Papahānaumokuākea Marine National Monument

RESEARCH Permit Application

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

ADDITIONAL IMPORTANT INFORMATION:

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

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

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

INCOMPLETE APPLICATIONS WILL NOT BE CONSIDERED

Send Permit Applications to:
Papahānaumokuākea Marine National Monument Permit Coordinator
6600 Kalaniana'ole Hwy. # 300
Honolulu, HI 96825
nwhipermit@noaa.gov
PHONE: (808) 397-2660 FAX: (808) 397-2662

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: Marc Lammers
Affiliation: Hawaii Institute of Marine Biology

Permit Category: Research
Proposed Activity Dates: July-September 2012
Proposed Method of Entry (Vessel/Plane): NOAA ship Hi'ialakai
Proposed Locations: For Short term acoustic surveys and/or deep EAR deployment

Nihoa (Moku Manu):	23.06°N	161.92°W
Necker (Mokumanamana):	23.57°N	164.70°W
French FS (Kānemilohaʻi):	23.87°N	166.29°W
Gardner Pinnacles (Pūhāhonu):	25.02°N	167.98°W
Maro Reef (Nalukākala):	25.42°N	170.59°W
Laysan (Kauō):	25.77°N	171.73°W
Lisianski (Papaāpoho):	26.06°N	173.97°W
Pearl/Hermes (Holoikauaua):	27.93°N	175.74°W
Midway (Pihemanu):	28.20°N	177.35°W
Kure (Mokupāpapa):	28.42°N	178.33°W

Estimated number of individuals (including Applicant) to be covered under this permit: 2
Estimated number of days in the Monument: 25

Description of proposed activities: (complete these sentences):

a.) The proposed activity would…

Involve deploying and retreiving a portable diver-deployed line-array of hydrophones, secured temporarily to the sandy bottom at approximately 10-20 m depth. Hydrophone deployment will be conducted simultaneously with benthic and reef-fish surveys in order to correlate recorded reef noise with ecological conditions around each field site. Deployments will last a maximum of three days at each site. We will also deploy four deep water Ecological Acoustic Recorders (EARs) to depths ranging from 100 m to 500 m that will be used to record marine mammal activity, vessel traffic and sounds produced by the benthic and mesophotic communities. The

items used with each EAR will be a syntatic foam collar on the EAR, an acoustic release, a garage post concrete block and two sandbags.

b.) To accomplish this activity we would ….
Survey each field site and find an appropriate flat sandy region of sea floor adjacent to a large coral reef outcrop. Divers would then take the cable from the line array buoy from the dive tender and anchor it to the bottom using temporary sand-screw anchors. The floating buoy section of the array will float at the surface allowing for re-location and radio communication with the data logger. After deployment a survey of reef fish and benthic habitat will be conducted around the hydrophone site to a range of 100 m from the array, at depths of no more than 20 m. Retrieval of the array will be a reversal of the deployment process. A small boat dive tender will be required and at least two dives will need to be completed in the same location. For deep EAR deployments, we will first survey candidate locations with the ship's echosounder for relatively flat, sandy sites. We will then use the ship's J-frame or A-frame to lift the mooring anchor (cement block and sandbag), the acoustic release and deep EAR package along with flotation foam over the side of the ship and then release the entire package and let it drop to the bottom.

c.) This activity would help the Monument by …
Helping to evaluate the relative health of coral reef ecosystems in the Monument and validating the effectiveness of Monument protection via passively 'listening' to sounds made by reef organisms. We aim to collect data for the development of a process through which rapid assessments of reef health can be made by listening to reef sounds over a period of days. This way, ecological differences within and outside the Monument can be acoustically characterized, in addition to any changes within the Monument. It is intended that this tool will be used in aiding management decisions regarding protection of valuable marine resources such as the Monument. This process will also assist in evaluating vessel traffic patterns and marine mammal activity near the acoustic deployment areas.

Other information or background:
Evaluating the ecological state of the Monument is important to the successful management of the ecosystem within the Monument. Using passive acoustic recording, the relative state of Monument ecosystems over time and space can be quantified, allowing for rapid appraisal of any changes that may take place due to climate effects or human-related activities within the Monument.
Hydrophone arrays determine where sound producers are located in addition to recording their sounds. Using an array will allow us to pinpoint sections of the reef that are acoustically active and record what types of biological sounds are produced on different portions of the reef and the surrounding water. Combined with visual surveys, this information will allow us to determine to what extent different types of organisms contribute to the overall recorded sound field.

