Montipora, Porites, and Pocillopora spp.).*

*Obj 3 - To characterize the abundance and characteristics of Montipora capitata, a sometimes 'weedy' coral that shows potential for adaptation under climate change conditions through 1) underwater photogrammetry and standard reef surveys (including colony morphology), and 2) in situ DNA sequencing (Oxford Nanopore technology) to investigate fine-scale population genomics and genes under selection.*

*Obj 4 - To create an educational resource that highlights the significance of exploration, investigation, the importance of coral reefs, cutting-edge technologies to evaluate and protect them (e.g. Nanopore technology, underwater photogrammetry, GIS, and image analysis).*

*Obj 5 - To promote local advocacy and stewardship by integrating scientific and indigenous knowledge through storytelling and the recognition of shared narratives.*

*Obj 6 - To capture the work of the expedition and document the coral reefs using hand-held, non-substrate, fixed, still photography, as well as motion and limited hydrophone recorded sound.*

c.) This activity would help the Monument by …

*This activity would help the Monument by improving our understanding of coral reefs under current and future climate regimes and filling the knowledge gaps in our understanding of how large and far from human pressure marine protected areas affect coral reefs in terms of habitat and fish, carbonate budgets, and population genomics of Montipora capitata which is important for the current and future management of PMNM. In addition, our activity includes creating educational resources combining multimedia storytelling and shared narratives with Native Hawaiians, which will help engage future PMNM guardians.*

**Other information or background**:

*The National Geographic Society is a global nonprofit that uses the power of science, exploration, education, and storytelling to illuminate the wonder of our world. For more than 130 years, the Society has identified and funded trailblazing scientists, researchers, conservationists, storytellers, and educators—known as National Geographic Explorers—from around the world who are working to better understand our world and everything in it.*

*To expand this work to help safeguard the world's ocean, the National Geographic Society is partnering with Ocean Exploration Trust from August — October 2022 by leveraging their ship, the E/V Nautilus, to conduct five research expeditions led by National Geographic Explorers in Papahānaumokuākea Marine National Monument. The Society has submitted permit applications for five distinct research projects, which together form the "National Geographic Society Expedition Sponsor Program." Some of the five NGS expeditions will include multiple NGS research teams,and some of the NGS research teams will join multiple expeditions. During the period when the NGS teams are onboard, Ocean Exploration Trust will simultaneously be conducting seafloor mapping surveys funded by NOAA Ocean Exploration, focusing on areas that have not previously been mapped at high resolution.*

*In addition to the identified Explorers who will conduct work on the ship, each expedition will be joined by a number of citizen scientist participants. These individuals will join each expedition and participate in the scientific projects through daily citizen science activities through which they will assist in collecting data and conducting analysis under the guidance of the National Geographic Explorers leading each project. Citizen science activities will include participating in photo documentation and data collection while snorkeling, supporting species identification, participating in educator engagement, and contributing to a digital multimedia mosaic. Different citizen scientists will join each expedition.*

*Each expedition will also be joined by a Native Hawaiian Liaison, identified in collaboration with the Monument's Cultural Working Group. We anticipate that there will be a different Liaison on each of the five expeditions.*

## Section A - Applicant Information

### 1. Applicant

Name (last, first, middle initial): *Leonardo, Teresa*

Title: *Director, Citizen Science and Special Projects*

### 1a. Intended field Principal Investigator (See instructions for more information):

*Nunez Lendo, C. Isabel*

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

[redacted]

[redacted]

For students, major professor's name, telephone and email address: *N/A*

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

*National Geographic Society (Leonardo)*
*University of Technology Sydney (Lendo)*

**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):**

*Turner, Sandra - Global Climate Change Specialist & Ocean Educator;*
*de Castro, Llenel - Archeologist, Educator, and Heritage researcher.*
*Crane, Nicole - Conservation scientist, Ecologist, Scientific diving officer and research diver*
*Bernardi, Giacomo - Molecular biologist, Fish Biologist, and research diver*
*Doubilet, David - National Geographic Contributing Photographer*
*Hayes, Jennifer - National Geographic Contributing Photographer*
*TBD - Native Hawaiian Liaison*
*7 to 12 Citizen Scientists for each expedition this project is on. Ian Miller will join one expedition as a citizen scientist.*

*TBD - Dive Safety Officer*
*TBD - Diver Medical Technician*
*TBD - Dive support 1*
*TBD - Dive support 2*

## Section B: Project Information

**5a. Project location(s):**

| | | Ocean Based | |
|---|---|---|---|
| ☐ Nihoa Island | ☐ Land-based | ☐ Shallow water | ☐ Deep water |
| ☐ Necker Island (Mokumanamana) | ☐ Land-based | ☐ Shallow water | ☐ Deep water |
| **X** French Frigate Shoals | ☐ Land-based | **X** Shallow water | ☐ Deep water |
| **X** Gardner Pinnacles | ☐ Land-based | **X** Shallow water | ☐ Deep water |
| **X** Maro Reef | ☐ Land-based | **X** Shallow water | ☐ Deep water |
| **X** Laysan Island | ☐ Land-based | **X** 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:

*Shallow water (<100m) within original PMNM boundary; TBD - Nihoa Island, Necker island (Mokumanamana), French Frigate Shoals, Gardner Pinnacles, Maro Reef, Laysan Island. Final locations will be determined based on sea state and weather conditions at the time of the expedition.*

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

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

☐ 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

***X Anchoring a vessel -*** *Anchoring the E/V Nautilus 5.5-meter RHIB supporting SCUBA/snorkeling operations is not planned but may be required for longer SCUBA/snorkeling dives or in the event of engine failure. If anchoring should be necessary, the team will endeavor to have divers/snorkelers hand place anchors to minimize any potential impact to underwater fauna and substrate.*

☐ Deserting a vessel aground, at anchor, or adrift
☐ Discharging or depositing any material or matter into the Monument
***X Touching coral, living or dead***
☐ Possessing fishing gear except when stowed and not available for immediate use during passage without interruption through the Monument
☐ Attracting any living Monument resource
☐ Sustenance fishing (Federal waters only, outside of Special Preservation Areas, Ecological Reserves and Special Management Areas)
☐ Subsistence fishing (State waters only)
***X Swimming, snorkeling, or closed or open circuit SCUBA diving within any Special Preservation Area or Midway Atoll Special Management Area***

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

*The Papahānaumokuākea Marine National Monument (PMNM) is among the largest (1.51 million km²) marine conservation areas in the world. It supports a rich diversity of habitats and life, such as coral islands and reefs, seamounts, banks, and shoals, associated with a unique array of terrestrial and marine flora and fauna, many of which are endemic to the Hawaiian Archipelago. The natural endemism of the area makes it a priority in Hawaiian ecosystem management plans. Moreover, this unique area is of great importance to Native Hawaiians, with significant cultural sites found on Nihoa and Mokumanamana. In particular, Mokumanamana has the highest density of sacred sites in the Hawaiian Archipelago and has spiritual significance in Hawaiian cosmology. This unique configuration was recognized in 2010 when PMNM was designated as a mixed (natural and cultural) World Heritage Site by UNESCO delegates. The management of such a complex system, more challenging than ever due to the current and projected climate crisis, requires the inclusion of local communities in the decision-making process.*

*Among our collective challenges is the worldwide recognition of drastic coral decline due to a wide range of anthropogenic pressures, including climate change and other local stressors. This global situation poses uncertainty to the current and future status of the coral reefs of PMNM, including coral and reef-associated fish. Moreover, the amount of carbonate the reefs store is also at stake in this projected warming climate. Reef carbonate budgets are directly linked to the vital ecosystem services of wave attenuation and shoreline protection so much needed for islands. In addition, shifts in coral assemblages are being observed on Hawaiian shore reefs. In particular, Montipora coral seems to be capable of withstanding some local and global anthropogenic pressures. Looking at their population structure is more important than ever to understand how human-distanced reefs cope with climate change. Therefore, the PMNM is the ideal ecological scenario to address these research questions. Moreover, the environmental features are embedded in a context of strong Native Hawaiian identity and the need to engage local communities to be the next generation of explorers and PMNM guardians to best manage this unique area.*

*Interestingly, the story of PMNM is one-of-its-kind since it mixes natural and cultural heritage. However, this story can only be entirely told if we recognize and honor its multiple values and meanings to a wide array of stakeholders. Therefore, the PMNMsets a unique scenario to integrate different knowledge and voices, including conservation, research, technology, education, storytelling, and cultural identity and heritage. The remarkable history behind Hawaiian culture is that they were the ancient explorers of these islands. By telling the stories of scientific research explorations alongside Native Hawaiian narratives of exploring their home islands, we can better understand the importance of PMNM.*

