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

June 8, 2012

Board of Land
and Natural Resources
Honolulu, Hawaii

Request for Authorization and Approval to Issue a Papahānaumokuākea Marine National Monument Research Permit to Dr. Greta Aeby, Assistant Researcher, University of Hawaii, Hawaii Institute of Marine Biology, for Access to State Waters to Conduct Coral Disease Research Activities

The Division of Aquatic Resources (DAR) hereby submits a request for your authorization and approval for issuance of a Papahānaumokuākea Marine National Monument research permit to Dr. Greta Aeby, Assistant Researcher, University of Hawaii, Hawaii Institute of Marine Biology, pursuant to § 187A-6, Hawaii Revised Statutes (HRS), Chapter 13-60.5, Hawaii Administrative Rules (HAR), and all other applicable laws and regulations.

The research permit, as described below, would allow entry and research activities to occur in Papahānaumokuākea Marine National Monument (Monument), including the NWHI State Marine Refuge and the waters (0-3 nautical miles) surrounding the following sites:

- Nihoa Island
- Necker Island
- French Frigate Shoals
- Gardner Pinnacles
- Maro Reef
- Laysan Island
- Lisianski Island, Neva Shoal
- Pearl and Hermes Atoll
- Kure Atoll

The activities covered under this permit would occur between July 1, 2012 and June 30, 2013.

The proposed activities are largely a renewal of work previously permitted in the Monument.

INTENDED ACTIVITIES:

The purpose of these activities is to examine coral disease occurring within the Monument.

Coral disease

The objectives of the activities are to

- Determine the prevalence and incidence (change in disease levels through time) of coral disease at several sites within the Monument;
- Examine the degree of recovery of colonies or reefs affected by disease;
- Investigate disease pathogenesis and etiology by comparing microbial communities between healthy corals and corals with White Syndrome diseased coral;
- Determine whether intrinsic factors, such as genetic relatedness or zooxanthellae clade may help explain the high prevalence of *Acropora* growth anomalies (GA) at French Frigate Shoals.

To conduct this research, the applicant's Field Principle Investigator (PI) would survey reefs for coral disease, mark and photograph individual colonies exhibiting signs of disease, repair permanent sites, sample diseased and healthy Acroporid corals for molecular and microbial analysis, and if new diseases are identified, collect samples for histological analysis.

Disease surveys

Re-survey of established sites throughout the Monument would follow established protocol. Transect lines would be laid out along the permanent pins. Corals along the lines would be identified to species, counted, and assigned to a size class. In addition, divers would examine all corals for signs of bleaching or disease. For corals exhibiting disease, a general description of the condition would be recorded, and the coral would be photographed. Colonies tagged in previous years would be relocated, remarked and photographed. Any newly infected colonies along transects would be photographed and tagged. Any lost pins would be replaced.

The Applicant requests to collect additional samples of targeted species of diseased corals that have not already been characterized by histology. For these activities, she would sample up to 20 diseased colonies (1 healthy and 1 diseased sample per colony) per island visited, if new diseases are encountered (a maximum of 400 samples total; see table below). Sample sizes would be 3-5 cm each.

White Syndrome disease and Growth Anomaly (GA) studies

If White Syndrome diseased corals are encountered, both diseased and healthy table and rice corals would be collected for subsequent microbial analysis. To do this, 1 healthy and 1 diseased sample would be collected per colony and per island (up to 30 samples total from each species).

For GA studies, Dr. Steven Karl would collect samples for genetic analysis (these activities would be permitted separately, through the proposed activities in permit PMNM-2012-030), and a small portion of each of these would be shared with the Applicant for zooxanthellae clade analysis (the present permit application). This sharing of samples between the Applicant and Dr. Karl would minimize overall biological collections from PMNM.

A summary of total requested collections for all objectives is as follows:

Coral species	**common name**	**island #**	**size**	**tot #**
Acropora cytherea	table coral	FFS up to 30	3-5cm	**30**
Montipora sp.	rice coral	all islands(up to 5) up to 30/is	3-5cm	**150**
Porites sp.	reef coral	all islands(up to 10) up to 20/is	3-5cm	**200**
Pocillopora sp.	reef coral	all islands(up to 10) up to 20/is	3-5cm	**200**
Pavona sp.	reef coral	all islands(up to 10) up to 20/is	3-5cm	**200**
				Grand total 780

The activities described above may require the following regulated activities to occur in State waters:

- ☒ Removing, moving, taking, harvesting, possessing, injuring, disturbing, or damaging any living or nonliving monument resource
- ☒ 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
- ☒ Touching coral, living or dead
- ☒ Swimming, snorkeling, or closed or open circuit SCUBA diving within any Special Preservation Area or Midway Atoll Special Management Area

REVIEW PROCESS:

The permit application was sent out for review and comment to the following scientific and cultural entities: Hawaii Division of Aquatic Resources, Hawaii Division of Forestry and Wildlife, Papahānaumokuākea Marine National Monument (NOAA/NOS), NOAA Pacific Islands Regional Office (NOAA-PIRO), United States Fish and Wildlife Service Hawaiian and Pacific Islands National Wildlife Refuge Complex Office, and the Office of Hawaiian Affairs (OHA). In addition, the permit application has been posted on the Monument Web site since April 16th, giving the public an opportunity to comment. The application was posted within 40 days of its receipt, in accordance with the Monument's Public Notification Policy.

Comments received from the scientific community are summarized as follows:

Scientific reviews support the acceptance of this application. The following concerns were raised during the review process. The applicant's responses are noted below.

1. *Do you have funds to ensure analysis and publication of the data? If so, what is the source of those funds? If not, how will you ensure that this project will be carried through to completion?*

   The applicant responds that yes, they have NSF and NOAA funds and will continue to apply for other funds to complete the work.

2. *Studying fixed sites will not address one of the applicant's primary stated objectives, which is "to determine the prevalence... of coral disease within the Monument" (Part A, page 2). The proposed activities may determine the prevalence of disease states along a single transect, but unless those sites are randomly selected, the results cannot be extrapolated up to atoll-wide prevalence. Fixed sites may be better suited for determining incidence, but cannot be used to determine prevalence. Transmission and the generation of new disease cases (incidence) will be biased compared to sites with normal background levels of disease. Levels of incidence found at such sites cannot be assumed to be representative of the atoll-wide population.*

   The following questions related to coral disease would be of primary interest to managers: (1) what is the atoll-wide prevalence of disease; (2) what is the atoll-wide incidence of disease; and (3) are these levels changing over time? These questions look at marine diseases at an ecosystem-wide scale, similar to what is called for in the PMNM Natural Resources Science Plan (page 31). How are these three questions addressed or not addressed in the proposed activities?

   The Applicant states that these broader scale questions are being addressed by the PMNM's normal monitoring program, which has disease assessment also. She states that these are very important questions but that the proposed work is extremely limited to time allowed up in PMNM and which islands they are allowed to visit, so they would like to use this time to address focal questions on disease processes that would complement PMNMs monitoring program. At the permanent sites they would look for changes in disease levels (incidence) and ultimate outcome of disease outbreaks. For example, at one site at FFS where there was a massive disease outbreak, the acroporid cover has declined from ~60% (2006) to ~20% (2011).