This type of information is important for managing the reso urces of the Monument, as it allows us to determine differences in the ecology of each area acoustically, and provide baseline data so that we may detect changes in the ecology of each area over time.

Comparisons between acoustic data recorded within and outside the Monument (in the main Hawaiian Islands) will allow us to quantify the effect of the Monument's protected status on the sound field, yielding insight toward the effect of the Monument on the overall ecology of the marine environment.

EARs have been used to acoustically monior Monument waters since 2006. Over the past several years, acoustic analyses have focused on documenting natural ambient sounds in order to establish baselines of activity for long-term comparisons. Considerable attention has been focused on the sounds produced by snapping shrimp, which are the most ubiquitous source of sound on coral reefs. Data collected in the Monument have so far yielded a wealth of information regarding temporal patterns of activity over periods of days, weeks and seasons. For example, EAR data have revealed that snapping shrimp are more active at night and also during periods of the new moon. They have also shown that snapping shrimp respond acoustically to storm events and changes in water temperature. In addition, it was recently shown that snapping shrimp activity is tied to variations in the concentration of Chlorophill a in surrounding waters. All these findings point to the fact that snapping shrimp are good bio-indicators of physical factors affecting the reef and that they will be very useful, over time, to help determine the relative stability of the ecosystems being monitored.

Other important findings obtained by deploying EARs in the Monument have involved documenting the occurrence of marine mammals in Monument waters. Last year a paper was published describing the occurrence of humpback whales in the NWHI. It demonstrated that the NWHI are an important wintering area for the north Pacific population, probably on par with the main Hawaiian Islands. Recent analyses suggest that the abundance of humpback whales in the NWHI have been rising over the past several years. In addition, fin whales and minke whales are being documented in Monument waters and subsequent analyses will focus on documenting trends associated with their occurrence.

Finally, deep water EAR deployments made in the past 2 years have been successful at recording vessel traffic at several sites. Both shipping and non-shipping traffic has been found in many recordings. Analyses related to vessel traffic patterns are ongoing but have been temporarily suspended due to a lack of funding. They will be resumed as soon as new sources of funding have been secured. A proposal was recently submitted to the NOAA Acoustics Program to specifically support the analysis of these data and any new data collected.

Section A - Applicant Information

1. Applicant

Name (last, first, middle initial): Lammers, Marc O.

Title: Assistant Researcher, HIMB

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

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

Phone: [redacted]

Fax: [redacted]

Email: [redacted]

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

3. Affiliation (institution/agency/organization directly related to the proposed project):
Hawaii Institute of Marine Biology and Scripps Institute of Oceanography

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):
Simon Freeman, Field Principal Investigator
Lauren Freeman, Research diver.

Section B: Project Information

5a. Project location(s):

		Ocean Based	
☒ Nihoa Island	☐ Land-based	☒ Shallow water	☒ Deep water
☒ Necker Island (Mokumanamana)	☐ Land-based	☒ Shallow water	☐ Deep water
☒ French Frigate Shoals	☐ Land-based	☒ Shallow water	☒ Deep water
☒ Gardner Pinnacles	☐ Land-based	☒ Shallow water	☐ Deep water
☒ Maro Reef			
☒ Laysan Island	☐ Land-based	☒ Shallow water	☐ Deep water
☒ Lisianski Island, Neva Shoal	☐ Land-based	☒ Shallow water	☒ Deep water
☒ Pearl and Hermes Atoll	☐ Land-based	☒ Shallow water	☒ Deep water
☒ Midway Atoll	☐ Land-based	☒ Shallow water	☒ Deep water
☒ Kure Atoll	☐ Land-based	☒ Shallow water	☒ Deep water
☐ Other			

NOTE: There is a fee schedule for people visiting Midway Atoll National Wildlife Refuge via vessel and aircraft.