*In this context, the purpose of our proposed activity is to support effective management of the PMNM through an investigation of three components that are critical to an understanding of change under current and future climate regimes: baseline habitat and fish surveys, carbonate budgets, and genomics of Montipora capitata, a coral that has shown an ability to thrive under higher temperatures and lower pH conditions. The data collected will be used first and foremost to inform the Monument how effective the established conservation and management initiatives are at protecting local coral reefs. Moreover, there will be a comparison of data to monitor and identify any trends from previous studies relating to any changes in coral reef status within the Monument, and compare coral reefs at PMNM with other protected areas as well as identify effective management approaches that can be adopted in more remote areas. A parallel goal is to provide opportunities for knowledge sharing to enhance an understanding of PMNM, and the changes it faces. Materials will be designed (especially for Hawaiian partners) to highlight the value of marine and cultural resources in order to protect their heritage.*

*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 **X No**

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

*We do not intend to record federally protected species beyond the Monument's best practices. The reef habitat and fish surveys will be video recorded and are primarily aimed at documenting benthic organisms, including coral, as well as fish; however, due to the non-selectiveness of this method, other protected species of coral and invertebrates may be captured on video as well. Any video or imagery recorded using diver-operated camera systems will not target specific species but rather the overall underwater environment and the scientific work taking place underwater and will always aim to abide by the listed protocols.*

*None of the collected species are included in the ESA list regarding the coral sampling. In particular, for the genetics work, only Montipora capitata will be sampled. The same samples will be used to estimate carbonate budgets alongside other dominant and non-threatened coral species such as Porites spp. and Pocillopora spp.*

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?

*Our activities will be coordinated with Native Hawaiians (Keolu Fox's team), and will have input from our partner NGO Kalanihale and other local stakeholders as well as supervised by NGS/OET to ensure we respect the cultural, natural, and historic resources of the PMNM. The ecological integrity of the PMNM will be honored because the nature of the majority of our activities does not require the collection of biological samples except for the coral genetics work and carbonate budgets. This work will require the collection of small amounts of coral, but will not remove whole colonies. All living tissue will be removed pursuant to guidance provided from Hawaiian practitioners. Briefly, the onboard activities (educational and cultural heritage sections) and most of the research activities (coral and fish reef surveys and photogrammetry of coral) are conducted without the need to collect samples. The first activities will require computers and video footage, and the research activities will be collecting the data using video surveys. Regarding the coral genetic work and carbonate budgets, this requires sampling small coral fragments of less than 5 cm in length (see above).*

*The team will share any data collected as part of this project, and any intellectual property derived from such data, with one or more local collaborators in ways that follow the (1) FAIR (Findable, Accessible, Interoperable, and Reusable); (2) CARE (Collective Benefit, Authority to Control, Responsibility, Ethics) and; (3) Mai Ka Pō Mai (Native Hawaiian Data governance) principles. Any genetic data will be collected in accordance with the Nagoya Protocol on Access and Benefit-sharing.*

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?

*As mentioned previously in section a) our activities are coordinated and supervised by Native Hawaiians and NGS/OET to ensure that there are no negative impacts during and after the*

*development of our activities. Moreover, our project proposal is flexible, and capable of adapting to changes if this would be considered necessary.*
*Since we are very concerned about colonial/parachute science we are making sure our activities will engage and benefit a wide range of local stakeholders. An example of this is the educational resource that we intend to create that will summarize our activities and could be used for future expeditions in the PMNM. Moreover, before embarking we plan to have conversations with a diverse group of local stakeholders to ensure that our activities are of benefit to them.*

*This project has an opportunity to enhance the Monument's cultural and ecological appreciation by working closely with an indigenous data sovereignty team that will be first sharing data with local and indigenous stakeholders. The various components of the project will be seeking indigenous perspectives to amplify on our project website and outreach plan, as well as consulting with local members with regards to proper and respectful conduct within the Monument. A major goal of the project is to highlight the importance of indigenous knowledge, perspectives, and leadership. Likewise, the team includes members who are knowledgeable about the cultural, historical, and natural value of Papahānaumokuākea Marine National Monument and will therefore guide all the activities to be carried out within the Monument.*

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.

*No. Reef carbonate budgets are directly linked to the vital ecosystem services of wave attenuation and shoreline protection so much needed for islands. In addition, shifts in coral assemblages are being observed on Hawaiian shore reefs. In particular,* Montipora *coral seem to be capable of withstanding some local and global anthropogenic pressures. Looking at their population structure is more important than ever to understand how human-distanced reefs cope with climate change. Therefore, the PMNM is the ideal ecological scenario to address these research questions. Moreover, the environmental features are embedded in a context of strong Native Hawaiian identity and the need to engage local communities to be the next generation of explorers and PMNM guardians to best manage this unique area. Interestingly, the story of PMNM is one-of-its-kind since it mixes natural and cultural heritage. However, this story can only be entirely told if we recognize and honor its multiple values and meanings to a wide array of stakeholders. Therefore, the PMNMsets a unique scenario to integrate different knowledge and voices, including conservation, research, technology, education, storytelling, and cultural identity and heritage. All the research activities are related to coral reefs (coral reef and fish surveys, coral genetics, and carbonate budgets) and therefore we must dive in order to collect the data.*

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 adverse impacts, as mentioned above, are very minimal. The scientific value and educational outreach of this project outweighs the temporary and minimal impacts of the sampling methodology. Coral reefs are in decline globally and understanding key ecological*

*information such as the current status of the reef habitat and fish abundance and diversity, genetics populations of a dominant coral such as Montipora capitata, and estimating carbonate budgets from pristine areas and is necessary to develop regulatory frameworks and conservation initiatives elsewhere, especially in more remote areas. Additionally, being able to tell and share the story of this expedition and research is important in pushing for coral conservation.*

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

*The duration of the expedition is sufficient time to be able to conduct adequate collection of data for characterization of reef habitat and fish diversity and abundance, coral genetic populations and carbonate budgets.*

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

*C. Isabel Nunez Lendo (PI)*
*Isabel is an expert in coral biology (physiology and reproduction), ecology, conservation, and restoration (10 years of experience in marine biology and corals). She is part of the IUCN Coral Specialist Group in charge of updating the new IUCN Red List of Threatened Indo-Pacific Coral Species, whose release is expected early this year after the first report ten years ago. She is also an expert in underwater photogrammetry (creating 3D models and images post-treatment). She has developed a new methodology to estimate reef carbonate budgets using 3D modeling (as part of her PhD thesis) and minor coral sampling. She has a multicultural background (including Indigenous heritage from Central America) and extensive international experience doing fieldwork in remote coral reefs, including the Hawaiian Archipelago, making it easier for her to understand the complexity of such a diverse team of experts and field logistics. Her role in the project will be leading the expedition by combining the areas of expertise of the team members: conservation, research, technology, education, storytelling, and cultural heritage; as well as being involved in the technical activities (e.g. reef surveys to characterize reef habitat, coral cover and diversity, coral sampling, and underwater photogrammetry and imaging processing). Also, due to her field experience and network in Hawai'i, she will connect this project with several local Hawaiian partners to engage in live sessions with the expedition.*

*Nicole Crane*
*Nicole will conduct the Montipora surveys, assist with coral and fish surveys and the photogrammetry. She is also a former scientific diving officer, and will work with interested volunteers to engage them in the project. She will work with Dr. Bernardi to use the Oxford Nanopore MinIon technology to sequence the coral data on site. Nicole is an educator (faculty member in the Biology Department at Cabrillo College in Aptos, California) and a researcher (Senior Conservation Scientist and Co-Director with John Rulmal, of One People One Reef), with a focus on ecosystem dynamics and management. Our work involves*

*collaborative knowledge building with outer island communities to help with their sustainable reef management planning. She is working with a team to develop a coral diagnostics tool kit that includes genomics, metabolomics and isotopes to assess potential genes under selection, stress mapping and trophic structure to assess fishing pressure.*

*Nicole has more than 25 years of experience working with communities and conducting ecological assessments of reefs. She is dedicated to linking rigorous science with cultural knowledge and community leadership in conservation in an inclusive and collaborative way. She has established several science education programs in the United States and Micronesia, with a focus on enhancing diversity in STEM. She was the Founder and Director of the National Science Foundation Center for Excellence in Marine Advanced Technology Education (Monterey Peninsula College), and Executive Director for Camp SEA Lab (California State University Monterey Bay). She includes citizen scientists and students in her work, and she is committed to enhancing citizen science across cultures and disciplines. Nicole was nominated for a PEW fellowship, and is a Fellow National at the Explorers Club, and associate at the California Academy of Sciences.*