3. *It is not clear how this project fits with that proposed by Karl. How do these projects work together? Is there overlap? Or how do they complement each other?*

   The applicant explains that the projects complement each other. The question addressed is why there is a massive outbreak of growth anomalies on acroporids at the one site (FFS). Dr. Karl would look at potential underlying genetic mechanisms of potential disease susceptibility and the Aeby lab, in collaboration with Dr. Toonen, would examine zooxanthellae clade as well as provide the field ecology portion of the question.

4. *What are the number and size of Acropora cytherea samples to be collected, personnel with whom they will be shared, and purpose for which shared samples will be used.*

   The applicant responds that Dr. Karl would collect the samples for his genetic analysis and share a small portion of each for zooxanthellae clade analysis. If they find *Acropora* white syndrome, they would collect samples for microbial analysis (n= 30 fragments (3-5cm2)).

5. *Will the permanent sites be resurveyed? If GPS waypoints are not available, they should be collected on this trip and provided in the trip report.*

The applicant states that she would survey as many of the permanent sites as they can and would be happy to include all waypoints in the trip report.

6. *Request that the PI work with FWS on-island staff to develop non-technical year-round monitoring methods for coral disease and related data.*

   The applicant responds that this is a great idea, and thanks the reviewer suggesting this. She also asks who should be contacted to initiate this conversation.

7. *The number, size, use of, and sharing scheme of the Acropora samples confusing. I'm confused by the number of Acropora samples to be collected and the sharing scheme. On page 12 it is stated, "50 samples (1.0 cm) each of tumors and healthy tissue from different colonies will be collected for molecular analysis for the Toonen lab." But on page 13, the number of size of Acropora cytherea samples is stated as 30 samples @3-5 cm (same as stated in the table on page 17). On page 14 the applicant states, "Acroporid samples will be shared with the Callahan lab for microbial analysis". These samples seem to be in addition to those requested for collection under the Karl application (PMNM-2012-030).*

   The applicant apologizes for the confusion. She states that she would only be collecting 30 acroporid samples for microbial analysis of *Acropora* white syndrome and requests permission to collect samples of other coral genera if we run across a disease outbreak. Otherwise it would only be the 30 acroporid samples and that would be only if they find enough diseased corals.

8. *Locations/patch reefs where the samples are collected should have a GPS waypoint assigned. This is for future reference for Monument managers and researchers and to have a record of the collection sites. Multiple sampling activities at the same patch reefs may have a negative impact (cause stress) to the coral colonies present.*

   The applicant states that she would record and provide GPS waypoints for any collection.

9. *NMFS requests that the researchers ensure that their sample size stays within their 3 – 5 cm^2 range described in their application.*

   The applicant confirms that samples would stay within the 3-5cm^2 range.

10. *NMFS emphasizes the need for the researchers to follow strict sterilization protocols, per the PMNM BMPs, in order to prevent spread from a diseased coral to a healthy one.*

    The applicant confirms that sterilization protocols as per the PMNM BMPs will be strictly adhered to.

11. *Do the researchers have the ability to monitor a subset of the sampled coral over a period of time to ensure that the lesions heal, and that the colonies were not adversely affected by the research?*

The applicant responds that she has monitored numerous colonies in the past that were collected from other areas where they have the ability to photograph more than once a year. Corals heal very quickly, especially acroporids. She states that she could send some recent pictures of recovery from growth anomaly removal in American Samoa if the reviewer would like to see these.

12. *The total numbers are unclear and vary throughout the application. The applicant's request for a minimum number in the beginning of the application begs the question of how many samples would be allowed under her permit application. She then uses different numbers later in the application. Karl's application requests a maximum of 750 samples (which also sounds like a lot), whereas this application requests a total of 780 samples. How many of these respective samples are duplicative and able to be used by both applicants?*

To clarify the above two questions concerning sample collection and sharing of samples with the Karl lab, the applicant responds with the following answers:

One objective of our studies is to examine why there is such a high number of corals with tumors at one of the sites. To this end, Dr. Karl's lab would be collecting samples of both affected and healthy colonies and these samples would be used to look at the whether genetics play a role in disease occurrence (Karl lab) and whether tumored colonies might have a different type of zooxanthellae (symbiotic partner of the coral) as compared to healthy colonies (Toonen lab). This represents a multi-investigator partnership among researchers at HIMB to determine why disease prevalence is so high at this reef (~40% of the corals have tumors) compared to other reefs (<1% of the corals have tumors). If we can figure out why this site is so diseased it will help us determine whether management actions are needed at this or other coral reef sites. Samples to answer this objective are the only ones that can be shared between the Aeby, Karl and Toonen labs.

A second objective is to determine whether bacterial pathogens might be responsible for the tissue loss disease, *Acropora* white syndrome. We are requesting to collect samples separate from the Karl lab for this objective and as it is a different disease from the tumors mentioned above so we would have to sample different colonies than those shared with the Karl lab.

The final objective is looking at disease levels through time and samples would only be needed if new diseases are encountered or if tissue loss disease on *Montipora* is found. *Montipora* white syndrome outbreaks are occurring on reefs in the main Hawaiian Islands and we want to be proactive and determine whether the same bacterial pathogens are occurring in the NWHI. The request is for a total of 780 samples, to allow for sampling of new diseases or disease outbreaks. In 2011, we did not run across any new diseases or outbreaks and so only ended up collecting 27 small coral samples. We anticipate the same this year but want to have the flexibility to collect if a disease outbreak is occurring while we are up there. Coral disease is a serious problem worldwide and it is starting to

kill reefs here in Hawaii. Our only hope to help these reefs is by determining what is causing these diseases. Humans have seriously degraded our natural resources and it is now up to us to try and protect what is remaining.

Comments received from the Native Hawaiian community are summarized as follows:

Cultural reviews support the acceptance of this application. No concerns were raised.

Comments received from the public are summarized as follows:

No comments were received from the public on this application.

Additional reviews and permit history:

Are there other relevant/necessary permits or environmental reviews that have or will be issued with regard to this project? (e.g. MMPA, ESA, EA) Yes ☒ No ☐
If so, please list or explain:

- The proposed activities are in compliance with the National Environmental Policy Act.
- The Department has made an exemption determination for this permit in accordance Chapter 343, HRS, and Chapter 11-200, HAR. See Attachment ("DECLARATION OF EXEMPTION FROM THE PREPARATION OF AN ENVIRONMENTAL ASSESSMENT UNDER THE AUTHORITY OF CHAPTER 343, HRS, AND CHAPTER 11-200, HAR, FOR PAPAHĀNAUMOKUĀKEA MARINE NATIONAL MONUMENT RESEARCH PERMIT TO DR. GRETA AEBY, HAWAII INSTITUTE OF MARINE BIOLOGY, FOR ACCESS TO STATE WATERS TO CONDUCT CORAL DISEASE RESEARCH ACTIVITIES UNDER PERMIT PMNM-2012-040")

Has Applicant been granted a permit from the State in the past? Yes ☒ No ☐
If so, please summarize past permits:

- The applicant was granted permit DLNR/NWHI/06R008 to conduct similar work in 2009 and in 2011 under permit PMNM-2011-020.
- In addition, joint Monument permit PMNM-2008-036 was issued to Dr. Fenny Cox for similar work in 2008, but the activities were never carried out.