Location Description:

Although exact locations of acoustic instrument deployment are cruise and weather dependent, general locations we intend to target are:

Nihoa (Moku Manu):	23.06°N	161.92°W (array & deep EAR site)
Necker (Mokumanamana):	23.57°N	164.70°W (array site)
French FS (Kānemilohaʻi):	23.87°N	166.29°W (array & deep EAR site)
Gardner Pinnacles (Pūhāhonu):	25.02°N	167.98°W (array site)
Maro Reef (Nalukākala):	25.42°N	170.59°W (array site)
Laysan (Kauō):	25.77°N	171.73°W (array site)
Lisianski (Papaāpoho):	26.06°N	173.97°W (array & deep EAR site)
Pearl/Hermes (Holoikauaua):	27.93°N	175.74°W (array & deep EAR site)
Midway (Pihemanu):	28.20°N	177.35°W (array site)
Kure (Mokupāpapa):	28.42°N	178.33°W (array site)

Attached is a map showing the tentative locations where the array work might be conducted (white squares). The final locations will be determined by the cruise's itinerary, which will be set by other priorities. Also shown are the tentative locations of deep EAR mooring deployments. These also will be subject to the limitations imposed by cruise priorities, logistics and weather.

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

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

☒ Drilling into, dredging, or otherwise altering the submerged lands other than by anchoring a vessel; or constructing, placing, or abandoning any structure, material, or other matter on the submerged lands
☐ Anchoring a vessel
☐ Deserting a vessel aground, at anchor, or adrift
☒ Discharging or depositing any material or matter into the Monument
☐ Touching coral, living or dead
☐ Possessing fishing gear except when stowed and not available for immediate use during passage without interruption through the Monument
☐ Attracting any living Monument resource
☐ Sustenance fishing (Federal waters only, outside of Special Preservation Areas, Ecological Reserves and Special Management Areas)
☐ Subsistence fishing (State waters only)
☒ Swimming, snorkeling, or closed or open circuit SCUBA diving within any Special Preservation Area or Midway Atoll Special Management Area

6 Purpose/Need/Scope ***State purpose of proposed activities:***
To characterize the ambient biological noise produced by different reefs within the Monument and determine the azimuth of vessel traffic noise sources in Monument waters by deploying and retrieving small acoustic recorders for 1-3 days at a number of field sites within the Monument. To deploy up to 4 deep EARs at depts ranging from 100 m to 500 m in order to monitor vessel traffic, marine mammal activity and the acoustic activity of the benthic and mesophotic communities for one year.

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

The Findings are as follows:

a. How can the activity be conducted with adequate safeguards for the cultural, natural and historic resources and ecological integrity of the Monument?
We will be deploying and retrieving an array of acoustic sensors in shallow water and will not be collecting any samples. The array will only be deployed for 1-3 days and will be completely removed afterwards. The deep EARs that will be deployed are entirely passive and do no emit any sounds themselves. EAR moorings have been used to monitor marine mammals and other marine biota around the world for the past several years and are completely safe to the environment. They do not interfere in any way with the behavior of nearby animals as they are entirely passive and no different fundamentally from any other moored instrument, such as a temperature sensor. In addtion, their presence in the environment is temporary, as they will be removed the following year. Therefore, no cultural, natural and historic resources will be jeopodized by our activities and ecological integrity of the Monumnet will be left undisturbed.

The four deep EARs that were deployed in the Monument in 2010 were recovered in 2011 from the following locations:

Kure Atoll	28 20.052'	178 15.195'	depth = 123 m
Nihoa	23 04.474'	162 04.967'	depth = 405 m
French Frigate Shoals	23 44.373'	166 23.473'	depth = 372 m
Lisianski Island	25 54.207'	174 01.373'	depth = 374 m

Recovery of the instruments required that the anchoring weights be left on the ocean floor. Each mooring anchor was composed of a 75 lbs concrete garage post anchor and three burlap bags filled with sand weighing approximately 25 lbs each. No plastic bags were used. Althought the exact susbrated on which deployments were made could not be visually verified, deployment locations were selected based on the relative rugosity observed on the ship's echosounder. To maximise the likelyhood of landing the moorings on sand, the locations selected were the flattest

that could be found in the area. The same deployment procedure and materials will be used for this year's proposed deployments.