*Sandra Turner*
*Sandra is a National Geographic Certified Educator. She teaches global climate change and ocean science to students of all ages. Her pedagogy includes a blend of field experiences as an ocean conservationist, certified scuba diver, and Caribbean photographer. Turner integrates geo-inquiry learning projects, ArcGIS spatial applications, and digital storytelling to deepen our human connection to our natural environment and cultivate new generations of explorers. Her own research focuses on the Caribbean's changing landscapes and traditional cultures due to climate change and partners with marine protected areas on coral reef and mangrove restoration projects.*

*For this project, Sandra will use ArcGis applications to create a multimedia StoryMap highlighting the work that our team will do to research, plan, prepare, and embark upon Expedition Nautilus. Harnessing the power of storytelling, we will describe what National Geographic Explorers do in the field and how we illuminate, protect, and save the planet. With captured photography, audio, video footage, and use of geographic mapping applications, students will follow us on this expedition to learn about some of the skills and new technologies that Explorers will be using. Ultimately, students will learn about the relevance of place and culture and the important role the Papahānaumokuākea Marine National Monument (PMNM) plays as sacred land. The ArcGIS StoryMap will be published on the web. Additionally, the ArcGIS StoryMap and related content will be made available for National Geographic's Educational Resources Library to be used by members of the Education Community.*

*Llenel de Castro*

*Llenel is an archaeologist, educator, and heritage researcher. She finished her Master's degree in archaeology at the University of the Philippines Archaeological Studies Program in 2019 with a thesis that assessed the social impact of a long-term archaeological research project on a community where it has been based for over two decades. Her thesis was the culmination of five years of engaged heritage work, focused on placemaking, listening, and relationship building in the Dewil Valley, Philippines. She spends most of her time finding ways to bring heritage education closer to youth, especially those who live around the archaeological sites she has worked in Ifugao and Palawan, Philippines. Her most recent National Geographic Grant, Explore My Ili, is the development of a low-cost exploration kit with accompanying radio storytelling episodes for Filipino teens. Done in collaboration with National Geographic Explorers, Explore My Ili aims to encourage curiosity in the youth and trains them to be local researchers and scientists in their own communities.*

*For this project, she will be focusing on examining the social impact of the PMNM's declaration as a marine protected area, and a UNESCO World Heritage Site on its various stakeholders through storytelling and the creation of an exhibit focused on the exploration experiences and journeys of National Geographic Explorers and Native Hawaiians.*

*Giacomo Bernardi*
*Dr. Bernardi is a molecular biologist who looks at population genomics of marine organisms. He has over 25 years of experience working in tropical and temperate ecosystems around the world. He is an expert in fish identification and surveys, and conducts fish biomass and species diversity surveys in addition to his molecular expertise. Dr. Bernardi is currently investigating the genomics and population structure of Montipora (capitata) sp. in both Hawaii and Micronesia. Dr. Bernardi will conduct the on-site sequencing and fish (habitat) surveys.*

*David Doubilet*
*David Doubilet is a National Geographic Photographer who has spent five decades exploring and documenting the far corners of the world from beneath interior Africa, remote tropical coral reefs, rich temperate seas and recent projects beneath the polar ice. His personal challenge is to create a visual voice for the world's oceans and to connect people to the incredible beauty and silent devastation happening within the invisible world below. David is a contributing editor for several publications and an author of 12 titles including the award winning Water Light Time. His numerous photographic awards include Picture of the Year, BBC Wildlife, Communication Arts and World Press. David is a member of the Academy of Achievement, Royal Photographic Society, International League of Conservation Photographers and International Diving Hall of Fame. David was named a National Geographic Contributing Photographer-in-Residence in 2001.*

*Jennifer Hayes*
*Jennifer Hayes is a contributing photographer and speaker for National Geographic Partners. Jennifer is an aquatic biologist with graduate degrees in marine ecology and zoology that has directed her focus to photojournalism specializing in natural history,*

*conservation, and the documentation of freshwater and marine environments. Her research focused on shark finning and commercial landing in the western Atlantic and the population dynamics and movements of sturgeon. Jennifer has translated her love of science into storytelling, and working with scientists around the globe to share their stories. Jennifer is an award winning photographer, contributor to numerous global publications and author/ contributor to books on marine environments. She is a trustee of the Shark Research Institute, Explorer Club fellow, editorial board advisor for Ocean Geographic and recipient of the President's medal for contributions to the natural world.*

g. Provide information demonstrating that you have adequate financial resources available to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.

*The National Geographic Society (NGS), in partnership with Ocean Exploration Trust (OET), are funding teams of Explorers to conduct projects on the E/V Nautilus, one of the world's most sophisticated ocean exploration ships. The funds provided by NGS will cover all expenses related to this project.*

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 monitoring and research of local coral reefs are among the most vital first steps for any reef management. Our intended methods are the popular quadrat surveys that involve placing a grid over the surveyed area. This methodology has many benefits:*

1. *It allows for an accurate estimation of percent coverage.*
2. *It facilitates the counting of tiny benthic organisms.*
3. *It is easily coupled with photographic techniques.*
4. *It requires little training.*

*Our survey method will be adapted to previous reef monitoring studies so that our data can be comparable and of interest to the PMNM.*
*Fish surveys are also a widespread method and involve replicate belt transects of at least 30 m length by 5 m width where observations should be made between 10 am and 5 pm (the period of maximum feeding activity).*

*Estimating reef carbonate budgets has been classically done with the ReefBudget methodology; however this method requires more trained personnel and longer time in the water. Recently, photogrammetry has gained popularity due to its efficacy in obtaining 3D imagery of coral reefs in a shorter time. This photogrammetry will be paired with skeletal data obtained from the coral sampling to estimate the current coral carbonate budgets of the Monument, a critical ecosystem service to attenuate wave action and protect shorelines.*
*For the genetics work, we will utilize the Oxford Nanopore Technology to in situ sequence the DNA (low coverage whole genome sequencing) of Montipora capitata samples to compare with existing genomes of Montipora to better understand fine-scale population genomics*

*between the islands and look at genes under selection. The sequencing will be conducted on the Nautilus using portable MinIon sequencers. This methodology does not require lab processing on land or exportation of samples outside the Hawaiian territory.*

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

*E/V Nautilus will be obtaining a VMS system in 2022 per the OLE requirements and will have it aboard for the duration of the time the vessel will be in the Monument. The vessel currently utilizes AIS, which it will also retain and have on for the duration of the permitted activities.*

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

*The scope of work, timeline, non-invasive methodology, and intention behind this project is designed to provide a critical understanding of change under current and future climate regimes* in *PMNM without disturbance or damage.*

FOR SPECIAL OCEAN USE ACTIVITIES <u>OUTSIDE</u> OF MIDWAY ATOLL SPECIAL MANAGEMENT AREA, ANSWER THE ADDITIONAL THREE FINDINGS BELOW:

k. Explain how your activity will directly benefit the conservation and management of the Monument.

*The data collected will help us gain important ecological information into the current status of the coral reefs of Papahānaumokuākea Marine National Monument under a changing climate, which can be used as a benchmark for evaluating the effectiveness of the Monument in achieving its intended conservation goals for protecting these coral reefs and the species they sustain. That data can be used in conjunction with previous studies in order to determine population trends and status of coral reefs in areas closed off to human activity, how this has changed from the past, and what future management interventions can focus on for sustaining or improving the Monument objectives.*

l. Explain how the purpose of your activity is for research or education related to the resources or qualities of the Monument.

*Our central purpose is to contribute to knowledge about the current ecological status of the coral reefs around the Monument. Concurrent and complementary purposes through educational outreach are to elevate Indigenous knowledge about the Monument, and modern scientific and technological methods used to study it. Documentation of the project by National Geographic photographers will enable sharing storytelling about this remote and unique seascape with broader audiences on additional platforms.*

m. Does the activity involve the use of a commercial passenger vessel (defined as a vessel that carries individuals who have paid for such carriage)?

*No*

FOR SPECIAL OCEAN USE ACTIVITIES WITHIN MIDWAY ATOLL SPECIAL MANAGEMENT AREA, ANSWER THE ADDITIONAL TWO FINDINGS BELOW:

n. Explain how your activity will further the conservation and management of the Monument.

*N/A*

o. How is your activity compatible with the purposes for which the Midway Atoll National Wildlife Refuge was designated?