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

- The 2006 state permit, referenced above, resulted in a violation against Greta Aeby. Her violation fine was paid in 2008.

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

STAFF OPINION

DAR staff is of the opinion that Applicant has properly demonstrated valid justifications for her application and should be allowed to enter the NWHI State waters and to conduct the activities therein as specified in the application with certain special instructions and conditions, which are in addition to the Papahānaumokuākea Marine National Monument Research Permit General Conditions. All suggested special conditions have been vetted through the legal counsel of the Co-Trustee agencies (see Recommendation section).

MONUMENT MANAGEMENT BOARD OPINION

The MMB is of the opinion that the Applicant has met the findings of Presidential Proclamation 8031 and this activity may be conducted subject to completion of all compliance requirements. The MMB concurs with the special conditions recommended by DAR staff.

RECOMMENDATION

Based on the attached proposed declaration of exemption prepared by the department after consultation with and advice of those having jurisdiction and expertise for the proposed permit actions:

1. That the Board declare that the actions which are anticipated to be undertaken under this permit will have little or no significant effect on the environment and is therefore exempt from the preparation of an environmental assessment.

2. Upon the finding and adoption of the department's analysis by the Board, that the Board delegate and authorize the Chairperson to sign the declaration of exemption for purposes of recordkeeping requirements of Chapter 343, HRS, and Chapter 11-200, HAR.

3. That the Board authorize and approve a Research Permit to Dr. Greta Aeby, Hawaii Institute of Marine Biology, with the following special conditions:

   a. This permit is not to be used for nor does it authorize the sale of collected organisms. Under this permit, the authorized activities must be for noncommercial purposes not involving the use or sale of any organism, by-products, or materials collected within the Monument for obtaining patent or intellectual property rights.

   b. The permittee may not convey, transfer, or distribute, in any fashion (including, but not limited to, selling, trading, giving, or loaning) any coral, live rock, or organism collected under this permit without the express written permission of the Co-Trustees.

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

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

e. Refueling of tenders and all small vessels must be done at the support ships and outside the confines of lagoons or near-shore waters in the State Marine Refuge.

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

Respectfully submitted,

GUY KAULUKUKUI
Acting Administrator

APPROVED FOR SUBMITTAL

WILLIAM J. AILA, JR.
Chairperson

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: Greta Smith Aeby
Affiliation: HIMB

Permit Category: Research
Proposed Activity Dates: May 1 - Sept 30, 2012
Proposed Method of Entry (Vessel/Plane): NOAA research vessel Hiialakai
Proposed Locations: shallow water reefs throughout the Monument (Nihoa, Necker, FFS, Gardner, Pearl and Hermes, Maro, Laysan, Lisianski, Midway, Kure,)

Estimated number of individuals (including Applicant) to be covered under this permit: 8
Estimated number of days in the Monument: 21-28 days

Description of proposed activities: (complete these sentences):

a.) The proposed activity would…

Determine the prevalence and incidence (change in levels through time) of coral disease within the Monument. Examine degree of recovery of colonies or reefs affected by disease. Compare the microbial communities between healthy and diseased coral to investigate disease pathogenesis and etiology. If Montipora white syndrome is found, microbial studies will tell us whether the pathogen is the same or different as what is found in the MHI. Determine whether intrinsic factors such as genetic relatedness or zooxanthellae clade may help explain the high prevalence of Acropora growth anomalies (~40% of the colonies) within "tumor city" at FFS as compared to disease levels elsewhere within the Monument and the Indo-Pacific (<1% of the coral colonies).

b.) To accomplish this activity we would ….

Survey reefs for coral disease, mark and photograph individual colonies exhibiting signs of disease, and repair permanent sites. Coral colonies are tagged by placing a cable tie through a natural hole in the colony thereby producing no harm to the coral. GA-affected and healthy table corals would be sampled for follow-up molecular studies for relatedness and zooxanthellae clade by the Toonen lab. Genetic analysis requires a minimum of 50 small samples from individuals

within a population. White syndrome and healthy table and rice corals will be sampled for follow-up microbial studies by the Callahan lab. If we encounter any new coral diseases then we need to sample these for histological analyses to determine what the disease is doing to the coral at the cellular level. We will collect one healthy and one disease sample per colony. I am asking to be able to sample 20 diseased colonies (1 healthy and 1 diseased sample/colony) per island, which I estimate, based on disease prevalence from past surveys, as being sufficient to cover all the surveys at each of the islands. This request should cover our ability to adequately investigate any disease outbreaks we might encounter.

c.) This activity would help the Monument by …
giving them information as to the health status of their reefs, ability to predict amount of damage to reefs from coral disease through time, and a measure of the degree of resilience (ability to recover) of their reefs. Tissue loss diseases on corals throughout the Indo-Pacific have been found to be caused by pathogenic bacteria with Vibrio corallyticus identified in 3 different regions. In the main Hawaiian Islands we have identified three different bacterial pathogens causing tissue loss disease in Montipora. Identifying bacteria in healthy and disease corals will tell us whether the same pathogens are killing coral within the PMNM or if they are novel. A comparison of microbial communities is also the first step in identifying the pathogen. Pathogen identification allows us to start to understand where the diseases may be coming from and allows for the development of disease treatment to help contain the diseases. Montipora White Syndrome (MWS) has emerged as a serious problem on reefs within the MHI. We will also screen the reefs of PMNM for this disease and if found, the microbial community will be examined to determine if the disease is caused by the same pathogens as in the MHI. Is MWS spreading up into PMNM? The prevalence of disease at "tumor city" is unusually high and could be due to intrinsic factors such as the genetic relatedness or zooxanthellae clade of the table corals at that site and/or extrinsic factors such as contaminants. Molecular studies on coral colonies with this disease will help answer this question.

Other information or background: Coral reef ecosystems are at risk locally and globally due to global climate change and human activities. Mass bleaching events have increased dramatically since the 1980's and have usually been linked to El Nino or global warming-related increases in annual sea surface temperature (Brown 1997, Barber et al. 2001). The El Nino Southern Oscillation (ENSO) conditions during 1997 to 1998 resulted in worldwide bleaching from the Western Atlantic to the Great Barrier Reef. ENSO events have increased in frequency and duration in the past two decades (Barber et al. 2001, Walker 2001) and it has been predicted that the frequency and severity of coral bleaching will also continue to rise (Hoegh-Guldberg 1999).

In the western Atlantic coral disease has been incriminated in the marked degradation of reef habitats (Santavy and Peters 1997, Green and Bruckner 2000). Coral disease is reported to be responsible for the dramatic decline of Acroporids, one of the major frame-building corals in the Florida Keys, changing the structure and function of the coral reef ecosystem (Aronson & Precht 2001). Despite the major impact disease can have on reef systems, the etiology of most coral diseases remains unclear (Santavy and Peters 1997, Richardson 1998). The causative agents,

mechanism of pathogenesis and link to environmental or anthropogenic stress are still largely unknown (Richardson 1998, Green & Bruckner 2000).