b. How will the activity be conducted in a manner compatible with the management direction of this proclamation, considering the extent to which the conduct of the activity may diminish or enhance Monument cultural, natural and historic resources, qualities, and ecological integrity, any indirect, secondary, or cumulative effects of the activity, and the duration of such effects? We believe the deployment and recovery of the hydrophones is completely compatible with the management direction and will not jeapordize any of the Monument's cultural, natural, and historic resources, qualities and ecological integrity. We are very aware of the cultural and spiritual importance of the NWHI to the Native Hawaiian community. We understand that for many Native Hawaiians the NWHI represent a genealogical origin and that they are considered a return path for their spirits after death. We also understand and agree that is it important that all resources in the Monument be treated with both a high degree of respect and reverence. Therfore, we assure that deployment and recovery of the hydrophones will take Native Hawaiian cultural aspects into full consideration. All activities related to the hydrophones will be conducted in a way so as to have the smallest and shortest impact possible and no activities will be knowingly engaged in that are somehow disrespectful of Native Hawaiian cultural and spiritual practices.

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Other important findings obtained by deploying EARs in the Monument have involved documenting the occurrence of marine mammals in Monument waters. Last year a paper was published describing the occurrence of humpback whales in the NWHI. It demonstrated that the NWHI are an important wintering area for the north Pacific population, probably on par with the main Hawaiian Islands. Recent analyses suggest that the abundance of humpback whales in the NWHI have been rising over the past several years. In addition, fin whales and minke whales are being documented in Monument waters and subsequent analyses will focus on documenting trends associated with their occurrence.

Finally, deep water EAR deployments made in the past 2 years have been successful at recording vessel traffic at several sites. Both shipping and non-shipping traffic has been found in many recordings. Analyses related to vessel traffic patterns are ongoing but have been temporarily suspended due to a lack of funding. They will be resumed as soon as new sources of funding have been secured. A proposal was recently submitted to the NOAA Acoustics Program to specifically support the analysis of these data and any new data collected.

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 Monument represents an ecological system within unique oceanographic conditions which experiences unique protection and isolation from human impacts. To evaluate the effects of these conditions and impacts acoustically, hydrophones must be placed within the Monument. Acoustic data collection from within the monument is a critical component of our study as we aim to draw comparisons between the sound fields within the Monument and those from unprotected areas subject to urbanization and resource extraction within the MHI.

Furthemore, if we want to determine the presence of vessel traffic using acoustic instruments within the monument then the recording devices need to be within the Monument.

The deep EAR deployments proposed for this year will help build on the data sets obtained two years ago. Long-term data series become more valuable with each year that they are collected and data from EARs are no different in this regard. An additional year of data collection will help answer questions about whether the incidence of fin and minke whales are increasing in the Monument, similarly to what has been found for humpback whales, and it will also provide more insight into vessel traffic patterns. In addition, the data will help continue to build a library of sounds from deep dwelling organisms, which we currently know nearly nothing about.

d. How does the end value of the activity outweigh its adverse impacts on Monument cultural, natural and historic resources, qualities, and ecological integrity?
There will not be any adverse impact on the Monument so our activities should be considered as harmless. The anchoring materials that will be used do not contain any plastic of synthetic components and will therefore naturally decompose with time. We believe that the benefits of better understanding the occurrence of protected resources and vessels in Monument waters outweigh any temporary negative impacts from the abandoment of anchoring materials. Documenting the presence of endangered species such as fin whales in Monument waters will bring positive media and public attention to the Monument, which will in turn help strengthen support for management goals. Documenting the relative presence of vessels in Monument waters will help guide management decisions regarding required enforcement levels and and will help guage the effectiveness of current management efforts.

e. Explain how the duration of the activity is no longer than necessary to achieve its stated purpose.
To obtain a three-dimensional acoustic view of the field site the array will need to be positioned along x, y, and z axes for 24 hours at a time due to the daily cycle of acoustic activity found on

most reefs. Therefore the duration of the experiment is 72 hours and there are no other reasons for us to remain at the location. The deep EARs that will be deployed will be deployed for a one-year period. This length of time is meant to maximize the monitoring period for vessel and marine mammal sounds as well as to conform to deployment and recovery logistics. Once deployed, we do no expect to be able to return to recover the instruments until the following year.

f. Provide information demonstrating that you are qualified to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.
Marc Lammers led the design of the EAR and has been deploying EARs in the NWHI and many other parts of the world since 2006. He has been involved in bioacoustic research for the past 17 years.