*N/A*

**NOTE: If this is a first time Special Ocean Use activity, it will be subject to a pilot project and will be restricted in duration. Special Ocean Use activities proposed outside the Midway Atoll Special Management Area will require public notice of the application and an opportunity to provide comments is given at least 30 days prior to issuing the permit.**

**8. Procedures/Methods:**

*Obj 1. The photo-transect survey method will be implemented to assess the benthic community. This method will quantify the projected cover of coral and other sessile organisms using digital photography and subsequent image analysis. The method employs 1m-interval photography along each of 5 horizontal transect lines (40m long) at the depth of 3m and 10m. Around 200 images (40 photos x 5 transects) will minimize the variability of coral distribution patterns within the transect lines. The photo-transect survey will be conducted by 4 scuba divers. In detail, a diver deploys 5 50m-tape on the bottom along the depth contour from a marked point. Subsequent divers photograph the bottom (0.5mx0.5m) at 1m-interval along with the tape measures. Additional team members and citizen scientists will photo document the work of the dive team while snorkeling.*

*Obj 2. Underwater photogrammetry will be done on the second quadrat which will be placed behind the first quadrat (both used in the benthic survey). It takes 5-10 min to photograph a quadrat using a GoPro camera. Images will be processed in the software Agisoft Metashape. Additional coral sampling of dominant Montipora, Porites and Pocillopora spp (Montipora capitata, Porites lobata or P. compressa, and Pocillopora damicornis or P. meandrina (5 cm x 3 fragments x photo-quadrat) will be executed inside the PNMN by C. Isabel Nunez Lendo, Giacomo Bernardi, and Nicole Crane (referred as the Researchers), and samples will be first*

*immersed in freshwater, then bleached and dried at ambient temperature for further extraction of physical information. This data will be crosslinked with the underwater photogrammetry images to estimate carbonate budgets as well as data on coral morphology and habitat complexity. If this is acceptable to the Monument, the denuded coral skeletons will be returned into the ocean or donated to a local institution for educational/research purposes. Any wastewater (e.g. bleach) will be stored in 5-L plastic bottles and/or ZipLoc bags and disposed of on land upon return from the expedition.*

*Obj 3. Coral sampling will take place inside the PNMN . We will collect 10-15 fragments of Montipora capitata per site (2 dives in 2 locations, for a total of 4 sites). In particular, the Researchers will collect the upper part of the branch (i.e. tip) - as this area will have none or less encrusting organisms - from colonines at least larger than >30 cm (coral sampling on smaller colonies could affect their survival) . The samples will be stored temporarily in ethanol prior processing for the genetics. The coral tissue will be brushed from the coral fragment, leaving a denunded coral skeleton that will be used to extract physical information for Objective 2. We will utilize the Oxford Nanopore Technology to re-sequence (low coverage whole genome sequencing) the samples to compare with existing genomes of M. capitata to better understand fine-scale population genomics between the islands and look at genes under selection. The sequencing will be conducted on the Nautilus using portable MinIon sequencers. This will enable us to compare these more northern M. capitata populations with the Main Hawaiian Islands and a western pacific population that has shown extreme invasive behavior. A separate 50m transect will be surveyed to establish % cover of M. capitata and colony morphology will be studied through photogrammetry. If this is acceptable to the Monument, the processed samples (fragments in ethanol and DNA extracts in solution) will be donated to a local institution for educational/research purposes. Any waste will be stored in 5-L plastic bottles and/or ZipLoc bags and disposed of on land upon return from the expedition.*

*Obj 4. The entire experience of the expedition will be documented and shared publicly. The diversity of our team of explorers with individual specializations is a one-of-a-kind for engaging local and international youth to become explorers and guardians. To achieve this objective, a multimedia ArcGIS Story Map and instructional guide will be created to highlight the role that conservation expeditions play in solving complex societal challenges. This educational resource will be offered to National Geographic Education to use in their Resource Library. While on the Nautilus, live sessions will be broadcasted to our local collaborators to highlight aspects of the expedition.*

*Obj 5. To tell a comprehensive story of PMNM as a place of natural and cultural value, our completed story will incorporate narratives of Native Hawaiian exploration. Through virtual sessions, youth will be trained to document local history, do community mapping, participate in citizen science experiments, and create an exhibit incorporating their own research and the*

*information gathered by the exploration team. This will be done using a research framework of action heritage [19] and place-based education perspectives [20].*

*Obj 6. - To capture the work of the expedition and document the coral reefs using hand held, non-substrate, fixed, still photography, as well as motion and limited hydrophone recorded sound. Geotags will be incorporated into the metadata of selected key imagery to enable incorporation into GIS mapping and allow other managers, scientists, stakeholders and storytellers to return to the same location to monitor the reefs over time, in support of conservation objectives.*

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

**9. Provide proof of general liability insurance, or indicate that you will be posting an equivalent bond against claims arising out of activities conducted under the permit:**

*Ocean Exploration Trust is insured for General Liability through American Casualty Company/Hylant-Cleveland (will be renewed in July), Hull & Machinery through Lloyd's Insurance Co S.A. & Beazley/Leviathan, and Protection & Indemnity through BML/QBE. Ocean ExplorationTrust's general liability limits include a general aggregate limit ($2M), a products/completed operations aggregate limit ($2M), bodily injury/property damage per occurrence limit ($1M), personal injury ($1M), fire damage liability ($1M) and medical payments ($5K).*

**10. If applicable, describe how you are collaborating with others in any way to reduce duplicative activities in the Monument or elsewhere?**

*This project from the onset will be collaborating with an indigenous data sovereignty team that aims to enhance data sharing among the local research institutions (i.e., University of Hawaii), stakeholders, communities, and others that are interested in acquiring the collected data. It is the intention for this project to relay the results with Papahānaumokuākea Marine National Monument for reviewing management objectives and strategies. As we believe that data should be available and accessible by anyone, all data and results will be open-access unless there is sufficient reason or request not to release data.*

**11. List all specialized gear and materials to be used in this activity:**

- *Scuba diving gear:*
    - *Buoyancy control device (BCD)*
    - *Regulator*
    - *Mask*
    - *Snorkel*
    - *Fins*

    - *Weights*
    - *Aluminum 12L tank*
- *Camera equipment to be used during diving operations:*
    - *Mirrorless camera system with underwater housing and lighting.*
    - *Several GoPro systems with housings and lighting*
- *Genetic work:*
    - *Oxford Nanopore MinIon sequencer*
    - *Disposables (gloves, towel paper, pipette tips)*
    - *95% Alcohol*
    - *Qiagen dna extraction kit (DNeasy Blood & Tissue Kit)*
    - *Pliers*

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

*None*

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

*None*

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

*Crane, N. L., et al. "Corallimorph and Montipora Reefs in Ulithi Atoll, Micronesia: documenting unusual reefs." Journal of the Ocean Science Foundation 21 (2016): 10-17.*

*Crane, Nicole L., et al. "Atoll-scale patterns in coral reef community structure: Human signatures on Ulithi Atoll, Micronesia." PloS one 12.5 (2017): e0177083.*

*Crane et al.(2017) COLLABORATING WITH INDIGENOUS CITIZEN SCIENTISTS TOWARDS SUSTAINABLE CORAL REEF MANAGEMENT IN A CHANGING WORLD The One People One Reef program. Citizen Science for Coastal and Marine ConservationEdition: 1, Chapter: 10, Publisher: Routledge. Editors: John Cigliano, Heidi Ballard. DOI: 10.4324/9781315638966-10*

*Crane et al. (2018) Clipperton Atoll as a model to study small marine populations: Endemism and the genomic consequences of small population size.PLoS ONE 13(6):e0198901. DOI: 10.1371/journal.pone.0198901*

*Bernardi, Giacomo. "Speciation in fishes." Molecular Ecology 22.22 (2013): 5487-5502.*
*Crow, Karen D., Hiroyuki Munehara, and Giacomo Bernardi. "Sympatric speciation in a genus of marine reef fishes." Molecular Ecology 19.10 (2010): 2089-2105.*

*Bernardi et al.(2018) Genomic islands of divergence in the Yellow Tang and the Brushtail Tang Surgeonfishes. Ecology and Evolution 8(17). DOI: 10.1002/ece3.4417*

*Doubilet, David. "Light in the Sea." World Literature Today 87.2 (2013): 94-97.*

*Daly, J., Zuchowicz, N., Nuñez Lendo, C.I. et al. Successful cryopreservation of coral larvae using vitrification and laser warming. Sci Rep 8, 15714 (2018). https://doi.org/10.1038/s41598-018-34035-0*

*Manon Fourier et al. (2014) Fishes of Clipperton Atoll, Eastern Pacific: Checklist, Endemism, and Analysis of Completeness of the Inventory. Pacific Science 68(3):375-395. DOI: 10.2984/68.3.7*

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.