The reefs of the Northwestern Hawaiian Islands (NWHI) are considered to be relatively healthy but they are not immune to the conditions that have led to the decline of other reef systems. In September 2002, the first mass-bleaching event was recorded on the reefs of the NWHI with a second bleaching event occurring in 2004. In the three northwestern-most atolls of the Archipelago (Pearl & Hermes, Midway and Kure) over half of all sites had significant bleaching (Aeby et al. 2003, Kenyon et al., 2005). Ten coral disease states have now been described from the NWHI (Aeby 2006) and we have established permanent sites which allow us to determine both temporal and spatial changes in diseases through time and the ultimate affect of disease on the health of the ecosystem. We will measure changes in disease levels through time, rates of tissue loss from different diseases, patterns of disease transmission among colonies, rate of spread of disease and evaluate changes in coral cover and coral species composition. In addition, two diseases of concern have been identified, Acropora white syndrome and Acropora growth anomalies which we are targeting for focused studies.

Acropora white syndrome (AWS) is a disease which causes acute tissue loss in acroporids and has been reported from across the Indo-Pacific. Acropora white syndrome appeared on one reef in the northwestern Hawaiian Islands (NWHI) in 2003 (Aeby 2006) and has since spread. Our prior studies in 2005 and 2006 found this disease to be highly virulent having killed over 19 large table acroporids with numerous other colonies suffering massive tissue loss from the disease. The disease occurs predominantly at French Frigate Shoals (FFS) within the NWHI, which is the center of abundance and diversity of acroporids in Hawaii. We plan to continue to follow the dynamics of this disease by re-surveying permanent sites to measure coral mortality and disease spread. We also need to start understanding the underlying etiology of disease and we will be comparing the microbial community of AWS and healthy coral as a first step. Within the MHI, Montipora white syndrome is becoming a problem with two separate disease outbreaks reported from Kaneohe Bay. Our disease surveys will document whether MWS is occurring in the PMNM and if so, microbial comparisons will inform us whether they are caused by the same or different pathogens as found in the MHI. This work will be conducted in collaboration with the Callahan lab.

"Tumor city" at FFS has an unusually high prevalence of Acropora growth anomalies (40%) as compared to other areas (<1%). We hypothesize this could be due to intrinsic factors (genetic susceptibility, zooxanthellae clade, etc) or extrinsic factors such as contaminants in the environments. As a first cut in understanding why disease levels are so high on that reef, we will examine the genetic relatedness and zooxanthellae clades of affected vs. unaffected colonies found on that reef. This work will be conducted in collaboration with the Toonen lab and will complement the work proposed by the Karl lab.

It is important for management agencies to have a through understanding of the vulnerability of these reefs to disease and the first steps in managing disease are developing an understanding of the causes of disease, modes of transmission and assessing its geographic extent. Management of disease in wildlife populations usually involves either reducing or removing the source of infection or reducing the spread of the disease. However, before appropriate management plans can be made the epizootiology of diseases must be understood. Corals are the very foundation of the entire coral reef ecosystem and as such threats to their survival must be managed using the best available science. Our studies, past, present and

proposed, are suppling critical information about coral disease and disease dynamics, which are a serious threat, within the NWHI.

Section A - Applicant Information

1. Applicant

Name (last, first, middle initial): Aeby, Greta S.

Title: assistant researcher

1a. Intended field Principal Investigator (See instructions for more information):
Dr. Steve Karl

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

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):
Dr. Sean Callahan: co-investigator
Dr. Fenny Cox: co-investigator
Dr. Frank Stanton: co-investigator
Amanda Shore: graduate student
Maya Walton: graduate student
Jonothon Whitney: graduate student

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:
shallow reefs throughout the Monument

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:***

1. To re-survey permanent sites for assessment of disease dynamics
2. To conduct new disease surveys at any sites of interest to management
3. To compare microbial communites between healthy and white syndrome corals
4. To determine the zooxanthellae clades of GA-affected vs. healthy coral colonies at FFS with samples received in collaboration with the Karl lab.

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?
PMNM is now considered a World Heritage Site which emphasises the cultural and historic importance of the area as well as the ecological importance. As such, members of this team will be informed of the uniqueness of PMNM and will be trained to conduct all activities in a manner reflecting this importance. All personnel will also attend established cultural training classes to better understand and respect the cultural and spiritual importance of PMNM. From a biological point of view, activities willl be conducted in a manner to minimally impact coral reef resources and standard protocols for disease studies developed for the Monument will be used. All gear will be sterilized each day and any collected organisms will be placed in plastic bags at depth before transer to the small boat. All laboratory work willl be conducted using established biosecure protocols including sterilizing all tools and work surfaces. All biological samples will be fixed in solution for transport to our laboratories in Honolulu.

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 collapse of coral reefs from disease in other regions points to the critical need to understand disease processes. Our research program is dedicated to studying disease in the Monument so that managers have the information they need to protect these vulnerable resources. All researsh proposed in this permit application is directly applicable to the management of diseases of coral within the region. All surveys are conduced in a manner causing little to no impact on the environment as they use visual and phtographic techniques. We will be collecting the minimal number of coral samples required to complete our laboratory analyses.

c. Is there a practicable alternative to conducting the activity within the Monument? If not, explain why your activities must be conducted in the Monument.
There is no alternative to conducting the activity in the Monument. Although, comparative studies of disease in other regions are useful, they cannot replace understanding damage from the specific diseases affecting coral populations in the Monument.

d. How does the end value of the activity outweigh its adverse impacts on Monument cultural, natural and historic resources, qualities, and ecological integrity?
If diseases are not managed in the Monument, the coral reefs will suffer the same fate as coral reefs in the Florida Keys and other regions of the Caribbean. In the Keys, their acroproids, which used to be their numerically dominant coral, have been reduced by 90% and are now on the endangered species list (Patterson et al. 2002). Acroporids in the Monument are already in decline due to two different diseases, Acropora white syndrome and Acorpora growth anomalies. Current models of global climate change predict a significant increase in sea surface temperature (Kleypas et al. 1999). Elevated temperatures have been shown to accelerate the growth rate and pathogenecity of pathogens and so it is predicted coral disease will become more common and widespread (Porter et al. 2001). On the GBR, increases in White Syndrome are associated with temperature anomalies. Acropora white syndrome is also currently killing corals in the Monument so information of the epizootiology of this disease is critically important for the development of both immediate and long-term management strategies. Montipora white syndrome outbreaks are now occurring in the MHI. We bring a pro-active approach to PMNM in screening reefs for this new potential threat to the corals.

e. Explain how the duration of the activity is no longer than necessary to achieve its stated purpose.
We are requesting the absolute minimum amount of time require to condut our studies. We anticipate staying a maximun of 5 days at any one island within the Monument.

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 been conducting coral disease surveys and studies in the Monument since 2002. I am familiar with the reefs and methodology required to safely conduct all proposesd studies. I was involved in the development of protocols for investigations of coral disease developed for the Monument. I am also a co-author on the book "A coral disease handbook: guidelines for assessment, monitoring and management." and was the lead in developing Hawaii Division of Aquatic Resources "Rapid Response Contingency Plan for unusual events of coral bleaching, disease and COTS outbreaks".

Both of these publications make recommendations for proper procedures involving investigating marine diseases including field techniques, the need for follow-up laboratory investigations and safe handling 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.
I am employed by the University of Hawaii and thus would be covered under University policies.