Simon Freeman is an experienced SCUBA diver having logged more than 500 dives. He is familiar with conducting complex procedures underwater through his experience in technical diving. He has conducted SCUBA field studies in the Main Hawaiian Islands, New Zealand, and San Diego previously and is familiar with the necessary procedures undertaken in scientific diving. He has logged more than 200 dives in tropical coral reef environments and understands the care required in minimizing damage to coral reef organisms. He also has previous experience in working with hydrophone arrays through the ONR funded Deep Ocean Detection Program (DODP) at Scripps Institution of Oceanography.

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 field-based component of this project is supported by an allocation of ship time (July-September period, dates TBD) on the NOAA research vessel Hiialakai, from a line item in the budget of the Monument. Subsequent data analysis is made possible by an NSF IGERT award that provides support for Simon Freeman until June 2013. The deep EARs that will be deployed were previously funded by by the HIMB-NWHI Coral Reef Research Partnership (NMSP MOA 2005-008/66882).

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 method we are applying, that is to record acoustic signals thorughout the Monument will allow us to investigate acoustically the relative state of the marine ecosystem througout the Monument and compare these findings to data collected in the Main Hawaiian Islands.
This type of information provides insight into the cultural, natural and historical resources of the Monument. These observational techniques will not affect the quality and ecological integrity of the Monument.

Each deep EAR mooring anchor will be composed of a 75 lbs concrete garage post anchor and three burlap bags filled with sand weighing approximately 25 lbs each. No plastic bags will be

used. Although the exact substrate on which the deployments will be made cannot be visually verified, deployment locations will be selected based on the relative rugosity observed on the ship's echosounder. To maximize the likelihood of landing the moorings on sand and away from any deep-water coral, the locations selected will be the flattest that can be found in the area.

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

j. Demonstrate that there are no other factors that would make the issuance of a permit for the activity inappropriate.
These acoustic recordings are a continuation of research efforts that have been conducted for five years and throughout the history of the Monument by Marc Lammers and Whitlow Au at HIMB. During these previous efforts, there have been no problems with permit violations by our research team, no safety issues, and no complaints of offensive behavior. Under these circumstances there are no other factors that would make the issuance of the permit inappropriate.

8. Procedures/Methods:
Observations, deployment and retrieval of all hydrophone array equipment will be conducted using SCUBA apparatus. Divers will work from a small tender deployed from the research vessel. Initial observations at each site will be conducted to determine an appropriate location for hydrophone deployment. Hydrophones will be deployed on subsequent dives in locations within sites that provide level, sandy ground adjacent to the reef edge with unobstructed acoustic direct pathways to reef habitat.
The hydrophone array will be deployed along the sea floor parallel to the reef edge and secured to the bottom using dive weights and screw anchors. The depth of deployment will be between 10-20 m depth. Additional stakes will mark the geometric placement of each array element. During subsequent dives 24 and 48 hours later if possible, the array will be repositioned first orthogonal to the reef edge, then vertically in the water column whilst taking care to record the relative geometric positions of each element. The array and all associated equipment will be removed after 72 hours at each site. The array will be deployed simultaneously with a single hydrophone recorder (Loggerhead). All acoustic recorders will work on a duty cycle (on and off periods) to record 7 minutes of acoustic information every 10. The data are subsequently analyzed with computer-based alogirthms that will allow us to evaluate diurnal patterns of acoustic activity at various locations within the Monument and to identify various sound producing organisms such as invertebrates, fish, and marine mammals. We are also able to record engine sounds and determine the diretion of vessels that enter the monument and are within 5-10 km of the hydrophones. During deployment dives, surveys of benthic cover and reef fish will be conducted in the immediate area of hydrophone deployment.

Benthic surveys will be conducted by Lauren Freeman and Simon Freeman, the same team that will be deploying and retrieving the hydrophone (both AAUS science divers at Scripps, with previous research diving experience in the main Hawaiian Islands). After hydrophone deployment, ecological surveys will be conducted at the beginning and end of the recording period. A series of four 25m transect lines with 10 photo-quadrats taken randomly along each transect will be conducted at each site, based on methods outlined in Preskitt et al. (2004). Photo-quadrats will subsequently be analyzed for percent coral cover, percent algae cover, and dominant coral growth form. Alongside each transect we will measure reef rugosity using a tape measure and meter-stick method. Lastly, we will estimate fish abundance and diversity estimates using visual techniques used on previous NOAA RAMP cruises at each location. Although estimation outcomes vary due to human biases, we intend to adhere as closely as possible to established NOAA techniques in order to maximize the accuracy of comparisons between this data set and previously collected information. Regarding all surveys, it is critical for interpreting the acoustic data to have simultaneous ecological data collection.