28 January 2022

Signature Date

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

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

**DID YOU INCLUDE THESE?**

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

# Papahānaumokuākea Marine National Monument

SPECIAL OCEAN USE 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:** *Miller, Rachael Z.*
**Affiliation:** *Rozalia Project for a Clean Ocean*

**Permit Category: Special Ocean Use**
**Proposed Activity Dates:** *Up to 5 weeks between August-October 2022*
**Proposed Method of Entry (Vessel/Plane):** *Vessel (E/V Nautilus)*
**Proposed Locations:** *Shallow water (<100m) within original PMNM boundary; TBD - Nihoa Island, Necker island (Mokumanamana), French Frigate Shoals, Gardner Pinnacles, Maro Reef, Laysan Island. Final locations will be determined based on sea state and weather conditions at the time of the expedition.*

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

*A maximum of twenty-three individuals per expedition - including one or more NGS research teams, citizen scientists, a Native Hawaiian Liaison (identified in coordination with the Monument's Cultural Working Group), and dive support specialists - will be covered by National Geographic Society Expedition Sponsor Program permits.*

*Across all five expeditions a maximum of 107 people will be covered by National Geographic permits.*

**Estimated number of days in the Monument:**

*National Geographic Society will be participating in five expeditions in the Monument over a 72 day period. We anticipate that the duration of this project will be approximately 15 - 38 days.*

**Description of proposed activities:** (complete these sentences):

a.) The proposed activity would…

*…create a map of microplastic and anthropogenic microfiber pollution found in the surface waters and air of the PMNM specifying multiple characteristic including material type, color,*

*shape and size; use accessible, affordable, low-impact, and replicable methods that will be part of a global citizen science microplastic mapping and monitoring project allowing scientists, Monument managers, conservation organizations, policymakers and other stakeholders access to data that will help protect this important part of the world and the people and creatures who call it home.*

b.) To accomplish this activity we would ….

*…collect ocean surface grab samples using metal buckets, collect samples that investigate microplastics suspended in the air by using a pump-based air sampler and collect samples that investigate microplastics that fall out of the sky through deposition by using buckets. All sampling will occur from onboard the Nautilus and/or one of her tenders at approximately 72 locations for surface water and air (suspension) while the atmospheric deposition buckets will be left on deck for ongoing investigation.*

*All samples will be processed onto a filter paper (via gravity/vacuum/pump) and fixed with the new, innovative Easy Lift Tape onto a glass slide. The team will use a stereomicroscope and polarizing light microscope to count and characterize the microplastics and anthropogenic microfibers that are found in the samples. Morphological details will be recorded and all data will be mapped and made available for collaborators in the Monument, throughout the Hawaiian Islands and beyond.*

c.) This activity would help the Monument by …

*…addressing a clearly stated issue in the Monument's Management Plan that acknowledges "a better understanding of contaminant levels associated with marine debris is needed. Additionally, the toxicity risk to birds, fish, and other organisms from ingesting plastics and the persistent organic pollutants and other chemical pollutants that cling to them, or from consuming prey that has consumed microplastics, requires further study." Furthermore, the plan acknowledges "the lack of regular monitoring for hazardous marine debris can result in potential hazards going unaddressed. Ideally, the detection, isolation, and removal of such hazardous debris would be beneficial."*

*At this point, more and more studies are revealing those toxicity risks to myriad organisms, making the former statement one for whom answers are forthcoming. The data that are missing, however, are those related to knowing the type, distribution, and concentration of MPs in the Monument. Putting those two data sets together would have a tangible impact on furthering the understanding of a known and acknowledged threat to the PMNM. To date, however, likely because of the difficulty and expense of current methods, no studies have been done to investigate MPs in the surface and air throughout the PMNM and at the level that identifies the morphology and material ID of the microplastic and/or anthropogenic microparticles that are found.*

*An additional global data gap is the relationship between atmospheric and surface microplastics with macro-debris in a location that is a known sink, rather than a source for debris. The PMNM is extremely unique in this regard. Few islands can be found with this particular proximity to a subtropical convergence zone. The Bahamas island chain or Bermuda could be seen as similar in relation to being islands in the path of the subtropical convergence zone in the North Atlantic, but neither are protected in the same way as the PMNM and both could be considered sources as well as sinks, whereas the PMNM is not generating its own marine debris, just receiving it from other places. This makes it uniquely possible to analyze the relationship between microplastics in the surface and air compared to macro-debris on the surface or on land in a remote area that is a known marine debris sink. This could be a new and important discovery - both for the PMNM's management itself and for understanding global MPs. Should we discover a link between the presence of MPs and macroplastics, our method would be an inexpensive and accessible way for any vessel to quickly identify marine debris hot spots, leaving a legacy of knowledge and action for the PMNM and its management as well as for the ability to understand MPs through citizen science around the world and compare those findings.*

**Other information or background**:

*The National Geographic Society is a global nonprofit that uses the power of science, exploration, education, and storytelling to illuminate the wonder of our world. For more than 130 years, the Society has identified and funded trailblazing scientists, researchers, conservationists, storytellers, and educators—known as National Geographic Explorers—from around the world who are working to better understand our world and everything in it.*

*To expand this work to help safeguard the world's ocean, the National Geographic Society is partnering with Ocean Exploration Trust from August — October 2022 by leveraging their ship, the E/V Nautilus, to conduct five research expeditions led by National Geographic Explorers in Papahānaumokuākea Marine National Monument. The Society has submitted permit applications for five distinct research projects, which together form the "National Geographic Society Expedition Sponsor Program." Some of the five NGS expeditions will include multiple NGS research teams,and some of the NGS research teams will join multiple expeditions. During the period when the NGS teams are onboard, Ocean Exploration Trust will simultaneously be conducting seafloor mapping surveys funded by NOAA Ocean Exploration, focusing on areas that have not previously been mapped at high resolution.*

*In addition to the identified Explorers who will conduct work on the ship, each expedition will be joined by a number of citizen scientist participants. These individuals will join each expedition and participate in the scientific projects through daily citizen science activities through which they will assist in collecting data and conducting analysis under the guidance of the National Geographic Explorers leading each project. Citizen science activities will include participating in photo documentation and data collection while snorkeling, supporting species identification, participating in educator engagement, and contributing to a digital multimedia mosaic. Different citizen scientists will join each expedition.*

*Each expedition will also be joined by a Native Hawaiian Liaison, identified in collaboration with the Monument's Cultural Working Group. We anticipate that there will be a different Liaison on each of the five expeditions.*

## Section A - Applicant Information

**1. Applicant**

Name (last, first, middle initial): *Miller, Rachael, Z.*

Title: *Principal Investigator*

**1a. Intended field Principal Investigator (See instructions for more information):**

*Miller, Rachael, Z*

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

[redacted]

For students, major professor's name, telephone and email address: *N/A*

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

*Rozalia Project for a Clean Ocean*

**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):**

*Mahu, Edem - Researcher/educator*
*Anagnostopoulos, Theo - Researcher/educator*
*Pelamatti, Tania - Researcher/educator*
*TBD - Native Hawaiian Liaison*
*7 to 12 Citizen Scientists for each expedition this project is on. Shannon Bartlett will join one expedition as a citizen scientist.*

## Section B: Project Information

**5a. Project location(s):**

| | | Ocean Based | |
|---|---|---|---|
| **X** Nihoa Island | ☐ Land-based | **X** Shallow water | ☐ Deep water |
| **X** Necker Island (Mokumanamana) | ☐ Land-based | **X** Shallow water | ☐ Deep water |
| **X** French Frigate Shoals | ☐ Land-based | **X** Shallow water | ☐ Deep water |
| **X** Gardner Pinnacles | ☐ Land-based | **X** Shallow water | ☐ Deep water |
| **X** Maro Reef | ☐ Land-based | **X** Shallow water | ☐ Deep water |
| **X** Laysan Island | ☐ Land-based | **X** 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:

*Shallow water (<100m) within original PMNM boundary; TBD - Nihoa Island, Necker island (Mokumanamana), French Frigate Shoals, Gardner Pinnacles, Maro Reef, Laysan Island. Final locations will be determined based on sea state and weather conditions at the time of the expedition.*

**5b. Check all applicable regulated activities proposed to be conducted in the Monument:**
***X Removing, moving, taking, harvesting, possessing, injuring, disturbing, or damaging any living or nonliving Monument resource***
☐ 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
***X Anchoring a vessel*** **-** *Anchoring the E/V Nautilus 5.5-meter RHIB supporting SCUBA/snorkeling operations is not planned but may be required for longer SCUBA/snorkeling dives or in the event of engine failure. If anchoring should be necessary, the team will endeavor*

*to have divers/snorkelers hand place anchors to minimize any potential impact to underwater fauna and substrate.*

☐ 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:***

*Microplastics have been found in samples in every body of water, from lakes, rivers and ocean to the most remote areas of the arctic, deep sea, and also in the air (1,2,3,7,12,14). Studies showing synthetic MP/microfiber ingestion by aquatic animals include mussels in coastal and freshwater environments (4,8), crabs (15), plankton (6) and both shellfish and finfish at a fish market (13). Ecotoxicological effects from MP pollution include behavior changes, neurotoxicity, decrease in fecundity and mortality to name just a few (4).*