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 Monuments goal is to preserve the integrity of the resources for cultural, historical and ecological reasons. Disease is already established in the Monument and is starting to degrade the coral populations. Corals are the very foundation of the coral reef ecosystem so if the Momument is to prevent irrepairable damage from disease it must first have information on the extent and harm from diseases. Our research addresses these needs for the Monument and does so in the most minimally invasive manner as possible. Our methods are predominanatly visual surveys which do no harm. Marking of individual colonies is also non-invasive. Small samples will be taken for molecular and microbial analysis for the Callahan lab, and Toonen lab and of any new diseases encountered not yet characterized by histology. The acropora GA and GA control samples will obtained from the Karl lab to minimize overall collections from the reefs.

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.
I am an established disease scientist who has conducted similar research throughout the Indo-Pacific and in the Florida Keys with no problems. I am familiar with all required protocols in disease assessment and have help author numerous publications outlining proper response and procedure for investigating disease outbreaks.

8. Procedures/Methods:
Disease surveys: As possible, re-survey of established sites or new sites of interest (up to 6) throughout the Monument will be done following established protocols. Two 25 m lines will be laid out along the permanent pins. A diver will then swim over the lines during which all corals within one half meter of either side of the transect lines will be identified to specie, counted, and assigned to a size class (0-5cm; 6-10cm; 11-20cm;

21-40cm; 41-80cm; 81-150cm; >150cm.). In the same manner, a second diver will swim over the lines and examine all corals for signs of bleaching or disease. Bleached colonies will be assigned a bleaching category: 0-no bleaching; 1- 10-30%; 2-30-50%; 3-50-100%; 4- 100%; 5-mortality. For corals exhibiting disease, a general description of the condition will be recorded, the coral will be photographed and a specimen will be collected for histopathological examination. 20 samples/island for other coral diseases are requested and are to be used for histology to examine disease processes at the cellular level. These samples will only be required if we come across undocumented diseased colonies or a disease outbreak within our transects. If we do not encounter a disease outbreak or undocumented diseases then no sampling will occur. I am asking to be able to sample 20 diseased colonies (1 healthy and 1 diseased sample/colony) per island, which I estimate, based on disease prevalence from past surveys, as being sufficient to cover all the surveys at each of the islands. Individual colonies tagged in 2005 or 2006 will be relocated, remarked and photographed. At permanent sites, any new infected colonies along the transect will be photographed and tagged. Coral colonies are tagged by placing a cable tie through a natural hole in the colony thereby producing no harm to the coral. Any lost pins will be replaced and loose pins re-glued.

Zooxanthellae clade of affected and unaffected Acropora

50 samples (1.0 cm) each of tumors and healthy tissue from different colonies will be collected for molecular analysis for the Toonen lab. 50 is the minimum number needed to do genetic analysis. All samples will be fixed in salt (DMSO) buffer for transfer to our labs at HIMB. The requested samples for Acropora cytherea with and without tumors will be used for both genetic and zooxanthellae clade analyses and will be obtained from collections covered under the permit by the Karl lab.

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:
table coral

Scientific name:
Acropora cytherea

& size of specimens:
30 samples @ 3-5 cm^2. total=30 samples. see attached table

Collection location:
FFS

☐ Whole Organism ☒ Partial Organism

9b. What will be done with the specimens after the project has ended?
Samples will be destroyed in the various analyses. Any samples that are not, will be be maintained preserved at HIMB.

9c. Will the organisms be kept alive after collection? ☒ Yes ☐ No
Samples will be kept alive until they can be frozen on the ship which kills microbes preventing disease spread. We will be processing the coral samples upon our return from the small boats so we should be done before leaving a location but that depends on how many samples we have and sometimes the ship leaves early, etc. so wanted to make sure we had some flexibility in processing time. will be frozen or placed in Z-fix in the lab both of which kills microbes preventing any disease spread.

• General site/location for collections:
FFS

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

• Is there an outfall? ☐ Yes ☒ No

• Will these organisms be housed with other organisms? If so, what are the other organisms?
no

• Will organisms be released?
no

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

Transport of preserved samples (dead samples) out of the Monument would occur during transit between islands and back to the MHI

11. Describe collaborative activities to share samples, reduce duplicative sampling, or duplicative research:
Acroporid samples will be shared with the Callahan (Dr. Sean Callahan, Microbiology Dept, UH Manoa) lab for microbial analyses. We are not requesting samples for the zooxanthellae clad analyses as these will be obtained from sharing samples with the Karl lab. Dr. Karl will serve as my field PI and our teams will be working together at FFS. We will not be doubly collecting Acropra cytherea but will be sharing samples when appropriate. Samples from colonies with growth anomalies will be shared between the two labs.

12a. List all specialized gear and materials to be used in this activity:
See list at end up 11.

Common name: reef coral

Scientific name: Porites sp., Pocillopora sp., Pavona sp., Species will vary depending upon disease occurrence.

& size of specimens: up to 200 samples per coral genera @ 3-5cm^2. see attached table

Collection location: shallow water reefs throughout the Monument (Nihoa, Necker, FFS, Gardner, Pearl and Hermes, Maro, Laysan, Lisianski, Midway, Kure,)

Whole Organism XPartial Organism

1b. What will be done with the specimens after the project has ended?
Samples will be destroyed in the various analyses. Any samples that are not, will be be maintained preserved at HIMB.

1c. Will the organisms be kept alive after collection? XYes No
Corals will be transported live in buckets of sea water to the Hi'ialakai where they will b frozen or placed in Z-fix in the lab which kills microbes preventing disease spread.

☐Specific site/location:
☐Is it an open or closed system? 0 Open XClosed

☐s there an outfall? 0 Yes XNo

☐Will these organisms be housed with other organisms? If so, what are the other organisms? No

☐Will organisms be released? No

2. If applicable, how will the collected samples or specimens be transported out of the Monument? Samples will be transported in buckets on small boats to the Hi'ialakai which may or may not be within Monument waters. Fixed or frozen samples (dead samples) will be transported back to Honolulu via the Hi'ialakai.

3. Describe collaborative activities to share samples, reduce duplicative sampling, or duplicative research: Samples may be shared with Callahan lab (UH Microbiology) if they need microbial analysis (MWS) or if histology is needed they will be shared with Dr. Thierry Work (USGS).

Common name: Rice coral

Scientific name: Montipora sp., Species will vary depending upon disease occurrence.

& size of specimens: up to 150 samples @ 3-5 cm^2. see attached table

Collection location: shallow water reefs throughout the Monument (Nihoa, Necker, FFS, Gardner, Pearl and Hermes, Maro, Laysan, Lisianski, Midway, Kure,)

Whole Organism XPartial Organism

1b. What will be done with the specimens after the project has ended?
Samples will be destroyed in the various analyses. Any samples that are not, will be be maintained frozen at HIMB.

1c. Will the organisms be kept alive after collection? XYes No
Corals will be transported live in buckets of sea water to the Hi'ialakai where they will be frozen in the lab which kills microbes preventing any disease spread.