The four deep EARs will be deployed directly off the ship by droping them overboard at sites ranging from 100-500 m in depth. EARs also work on a duty cycle and collect data through out the year on a daily basis. The data will be analyzed with computer-based alogirthms that will allow us to establish long-term activity patterns in the Monument and identify various sound producing organisms such as invertebrates, fish, dolphins and whales, as well as vessels that enter that occur within listening range of the EAR.

NOTE: If land or marine archeological activities are involved, contact the Monument Permit Coordinator at the address on the general application form before proceeding, as a customized application will be needed. For more information, contact the Monument office on the first page of this application.

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

Common name:
N/A

Scientific name:
N/A

& size of specimens:
N/A

Collection location:
N/A

☐ Whole Organism ☐ Partial Organism

9b. What will be done with the specimens after the project has ended?
N/A

9c. Will the organisms be kept alive after collection? ☐ Yes ☐ No
N/A

• General site/location for collections:
N/A

• Is it an open or closed system? ☐ Open ☐ Closed
N/A

• Is there an outfall? ☐ Yes ☐ No
N/A

• Will these organisms be housed with other organisms? If so, what are the other organisms?
N/A

• Will organisms be released?
N/A

10. If applicable, how will the collected samples or specimens be transported out of the Monument?
N/A

11. Describe collaborative activities to share samples, reduce duplicative sampling, or duplicative research:
N/A

12a. List all specialized gear and materials to be used in this activity:
In additon to the deep EARs that will be deployed, acoustic recordings will be made with two additional devices: the single-element standalone 'Loggerhead' acoustic recorder (approx 6 x 30 in. cylinder, 30lbs) built by Loggerhead Instruments and an 11-element unevenly-spaced line array built by the Buckingham lab at Scripps Institution of Oceanography (approx. 15 x 40 in. cylinder with 100ft-long cable, 80lbs).

The Loggerhead acoustic recorder consists of a single HTI hydrophone and a signal conditioning board that includes a preamp and adjustable band-pass filters. The sampling frequency of this recorder is 80 kHz. The array consists of eleven elements arranged in four five-element nested linear arrays. The design frequencies of these arrays are 250, 500, 1000, and 2000 Hz. The sampling frequency of each channel is 80 kHz. The word "element" is used to refer to any one of the eleven hydrophones in the hydrophone array. Each hydrophone is a small pressure sensor encased in rubber, connected together with a rubber-encased cable. The eleven hydrophones are

arranged in a geometric manner so that there are four groups of five hydrophones arranged with the same distance between each. The total lengths of these groups are 1.5 m, 3 m, 6 m, and 12 m. As the hydrophones in each group are arranged equidistantly, the spacings between the hydrophones within each group are 0.325 m, 0.75 m, 1.5 m, and 3 m respectively. The attached figure shows how the hydrophones are arranged along the cable. The hydrophones are arranged this way so that the array can focus on different acoustic frequencies – the spacing between hydrophones limits the frequencies that they can record. Having different spacings allows the hydrophones to record where a wider range of sounds come from.

The array can either be deployed horizontally along the bottom or vertically in the water column. During horizontal deployment the hydrophone cable will be held in tension between the two screw anchors at each end and the height of the screw anchor eyelets will be adjusted so that the hydrophones and cable will rest on the sand. As the hydrophones and cables are negatively buoyant they will be in contact with the sand and will not float in the water. The data collection module and battery pack are housed in floating, pressure-resistant containers that are designed to float at or near the surface. An extension cable may be coupled between the array and the data collection module to facilitate deployment along the bottom and/or in deeper water. A tilt sensor embedded in the array cable enables tilt-compensation when the array is deployed vertically. Eleven small stakes (similar to tent pegs) will be used to mark the position of each hydrophone. All stakes and any anchoring equipment will be removed after each survey.