*"The location of the Northwestern Hawaiian Islands in the path of the Subtropical Convergence Zone, coupled with its extensive shallow reefs, make it a particularly likely location for debris deposition and accumulation." (11) Images of trash covering Midway Atoll and in the bellies of albatross in the PMNM are used to illuminate the problem of plastic in our ocean. However, very little is known about MPs in the PMNM - in the air or water. This may be due to difficulties with MP science: a lack of a consistent methodology, risks of procedural contamination and expensive/difficult methods to achieve material identifications. There is a high potential for contamination during each step of MP science for both air and water sampling. Examples include fiber from researchers' garments and airborne fibers and fragments depositing into samples during fieldwork, processing and analysis. Our recently published study (9), defines state-of-the-art, yet simple and robust sampling techniques to reduce contamination while also being able to distinguish MPs that are contaminants from those that are environmental pollutants.*

*Identifying material type, cross-section, width and color can reveal possible sources and mechanisms of MP. These characteristics can be compared against repository data or samples of fibers used in everyday clothing, carpets, tarps, etc. Finding the source of the fibers or fragments*

*will give communities, innovators, industries and governments the opportunity to craft targeted solutions such as: regulating emissions from a newly known point source of resin pellets, innovating textiles used for road infrastructure or re-designing household drainage/municipal run-off strategies. Material verification, however, can be a time-consuming and costly process that typically requires access to FTiR/Raman spectroscopy. The breadth of the problem in every type of waterway from the most remote to the most urban (it's ubiquitous); the risks it poses to our marine creatures (inflammation, starvation, behavioral changes, etc.); the potential risks it poses to humans, in particular vulnerable populations; and the urgency of the need to understand global sources and develop and deploy local solutions (now!) suggests, if not requires, that data are generated from more than just institutions with the funding for machines that cost 6 figures plus a professional staff. This is a problem that is yearning for the access, speed, enthusiasm and global breadth of citizen science.*

*Lastly, being able to compare data worldwide will strengthen the possibility that we can find specific sources, as well as hot spots, and address them. We could only have this chance with a global method and by empowering more people to engage with it. The simple and cost-effective methods used by this project also enable countries such as least developed countries and small island developing states, where data collection is limited, to have access to this global database as both generators and users of the data. Other groups have tried citsci MP programs and because of problems with procedural contamination, small labs overwhelmed with samples and only distinguishing particles as plastic or not plastic, they have not succeeded. Thanks to innovations in MP collecting and processing techniques, those challenges can now be overcome.*

*Works cited:*

*(1) Alfaro-Núñez, A., Astorga, D., Cáceres-Farías, L., Bastidas, L., Villegas, C.S., Macay, K., Christensen, J.H., 2021. Microplastic pollution in seawater and marine organisms across the Tropical Eastern Pacific and Galápagos. Sci. Rep. 11, 6424.*

*(2) Barrett, J., Chase, Z., Zhang, J., Banaszak Holl, M.M., Willis, K., Williams, A., Hardesty, B.D., Wilcox, C.,, 2020. Microplastic Pollution in Deep-Sea Sediments from the Great Australian Bight. Front. Mar. Sci. 7:576170.*

*(3) Brahney, J., Mahowald, N., Prank, M., Cornwell, G., Kilimont, Z., Matsui, H., Prather, K.A. 2021. Constraining the atmospheric limb of the plastic cycle. Proceedings of the National Academy of Sciences, 118 (16) e2020719118.*

*(4) Carlos de sá et al., 2018 Studies of the effects of microplastics on aquatic organisms: What do we know and where should we focus our efforts in the future? Sci of the Total Env. 645 (1029-1039).*

*(5) Christoforou, E., Dominoni, D.M., Lindstrom, J., Stilo, G., Spatharis, S., 2020. Effects of long-term exposure to microfibers on ecosystem services provided by coastal musses. Environ. Pollut. 266(3), 115184.*

*(6) Cole, M., Lindeque, P., Fileman, E., Halsband, C., Goodhead, R., Moger, J., Galloway, T.S., 2013. Microplastic Ingestion by Zooplankton. Environ. Sci. Technol. 47, 12, 6646-6655.*

*(7) Dong M., Luo, Z., Jiang, Q., Xing, X., Zhang, Q., Sun, Y., 2020. The rapid increase in microplastics in urban lake sediments. Sci. Rep. 10, 848.*

*(8) Doucet, C.V., Labaj, A.L., Kurek, J., 2021. Microfiber Content in Freshwater Mussels from Rural
Tributaries of the Saint John River, Canada. Water Air and Soil Pollution, 232(1), 32.*

*(9) Gwinnett, C. and Miller, R.Z. 2021. Are we contaminating our samples? A preliminary study to investigate procedural contamination during field sampling and processing for microplastic and anthropogenic microplastics. Mar. Pollut. Bull. 173, 113095.*

*(10) Miller, R.Z., Watts, A.J.R., Winslow, B.O., Galloway, T.S., and Barrows, A.P.W. 2017. Mountains to the sea: River study of plastic and non-plastic microfiber pollution in the northeast USA. Mar. Pollut. Bull. 127, 245-251.*

*(11) NOAA Office of National Marine Sanctuaries. 2020. 2020 State of Papahānaumokuākea Marine National Monument: Status and Trends 2008–2019. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries, Silver Spring, MD. 221 pp.*

*(12) Pelamatti, T., Rios-Mendoza, L. M., Hoyos-Padilla, E. M., Galván-Magaña, F., De Camillis, R., Marmolejo-Rodríguez, A. J., & González-Armas, R. (2021). Contamination knows no borders: Toxic organic compounds pollute plastics in the biodiversity hotspot of Revillagigedo Archipelago National Park, Mexico. Marine Pollution Bulletin, 170, 112623.*

*(13) Rochman, C.M., Tahir, A., Williams, S.L., Baxa, D.V., Lam, R., Miller, J.T., Teh, F.C., Werorilangi, S., and Teh, S.J. 2015. Anthropogenic debris in seafood: plastic debris and fibers from textiles in fish and bivalves sold for human consumption. Sci. Reports. 5, 14340.*

*(14) Ross, P.S., Chastain, S., Vassilenko, E., Etemadifar, A., Zimmermann, S., Quesnel, A., Eert, J., Solomon, E., Patankar, S., Posacka, A.M., Williams, B., 2021. Pervasive distribution of polyester fibres in the Arctic Ocean is driven by Atlantic inputs. Nat. Commun. 12, 106.*

*(15) Watts, A.J.R., Urbina, M.A., Corr, S., Lewis, C., Galloway, T.S., 2015. Ingestion of plastic microfibers by the crab Carcinus maenas and its effect on food consumption and energy balance. Environ. Sci. Technol. 49, 14597–14604.*

*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 **X 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?

*Because these methods are designed to be part of a global microplastic mapping and monitoring project, they were also designed to be affordable, accessible, low-impact and replicable. The fact that we will take surface samples using a small metal bucket operated by hand, makes the water collection part of the project extremely low-impact. We will further reduce our impact and safeguard the resources and ecological integrity of the Monument by immediately returning all samples that inadvertently include visible flora or fauna and re-taking the sample. For example, if a bucket comes up with fish eggs or a small fish in it, the entire contents of the bucket (including the eggs/fish/other fauna) will be gently returned to the sea and a new sample collected. The same will be the case for visible pieces of flora. Macro and/or microplastics that are collected, however, will be kept out of the ocean and saved for potential future analysis.*

*Additionally, we will keep ocean water in place (geographically) by returning filtrate from samples back to the ocean while on location where it was collected. If that is not possible, then the filtrate will be put down the ship's grey water system. We will NOT transport water samples between atolls or return them to a different geographic location than where collected. Water that*

*is needed for washing equipment and for the air samples will be millipore (filtered) water from the boat's fresh water system. All water that comes from the boat's system will be put down the ship's drain.*

*We believe that our air sampling, via both the pump-based air sampler and buckets on the deck of the Nautilus, will have an undetectable impact on the Monument.*

*Per the design of our project, we will not interact with any cultural or historic resources in the Monument (no land-based activities, no installations) during either the water sampling, the air sampling or the processing.*

*Finally, the team will share any data collected as part of this project, and any intellectual property derived from such data, with one or more local collaborators in ways that follow the (1) FAIR (Findable, Accessible, Interoperable, and Reusable); (2) CARE (Collective Benefit, Authority to Control, Responsibility, Ethics) and; (3) Mai Ka Pō Mai (Native Hawaiian Data governance) principles.*

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?