☐Specific site/location:

☐Is it an open or closed system? 0 Open XClosed

☐Is there an outfall? 0 Yes XNo

☐Will these organisms be housed with other organisms? If so, what are the other organisms? No

☐Will organisms be released? No

2. If applicable, how will the collected samples or specimens be transported out of the Monument? Samples will be transported in buckets on small boats to the Hi'ialakai which may or may not be within Monument waters. Fixed or frozen samples (dead samples) will be transported back to Honolulu via the Hi'ialakai.

3. Describe collaborative activities to share samples, reduce duplicative sampling, or duplicative research: Samples may be shared with Callahan lab (UH Microbiology) if they need microbial analysis (MWS) or if histology is needed they will be shared with Dr. Thierry Work (USGS).

List all specialized gear to be used in this activity

dive gear
coral collection gear (bone cutters, hammer, chisel, ziplock and whirlpak bags, bag to carry gear)
coral processing gear (plastic jars, z-fix, clorox)
stereo microscope
cameras and underwater housing
sludge hammer, steel pins and underwater glue
field equipment (tape measures, floats, clipboards, underwater paper, cow ear tags, cable ties)
hand held GPS
computer
5 gal buckets with lids
Miscllaneous office supplies (books, tablets, pencils, pens, markers, scissors, stapler, 3-hole punch, etc.)
Personal gear (clothing, personal hygeine items, diet coke, snacks, sunglasses, etc)

Aeby NWHI permit sample collection table 2012

Coral specie	common name	island	#	size	tot #
Acropora cytherea	table coral	FFS	up to 30	3-5cm	30
Montipora sp.	rice coral	all islands(up to 5)	up to 30/is	3-5cm	150
Porites	reef coral	all islands(up to 10)	up to 20/is	3-5cm	200
Pocillopora	reef coral	all islands(up to 10)	up to 20/is	3-5cm	200
Pavona	reef coral	all islands(up to 10)	up to 20/is	3-5cm	200
total					780

12b. List all Hazardous Materials you propose to take to and use within the Monument:
Clorox- 5 gallons-used for sterilization of equipment and growth anomaly processing for skeletal analyses.
Z-fix-1gallon-used for preserving coral samples for histology
Ethanol-1 gallon-used for preserving samples for molecular analyses
DMSO-1 gallon used for preserving samples for molecular analyses
All chemicals will be contained in bottles within secondary containment and will be transported out of the Monument and sent back to our lab at HIMB

13. Describe any fixed installations and instrumentation proposed to be set in the Monument:
Repair or replacement of steel pins at permanent monitoring sites.

14. Provide a time line for sample analysis, data analysis, write-up and publication of information:
Fall 2012-Spring 2013: histology, molecular and microbial analyses. Summer - Fall 2012: data analysis and report writing

15. List all Applicants' publications directly related to the proposed project:
Wilson, B, Aeby, GS, Work, TM and DG Bourne. In press. Bacterial communities associated with healthy and Acropora White Syndrome-affected corals from American Samoa. Environ Micro.

Sudek, M, Aeby, GS, and SK Davy. In press. Localized bleaching in Hawaii causes tissue loss and a reduction of the number of gametes in Porites compressa. Coral Reefs.

Work, TM, Forsman, Z, Szabo, Z, Lewis, T, Aeby, G and R Toonen. 2011. Inter-

specific coral chimerism: genetically distinct metazoa associated with tissue loss in Montipora capitata. PLoS ONE 6(7):e22869.

Aeby, GS, Williams, GJ, Franklin, EC, Kenyon, J, Cox, EF, Coles, S and TM Work. 2011. Patterns of coral disease across the Hawaiian archipelago: relating disease to environment. PLoS ONE 6(5):e20370.

Williams, G, Knapp, I, Aeby, G and S. Davy. 2011. Spatial and temporal patterns of scleractinian coral, soft coral, and zoathid disease on a remote, near-pristine coral reef (Palmyra Atoll, central Pacific). Dis Aquat Org 94:89-100.
Work, TM and GS Aeby. 2011. Pathology of tissue loss (white syndrome) in Acropora sp. corals from the Central Pacific. J Invert Path 107(2):127-131.

Aeby, GS, Williams, GJ, Franklin, E, Haapkyla, J, Harvell, CD, Neale, S, Page, C, Raymundo L, Vargas-Angel, B, Willis, B, Work, T and S. Davy. 2011. Growth Anomalies on the Coral Genera Acropora and Porites are Strongly Associated with Host Density and Human Population Size. PLoS one 6(2):e16887.

Aeby, GS, Bourne, DG, Wilson, B and TM Work. 2011. Coral diversity and the severity of disease outbreaks: a cross-regional comparison of Acropora white syndrome in a species-rich region (American Samoa) with a species-poor region (Northwestern Hawaiian Islands). J Mar Bio2011.

Williams, G., Work, T., Aeby, G. and S. Davy. 2010. Gross and microscopic morphology of lesions in Cnidaria from Palmyra Atoll, remote Central Pacific. J Invert Path 106(2): 165-173.

Work, TM and GS Aeby. 2010. Wound repair in Montipora capitata. J Invert Path 105:116-119.

Aeby, GS, Ross, M, Williams GJ, Lewis TD and TM Work. 2010. Disease dynamics of Montipora white syndrome within Kaneohe Bay, Oahu, Hawaii: distribution, seasonality, virulence, and transmission. Dis Aquat Org 91:1-8.

Work, TM, Vignon, M and GS Aeby. 2010. Microparasite ecology and health status of blue-lined snappers (Lutjanus kasmira) from the Pacific islands. Aquatic Biology 9:185-192.

Williams, G., Aeby, G., Cowie, R. and S. Davy. 2010. Predictive modeling of coral disease distribution within a reef system. PLoS one 5(2):e9264.

Kenyon, K, Wilkinson, C., and G. Aeby. 2010. Community structure of hermatypic

corals at Midway Atoll in the Northwestern Hawaiian Islands: A legacy of human disturbance. Atoll Research Bulletin 581.

Aeby, G, Work, T, Fenner, D. and E. DiDonato. 2009. Coral and crustose coralline algae disease on the reefs of American Samoa. Proc Int. 11th Int. Coral Reef 197-201

Work, T., Aeby, G., Stanton, F., and D. Fenner. 2008. Overgrowth of fungi (endolithic hypermycosis) associated with multifocal to diffuse distinct amorphous dark discoloration of corals in the Indo-Pacific. Coral Reefs 27:663.

Work, T., Aeby, G. and S. Coles. 2008. Distribution and morphology of growth anomalies in Acropora from across the Indo-Pacific. Dis. Aquat. Org. 78(3):255-264.

Williams, G., Davy, S. and G. Aeby. 2008. Coral disease at Palmyra Atoll, a remote reef system in the Central Pacific. Coral Reefs 27:207.

Kenyon, J., Dunlap, M., Wilkinson, C. Page, K., Vroom, P and G. Aeby. 2007. Community structure of hermatypic corals at Pearl and Hermes Atoll, Northwestern Hawaiian Islands: Unique conservation challenges within the Hawaiian archipelago. Atoll Research Bulletin 549.

Kenyon, J., Wilkinson, C., Dunlap, M., Aeby, G. and C. Kryss. 2007. Community structure of hermatypic corals at Laysan and Lisianski/Neva Shoal, Northwestern Hawaiian Islands: A new layer of scientific exploration. Atoll Research Bulletin 550:

Aeby, G.S. 2007. First record of coralline lethal orange disease (CLOD) in the Northwestern Hawaiian Islands. Coral Reefs 26(2):385.