The array will preferably be secured to the bottom using only the screw anchors as the transportation of dive weights by divers to and from the hydrophone site would be more challenging than the transportation of relatively lightweight screw anchors. The array will be deployed in locations with little current and swell. However, if water movement results in the excessive motion of the array while deployed horizontally, two diver weight belts with up to 20 lbs. of weight will be secured tightly to the array cable to prevent array movement. No weights will be used during vertical deployment. The screw anchors to be used for securing the hydrophones to the sea floor are approximately 40 inches long – it is anticipated that 95% of this length (38 inches) will be below the sand surface when deployed. The hydrophone cable will be connected to two-inch diameter eyelets on the upper end of the screw anchors. The anchors will be inserted into the sand by rotating the screw using a wooden stick inserted in the eye at the top of the anchor. Removal involves rotating the anchor in the opposite direction. Attached image shows an example screw and a wooden dowel used during field trials in San Diego.

Time-lapse cameras will be synchronized to run simultaneously with the hydrophone during its recording periods, so that concurrent visual data can be collected with acoustic data. The hydrophones will record a sample of ambient reef noise for 2 minutes at the beginning of every 30 minute period. The time-lapse cameras will be programmed to simultaneously turn on and record still images during these periods. Time-lapse cameras will be mounted on removable plastic stakes, similar in size to tent-pegs, that will be inserted in to the sandy sea floor. Plastic stakes will be removed with the cameras upon recovery.

12b. 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:

The complete list of instruments we plan to deploy includes the following:
1. The hydrophone array
2. A compact single hydrophone recorder (Loggerhead systems) similar to the EARs
3. Four underwater digital cameras (Canon D10)
4. Four deep EARs

These are all temporary items and will be recovered either during the current cruise or in the case of the deep EARs, the following year.
Schematic diagrams showing how the first three types of instruments will be deployed as well as photos of the three types of acoustic recorders to be used, are attached.

14. Provide a time line for sample analysis, data analysis, write-up and publication of information:
We expect analysis of the array data to be mostly completed by the end of 2012. Write-ups usually take no more than an additional year, although the turn-around time for some journals can exceed 300 days, so time to publication can still be considerable post-submission of the study. The EAR data will only become available when EARs are recovered, sometime in the summer of 2013. We expect the data from the EARs to be analyzed by the end of 2013.

Results from these studies will be made available to the Monument, FWS, and state managers as quickly as possible. Brown-bag luncheons at HIMB allow researchers to highlight important or interesting new results and discuss them with the management personnel. In addition, HIMB holds an annual symposium during which researchers present the most current findings from their ongoing research in the Monument. These efforts ensure that research results are provided to the Monument co-trustees as quickly as they become available.

15. List all Applicants' publications directly related to the proposed project:
•Freeman, S. E., D'Spain, G. L., Lynch, S., Stephen, R., Heaney, K., Murray, J., Baggeroer, A., Worcester, P., Dzieciuch, M., Mercer, J. "Simultaneous horizontal and vertical direction-of-arrival characterization of water-borne seismic phases using adaptive processing methods". J. Acoust. Soc. Am. Subm.

•Lammers, M.O., Brainard, R.E. and Au, W.W.L (2006). "Diel trends in the mesopelagic biomass community of the Northwestern Hawaiian Islands observed acoustically". Atoll Research Bulletin, 543:391-407.

•Lammers, M.O., Brainard, R.E. and Au, W.W.L., Mooney, T.A. and Wong K. (2008). "An Ecological Acoustic Recorder (EAR) for long-term monitoring of biological and anthropogenic sounds on coral reefs and other marine habitats." J. Acoust. Soc. Am. 123:1720-1728

•Lammers, M.O., Fisher-Pool, P., Au, W.W.L., Wong, K., Meyer, C. and Brainard, R., (2011). "Humpback whale (Megaptera novaeangliae) wintering behavior in the Northwestern Hawaiian Islands observed acoustically." Mar. Ecol. Prog. Ser. 423:261-268.

•Lammers, M.O., Stieb, S., Au, W.W.L., Mooney, T.A., Brainard, R.E. and Wong, K. (In prep). "Temporal, geographic and density variations in the acoustic activity of snapping shrimp." To be submitted to Mar. Ecol. Prog. Ser.

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.

3/23/12

Signature Date

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

Papahānaumokuākea Marine National Monument Permit Coordinator
6600 Kalaniana'ole Hwy. # 300
Honolulu, HI 96825
FAX: (808) 397-2662

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