*Because we will return any visible flora or fauna, if any should come up in a surface water sample, our impact is extremely low. The sum total of our impact will be to filter anything that is greater than approximately 11 microns from approximately 216 liters of surface water. There is a chance that this includes some plankton and/or microscopic bits of flora. The items that are filtered out will be fixed on a glass slide for analysis and indefinite storage. The water that has been collected and filtered (filtrate) will be returned to the ocean while still on location where it was collected. If that is not possible, then the filtrate will be put down the ship's grey water system. No sample water will be transported away from the sample location and at no time during air or water sampling will any chemical of any kind (natural or synthetic) be added to either the sample or the filtrate. Additionally, water used for equipment washing and air sample bucket washdowns (see methods) will come from the ship's fresh water system and will be disposed of down the ship's drain. For these reasons and the relatively small amount of water to be sampled in the Monument, this project is expected to have a minimal impact on eggs/fauna and can consider our impact negligible.*

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.

*The only way to investigate microplastic in the air and on the surface of the water in the Monument, or anywhere, is to be there. It is especially important in this location since it has not been done before. That said, our project utilizes the least impactful way to identify and map*

*microplastic pollution in the Monument since we are not using any unmanned installations such as floating or anchored buoys or land-based structures.*

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 data we will collect are important to understand the threats faced by the Monument's ecosystem. The need for understanding microplastic is specifically described in the management plan for the Monument. Not doing this work can result in "potential hazards going unaddressed" and "Ideally, the detection, isolation, and removal of such hazardous debris would be beneficial."*

*On the adverse impacts side, this is an extremely low-impact project. Because of the relatively small sampling volume, the efforts we make to ensure that any visible flora and fauna are not impacted (put back in the water if inadvertently collected), complete lack of additional chemicals, returning sample water/filtrate to the location from where it was collected and nothing left behind in the Monument (no structures, no by-products, no equipment) as well as the removal of plastic pollution that we do find, this project will generate a useful and important data set with a negligible ecological impact (just the filtering of approximately 216 liters of surface water) and zero impact on the Monument's cultural and historic resources.*

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

*The duration of the expedition carried out by the Nautilus will allow us to gain an excellent initial understanding of the presence of microplastic pollution in the air and surface water of the Monument. In addition, the duration of this project will allow us to train collaborators in Hawaii (and beyond). This, in turn, will create an opportunity for a legacy of low-impact sampling on future vessels and from locations throughout Hawaii for high impact results to help protect the Monument and potentially the creatures and people who call the Hawaiian islands home.*

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

*From a personnel perspective, I (Rachael Miller, the PI) am extremely experienced in the collection of microplastic samples from both the water and air. Along with my team, we have used similar methods to collect over 1,000 samples over multiple expeditions along the length of the Hudson River, the length of Long Island Sound and offshore in the Gulf of Maine. These samples were taken in regions that are protected as well as highly populated areas. Our work has been published in several peer-reviewed journals and serves as the basis for our Global Citizen Science Microplastic Mapping and Monitoring Project, of which this data will be a part. Because this is a first-of-its-kind study for the Monument and because this is part of a global effort to identify hotspots of microplastic pollution and help point to solutions, we are*

*particularly motivated to ensure that the methods are as universally replicable as possible. That means that they must be as low impact as possible, use zero additional chemicals, consume the minimum amount of consumables and not interfere with wildlife, protected lands, protected waters or areas where the land and water overlap, such as estuarine environments. In addition, these methods must have zero impact on cultural and historic resources in locations worldwide. We have been able to uphold these requirements in our work over the last 6 years and are confident that we can continue to do so.*

*From a methods standpoint, we are extremely confident that the sample collection and processing will yield data that are robust. Multiple peer-reviewed papers utilizing the same methods with the same team (Miller and Gwinnett) have been published, most recently in November 2021. Additionally, the members of this team are trained and experienced field scientists, lab scientists, educators and communicators. Therefore, collecting, processing and analyzing data to map microplastic in the surface water and air of the PMNM at a scientifically robust level is assured.*

g. Provide information demonstrating that you have adequate financial resources available to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.

*The National Geographic Society (NGS), in partnership with Ocean Exploration Trust (OET), are funding teams of Explorers to conduct projects on the E/V Nautilus, one of the world's most sophisticated ocean exploration ships. The funds provided by NGS will cover all expenses related to this project.*

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.

*We recognize that there is always a trade-off in field-based science. It is essential to weigh the impacts of knowledge against the usefulness of that knowledge. Our project is designed with that awareness in mind and the goal for the impact of our data is to far outweigh the impact of obtaining those data. Our data-goal is to create a map of the presence (and type) of microplastic and anthropogenic microparticles in the surface water and in the air (suspension and deposition) along the cruise track of the Nautilus in the Monument. In order to create that map and data set, we are taking the minimum amount of water samples and doing so without stepping foot on land and without leaving any sensors or other structural elements behind. We are making specific and concerted efforts to avoid disturbing, much less, collecting any visible creatures of any kind and we will even return visible flora to the sea's surface immediately and on location. In selecting these methods, we have selected the least ecologically impactful. To weigh our methods against other methods to gain similar information, one would look at the relatively much higher impact of towing plankton/neuston/manta nets. Those have an arguably higher impact because there is very little opportunity to exclude any creature or item smaller than 1 x 0.5 meters. Our method, using a grab sample taken from a bucket allows us to be very deliberate in keeping all visible*

*creatures and flora alive and out of our samples. Furthermore, using the grab sample method has been shown to reveal three orders of magnitude more microplastics than the more potentially harmful net tow method (Barrows et al, 2017), making this the least ecologically impactful and most scientifically impactful way to fill an important data gap in the Monument.*

*In addition to the above, we will also sample the air. For these methods, as well, we've chosen the least ecologically impactful techniques and equipment with the most scientifically impactful data production. Because we are not building high structures (none of our air sampling will happen higher than the highest point on the Nautilus), nor are we installing any anchored or land-based structures or leaving any structures behind, the effect our air sampling will have on the Monument will be equal to that of the researchers breathing. In the case of the buckets to investigate atmospheric deposition, perhaps less.*

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

*E/V Nautilus will be obtaining a VMS system in 2022 per the OLE requirements and will have it aboard for the duration of the time the vessel will be in the Monument. The vessel currently utilizes AIS, which it will also retain and have on for the duration of the permitted activities.*

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

*The scope of work, timeline, non-invasive methodology, and intention behind this project is designed to maximize our knowledge and understanding of the PMNM's microplastic characteristics with negligible disturbance or damage.*

FOR SPECIAL OCEAN USE ACTIVITIES <u>OUTSIDE</u> OF MIDWAY ATOLL SPECIAL MANAGEMENT AREA, ANSWER THE ADDITIONAL THREE FINDINGS BELOW:

k. Explain how your activity will directly benefit the conservation and management of the Monument.

*Knowledge about threats to an ecosystem will contribute to the creation of appropriate and applicable conservation techniques and management policies that will benefit that ecosystem. In this case, the management plan for the Monument acknowledges that data related to the presence of microplastic will assist the Monument's managers in best protecting its natural resources. The research questions this project asks are: Is the PMNM a sink for atmospheric and marine microplastics? If so, what are the likely sources based on material ID, microparticle morphology, color, location and concentration? How do these numbers compare to locations around the globe? and, What can be done to protect the PMNM specifically? The data from this project will be analyzed and shared with Monument managers, local collaborators, Hawaii-based universities and more.*

l. Explain how the purpose of your activity is for research or education related to the resources or qualities of the Monument.

*This project brings together research, education and making understanding our ocean and the threats it faces, specifically microplastic, accessible to people throughout Hawaii and beyond. During the expedition, this project will engage citizen scientists onboard the E/V Nautilus to investigate the presence of plastic and anthropogenic microparticles in the waters and atmosphere of the Monument using a methodology that will be implemented at a global scale. The sampling methodology that the expedition team will use addresses the 3 primary impediments to microplastic research by citizen scientists: contamination, robust sample processing in the field and identifying the majority of microparticles without the need for expensive methods. Our Nautilus-based citizen scientists will not only reveal important information about microplastic pollution in the Monument, but they will be part of the team that launches this as a global program generating excitement through video content and live meet-ups. During the expedition, partner teams in Hawaii and locations around the world from Ghana to Greece to the Hudson River will use the same methods. The teams will come together in virtual meetings to compare the experience and share results, discuss what was found, the possible sources, causes and solutions. This project will leave a legacy of citizen science for solutions in the Monument and beyond launching a program that can be deployed worldwide in any body of water, from the most remote to the most urban.*

*An important element to this project that will happen outside of the Monument proper, but will contribute to its protection, is that we are developing a relationship with Hawaii-based researchers/educators. One of the enabling elements to our project is the use of a polarizing light microscope (PLM) to identify the characteristics and type of fibers (the most frequently found type of microplastic in our global waterways). Our team will work with our Hawaii-based collaborators sharing the methods and how to use the PLM. Furthermore, we will leave a PLM with our Hawaiian partners so they can become the hub for further study in Hawaiian waters. Because our sample collection methods are low impact, and use mostly everyday items and relatively low-cost equipment, it is reasonable to expect that this project launches ongoing research, education and contributions to the Monument's (and other waters around the Hawaiian island chain) protection, conservation and management. The project will also contribute to building and expanding data collection efforts in underdeveloped countries such as Ghana (Edem, one of our researcher's home countries) as well as Greece and Mexico. This will enable the comparison of data in global hotspots, and locations throughout other parts of Hawaii to the Monument.*

m. Does the activity involve the use of a commercial passenger vessel (defined as a vessel that carries individuals who have paid for such carriage)?