Aeby, G.S. 2007. Spatial and temporal patterns of infection of Porites trematodiasis on the reefs of Kaneohe Bay, Oahu, Hawaii. Bull. Mar. Sci. 80(1):209-218.

Aeby, G.S. 2006. Baseline levels of coral disease in the Northwestern Hawaiian Islands. Atoll Research Bulletin 543:471-488.

Domart-Coulon, J., N.Traylor-Knowles, E. Peters, D. Elbert, C. Downs, K. Price, J. Stubbs, S. McLaughlin, E. Cox, G. Aeby, P. Brown and G. Ostrander. 2006. Comprehensive characterization of skeletal tissue growth anomalies of the finger coral Porites compressa. Coral Reefs 25:531-543. Symp. 197-201.

Kenyon, J., Wilkinson, C. and G. Aeby. 2008. Community structure of hermatypic corals at Maro reef in the Northwestern Hawaiian Islands: A unique open atoll. Atoll Research Bulletin 558.

Work, T. and G. Aeby. 2006. Systematically describing gross lesions in corals. Dis Aquatic Org 70:155-160.

Kenyon, J. G. Aeby, R. Brainard, J. Chojnacki, M. Dunlap, C. Wilkinson. 2006. Mass coral bleaching on high-latitude reefs in the Hawaiian Archipelago. Proc. 10th Int. Coral Reef Symp. 631-643.

Kenyon, J., Vroom, P., Page, K., Dunlap, M., Wilkinson, C. and G. Aeby. 2006. Community Structure of Hermatypic Corals at French Frigate Shoals, Northwestern Hawaiian Islands: Capacity for Resistance and Resilience to Selective Stressors. Pac Sci 60(2):153-175.

Maragos, J., D. Potts, G. Aeby, D. Gulko, J. Kenyon, D. Siciliano, and D. VanRavensway. 2004. The 2000-2002 Rapid Ecological Assessment of Corals in the Northwestern Hawaiian Islands, Part I: Species and Distribution. Pacific Science 58(2):211-230 .

Aeby, G. 2003. Corals in the genus Porites are susceptible to infection by a larval trematode. Coral Reefs 22:216.

Aeby, G.S., Kenyon, J., Maragos, J. and Potts, D. 2003. First record of mass coral bleaching in the Northwestern Hawaiian Islands. Coral Reefs 22:256.

With knowledge of the penalties for false or incomplete statements, as provided by 18 U.S.C. 1001, and for perjury, as provided by 18 U.S.C. 1621, I hereby certify to the best of my abilities under penalty of perjury of that the information I have provided on this application form is true and correct. I agree that the Co-Trustees may post this application in its entirety on the Internet. I understand that the Co-Trustees will consider deleting all information that I have identified as "confidential" prior to posting the application.

Signature Date

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

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

Papahānaumokuākea Marine National Monument
Compliance Information Sheet

1. Updated list of personnel to be covered by permit. List all personnel names and their roles here (e.g. John Doe, Diver; Jane Doe, Field Technician, Jerry Doe, Medical Assistant): Dr. Steve Karl [redacted] field PI; Jonathan Whitney, diver; Sherril Leon Soon, diver; Jackie Troller, diver; Roxanne Haverkort-Yeh, back-up diver; Brent Snelgrove, back-up diver

2. Specific Site Location(s): (Attach copies of specific collection locations): shallow water reefs at Nihoa, Necker, FFS, Gardner, Pearl and Hermes, Maro, Laysan, Lisianski, Midway, Kure depending on cruise schedule.

Aeby permanent coral disease survey sites
Location of survey sites:

island	site	depth(ft)	habitat	lat	long
ffs	**r11b**	67	lagoon	23 38.149	166 11.138
ffs	**tc12**	30	lagoon	23 38.323	166 10.802
ffs	**tc21**	25	forereef	23 50.822	166 19.630
ffs	**r16**	24	shelf	23 51.049	166 19.759
ffs	**tc30**	14	lagoon	23 50.988	166 17.840
ffs	cred 8	31	lagoon	23 51.034	166 19.826
ffs	rapture	80	patch	23 38.10	166 11.12
ffs	La Perouse	28	lagoon	23 46.77	166 15.695
ffs	cred 28	40	lagoon	23 50.562	166 19.2
PHR	**jm10**	3	backreef	27 50.072	175 45.210
PHR	**tc31**	19	backreef	27 46.532	175 58.401
PHR	**tc32**	21	backreef	27 46.351	175 56.370
PHR	**tc26**	5	backreef	27 57.468	175 48.125
PHR	**r44**	46	backreef	27 54.631	175 54.280
mid	**tc1**	3	backreef	28 16.148	177 23.181
mid	**jm20**	3	backreef	28 16.288	177 23.167
mid	**r23-21**	3	backreef	28 16.436	177 21.048
mid	**r15**	3	backreef	28 16.672	177 21.831
Kur	**r36-10**	15	backreef	28 25.198	178 22.345
Kur	**tc17**	12	backreef	28 25.912	178 22.003
Kur	**tc13**	3	backreef	28 27.147	178 18.915
Kur	**tc14**	3	backreef	28 27.209	178 19.716

3. Other permits (list and attach documentation of all other related Federal or State permits): permits were obtained from DAR and FWS for research up in the NWHI

in 2002, 2003, and 2004 but they were not always in my name as back then one scientist took charge of all of the permits for the cruise. Permits were obtained from the NWHI Reserve in 2005, 2006 and PMNM in 2011.

3a. For each of the permits listed, identify any permit violations or any permit that was suspended, amended, modified or revoked for cause. Explain the circumstances surrounding the violation or permit suspension, amendment, modification or revocation. 2006 permit violation. I had an experiment with coral in buckets ongoing on the ship at FFS when the chief scientist made the decision to change the cruise plan, unbeknownst to me, and the ship traveled from FFW to Gardner and back. As such, my corals which were on the ship were also inadvertently transported "out of State waters" as the ship traveled from one island to the next.

4. Funding sources (Attach copies of your budget, specific to proposed activities under this permit and include funding sources. See instructions for more information): PMNM-HIMB MOA, NSF and NOAA grants with Dr. Callahan

5. Time frame:
Activity start: 6/2012
Activity completion: 12/2013

Dates actively inside the Monument:
From: 7/5/12
To: 7/25/12

Describe any limiting factors in declaring specific dates of the proposed activity at the time of application: subject to schedule changes for the NOAA research vessel Hiialakai

Personnel schedule in the Monument: All personnel will be onboard the Hiialakai for the entire trip and will be subject to the cruise schedule which is scheduled for 7/5/12-7/25/12.

6. Indicate (with attached documentation) what insurance policies, bonding coverage, and/or financial resources are in place to pay for or reimburse the Monument trustees for the necessary search and rescue, evacuation, and/or removal of any or all persons covered by the permit from the Monument: The Hiialakai is a self insured federal vessel and all personnel involved with this project are insured by

personal health insurance, workman's comp insurance and Diver's Alert Network (DAN).