*No*

FOR SPECIAL OCEAN USE ACTIVITIES WITHIN MIDWAY ATOLL SPECIAL MANAGEMENT AREA, ANSWER THE ADDITIONAL TWO FINDINGS BELOW:

n. Explain how your activity will further the conservation and management of the Monument.

*N/A*

o. How is your activity compatible with the purposes for which the Midway Atoll National Wildlife Refuge was designated?

*N/A*

**NOTE: If this is a first time Special Ocean Use activity, it will be subject to a pilot project and will be restricted in duration. Special Ocean Use activities proposed outside the Midway Atoll Special Management Area will require public notice of the application and an opportunity to provide comments is given at least 30 days prior to issuing the permit.**

**8. Procedures/Methods:**

*Our methodology is from Gwinnett & Miller 2021 and the full, detailed step-by-step process found in that paper. The following will be facilitated by the 4 member project Team and carried out by the citizen scientists on the E/V Nautilus with remote support from C. Gwinnett.*

*Three x 1L grab samples of surface water and one 30-minute air sample will be collected and secured at each location. Water samples will be taken from onboard the Nautilus or from a tender via a 7-liter (2 gallon) metal bucket lowered by a rope (or hand) to obtain the sample. Water samples will not be taken in areas of observed spawning activity or areas of high concentration of surface flora or fauna. If the water sample does contain visible fauna, including visible fish eggs, the whole sample will be put back in the ocean and re-taken. If the sample contains flora that is greater than approximately 5mm, the entire sample will be put back in the ocean and re-taken.*

*Should we find a piece of plastic where there is fauna using that plastic as a substrate, such as fish eggs attached to floating plastic, the team will make an assessment and will either: determine that the fauna cannot be separated from the plastic without harm, in which case the assemblage will be put back in the ocean as is. Or, determine that the fauna can be separated from the plastic without harm, in which case the fauna will be separated and returned to the ocean quickly and carefully and the plastic dried and saved for future analysis.*

*Samples will be decanted from the bucket to a 1-liter glass jar. Water samples will be inspected (through the glass) for any visible fauna that was previously missed. If fauna are observed, the sample will be returned to the ocean immediately and re-taken. Water samples that are clear of visible fauna will then be gravity filtered onsite or vacuum filtered in the ship's lab. If at this stage, there are flora or fauna observed on the filter paper, they will be carefully removed and returned to the ocean immediately. Once the filter paper is free of visible flora and fauna, the remaining material (microplastics, microfiber, etc.) will be transferred to a glass slide using Easy Lift tape. The tape stays permanently attached to the slide, fixing the sample in place between the tape and slide, protecting it from contamination in perpetuity.*

*In terms of the filtrate from water samples, ocean water will be kept in place (geographically) by returning filtrate from samples back to the ocean while on location where it was collected. If that is not possible, then the filtrate will be put down the ship's grey water system. Water samples will NOT be transported between atolls or returned to a different geographic location than where they were collected.*

*Using the prepared slides (withasy Lift Tape protecting the contents of the sample), the team will use stereo/polarizing light microscopy to count fragments and fibers and identify the material of the fibers. All participants will wear supplied coveralls (a bright color) when working with the samples and follow full QA/QC procedures detailed in Gwinnett & Miller 2021.*

*Concurrent to the water sampling, air sampling will take place via a pump-driven air sampler for 30 minutes per sampling location. The sampler pulls air through a filter paper. Any items on the filter paper will be transferred to a glass slide using Easy Lift Tape. No ocean water is needed for this procedure.*

*Sampling will take place 2-3 times per day every other day with processing on alternate days and content generation daily throughout the expedition. Specific sample locations are TBD but will happen from either the Nautilus or a tender (not from land). Observations will be recorded while the air sampler is running and will include weather and sea state, the presence of animals and the presence of any marine debris. Some samples may be taken for training purposes, if so, they will follow the same protocols as the formal project samples.*

*In addition to the above, air sampling to investigate atmospheric deposition will happen from onboard the Nautilus using metal and plastic buckets. Buckets will be placed in various locations on the deck of the ship. At the following intervals: 24 and 48 hours, plus 1 and 2 weeks, the buckets will be washed down with fresh water from the ship's water system that has been filtered (millipore water) ) and samples processed in the same way as the water samples above, ultimately ending up on glass slides covered by Easy Lift Tape. All fresh water used for these air samples as well as for washing equipment between samples will be put down the ship's drain.*

*The collected microplastics and anthropogenic microfibers from both the water and air samples will be fixed under Easy Lift tape on the glass slides. They will stay this way in perpetuity (unless*

*they are removed from the slide for different types of analyses such as spectroscopy or other methods to determine their material and associated chemicals). Should our team recover a piece of plastic too large for the slide, it will be dried and stored in a paper envelope for future analysis. All microplastics and larger pieces of plastic pollution recovered during this project will be removed from the Monument and saved for potential future analysis. None will be returned to the ocean. The slides (and any pieces of plastic saved) will stay together and stored by the PI and/or team members or partners who are performing additional analysis.*

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

**9. Provide proof of general liability insurance, or indicate that you will be posting an equivalent bond against claims arising out of activities conducted under the permit:**

*Ocean Exploration Trust is insured for General Liability through American Casualty Company/Hylant-Cleveland (will be renewed in July), Hull & Machinery through Lloyd's Insurance Co S.A. & Beazley/Leviathan, and Protection & Indemnity through BML/QBE. Ocean ExplorationTrust's general liability limits include a general aggregate limit ($2M), a products/completed operations aggregate limit ($2M), bodily injury/property damage per occurrence limit ($1M), personal injury ($1M), fire damage liability ($1M) and medical payments ($5K).*

**10. If applicable, describe how you are collaborating with others in any way to reduce duplicative activities in the Monument or elsewhere?**

*We are not aware of any projects who will be taking samples at the same time in the same areas as ours. Because of the nature of microplastic pollution and our hypothesis that the Monument is a sink, rather than a source of microplastic (and anthropogenic microfiber) pollution, we believe that the more research that is done to collect and identify these microparticles, the better, especially when those data can be shared and compared to help identify potential sources. To that end, this project is also part of an effort to launch a global citizen science microplastic mapping and monitoring project encouraging collaboration among scientists, citizen scientists and stakeholders of all types to participate in their own locations, use our methods and share their data as we will share ours. At the writing of this application, we are seeking Hawaiian collaborators with whom to share methods and data which, rather than duplicate the research, will have a significant effect to build a valuable dataset that can only help the Monument's managers first understand how microplastic is affecting the resources and ecological integrity of the Monument and then help point the way to prevent and manage the problem.*

*This project from the onset will be collaborating with an indigenous data sovereignty team that aims to enhance data sharing among the local research institutions (i.e., University of Hawaii), stakeholders, communities, and others that are interested in acquiring the collected data. It is the*

*intention for this project to relay the results with Papahānaumokuākea Marine National Monument for reviewing management objectives and strategies. As we believe that data should be available and accessible by anyone, all data and results will be open-access unless there is sufficient reason or request not to release data.*

**11. List all specialized gear and materials to be used in this activity:**

*The majority of the equipment used in this project is off-the-shelf such as metal buckets and mason jars. There is one piece of specialized equipment for air collection: an air sampler (Leeland Legacy Personal Sample Pump 100-3002). For all sample analysis, an off the shelf stereo-microscope and polarizing light microscope will be used. Consumables used include: filter papers, Easy Lift Tape and standard glass slides.*

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

*None*

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

*None*

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

*Miller, R.Z., Watts, A.J.R., Winslow, B.O., Galloway, T.S., and Barrows, A.P.W. 2017. Mountains to the sea: River study of plastic and non-plastic microfiber pollution in the northeast USA. Mar. Pollut. Bull. 127, 245-251.*

*Gwinnett, C. and Miller, R.Z. 2021. Are we contaminating our samples? A preliminary study to investigate procedural contamination during field sampling and processing for microplastic and anthropogenic microplastics. Mar. Pollut. Bull. 173, 113095.*

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

22 January 2022
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