7. Check the appropriate box to indicate how personnel will enter the Monument:

X☐ Vessel
☐ Aircraft

Provide Vessel and Aircraft information: NOAA ROV Hiialakai

8. The certifications/inspections (below) must be completed prior to departure for vessels (and associated tenders) entering the Monument. Fill in scheduled date (attach documentation):

☐ Rodent free, Date:
☐ Tender vessel, Date:
☐ Ballast water, Date:
☐ Gear/equipment, Date:
☐ Hull inspection, Date:

9. Vessel information (NOTE: if you are traveling aboard a National Oceanic and Atmospheric Administration vessel, skip this question):
Vessel name: Hiialakai
Vessel owner: NOAA
Captain's name:
IMO#:
Vessel ID#:
Flag:
Vessel type:
Call sign:
Embarkation port: Honolulu
Last port vessel will have been at prior to this embarkation:
Length:
Gross tonnage:
Total ballast water capacity volume (m3):
Total number of ballast water tanks on ship:
Total fuel capacity:
Total number of fuel tanks on ship:
Marine Sanitation Device:
Type:

Explain in detail how you will comply with the regulations regarding discharge in the Monument. Describe in detail. If applicable, attach schematics of the vessel's discharge and treatment systems:

Other fuel/hazardous materials to be carried on board and amounts: Z-fix (1 gallon), Clorox (5 gallons), ethanol (1 gallon), DMSO (1 gallon)

Provide proof of a National Oceanic and Atmospheric Administration (NOAA) Office of Law Enforcement-approved Vessel Monitoring System (VMS). Provide the name and contact information of the contractor responsible for installing the VMS system. Also describe VMS unit name and type:

VMS Email:
Inmarsat ID#:

* Individuals MUST ENSURE that a type-approved VMS unit is installed and that its automatic position reports are being properly received by the NOAA OLE system prior to the issuance of a permit. To make sure your VMS is properly configured for the NOAA OLE system, please contact NOAA OLE at (808) 203-2503 or (808) 203-2500.

* PERMITS WILL NOT BE ISSUED TO INDIVIDUALS ENTERING THE MONUMENT VIA VESSEL UNTIL NOAA OLE HAS CONTACTED THE MONUMENT PERMIT COORDINATOR WITH A 'POSITIVE CHECK' READING.

10. Tender information:

On what workboats (tenders) will personnel, gear and materials be transported within the Monument? List the number of tenders/skiffs aboard and specific types of motors: All research will be conducted from the Hiialakai and will use Hiialakai skiffs.

Additional Information for Land Based Operations

11. Proposed movement of personnel, gear, materials, and, if applicable, samples:
n/a

12. Room and board requirements on island: n/a

13. Work space needs: n/a

DID YOU INCLUDE THESE?
☐ Map(s) or GPS point(s) of Project Location(s), if applicable
☐ Funding Proposal(s)
☐ Funding and Award Documentation, if already received
☐ Documentation of Insurance, if already received
☐ Documentation of Inspections
☐ Documentation of all required Federal and State Permits or applications for permits

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

GUY KAULUKUKUI
FIRST DEPUTY

WILLIAM M. TAM
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF AQUATIC RESOURCES
1151 PUNCHBOWL STREET, ROOM 330
HONOLULU, HAWAII 96813

June 8, 2012

TO: Division of Aquatic Resources File

THROUGH: William J. Aila, Jr., Chairperson

FROM: Guy Kaulukukui, First Deputy and Acting Administrator
Division of Aquatic Resources

SUBJECT:

DECLARATION OF EXEMPTION FROM THE PREPARATION OF AN ENVIRONMENTAL ASSESSMENT UNDER THE AUTHORITY OF CHAPTER 343, HRS, AND CHAPTER 11-200, HAR, FOR PAPAHĀNAUMOKUĀKEA MARINE NATIONAL MONUMENT RESEARCH PERMIT TO DR. GRETA AEBY, UNIVERSITY OF HAWAII, HAWAII INSTITUTE OF MARINE BIOLOGY, FOR ACCESS TO STATE WATERS TO CONDUCT CORAL DISEASE RESEARCH ACTIVITIES UNDER PERMIT PMNM-2012-040.

The following permitted activities are found to be exempted from preparation of an environmental assessment under the authority of Chapter 343, HRS, and Chapter 11-200, HAR:

Project Title:
Papahānaumokuākea Marine National Monument Research Permit to Dr. Greta Aeby, Assistant Researcher, University of Hawaii, Hawaii Institute of Marine Biology, for Access to State Waters to Conduct Coral Disease Research Activities.

Permit Number: PMNM-2012-040.

Project Description:
The research permit, as described below, would allow entry and activities to occur in Papahānaumokuākea Marine National Monument (Monument), including state waters, from July 1, 2012 through June 30, 2013.

This permit is intended to cover all activities necessary to examine coral disease occurring within the Monument. The scope of activities in the permit include conducting visual surveys of corals, repairing permanent transect sites, collecting corals with targeted disease traits for molecular genetic and microbial analyses and collecting corals with new disease traits for histopathological analysis .

The proposed activities are in direct support of the Monument Management Plan's priority management needs 3.1 – Understanding and Interpreting the NWHI (through action plan 3.1.1 – Marine Conservation Science). This action plan specifies to "monitor shallow-water coral reef ecosystems to protect ecological integrity." Activities to support understanding and interpreting the NWHI, which could include monitoring of diseased coral, are addressed in the Monument Management Plan Environmental Assessment (December 2008) which resulted in a FONSI. This EA summarizes that understanding how populations change could be helpful to forecast, prepare for and mediate potential threats to populations within the Monument (PMNM MMP Vol 2, p.171). Disease monitoring, such as those activities proposed, would enhance this understanding.

Consulted Parties:
The permit application was sent out for review and comment to the following scientific and cultural entities: Hawaii Division of Aquatic Resources, Hawaii Division of Forestry and Wildlife, Papahānaumokuākea Marine National Monument (NOAA/NOS), NOAA Pacific Islands Regional Office (NOAA-PIRO), United States Fish and Wildlife Service Hawaiian and Pacific Islands National Wildlife Refuge Complex Office, and the Office of Hawaiian Affairs (OHA). The Principal Investigator for this project, Greta Aeby, has also been consulted with respect to her experience in successfully conducting studies on coral and fish diseases. In addition, the permit application has been posted on the Monument Web site since April 16th, giving the public an opportunity to comment. The application was posted within 40 days of its receipt, in accordance with the Monument's Public Notification Policy.

Exemption Determination:
After reviewing § 11-200-8, HAR, including the criteria used to determine significance under § 11-200-12, HAR, DLNR has concluded that the activities under this permit would have minimal or no significant effect on the environment and that issuance of the permit is categorically exempt from the requirement to prepare an environmental assessment based on the following analysis:

1. All activities associated with this permit, including the collection of coral samples have been evaluated as a single action. As a preliminary matter, multiple or phased actions, such as when a group of actions are part of a larger undertaking, or when an individual project is precedent to or represents a commitment to a larger project, must be grouped together and evaluated as a single action. § 11-200-7, HAR. Since this permit involves an activity that is precedent to a later planned activity, i.e. the re-survey and sampling of target corals, the categorical exemption determination here will treat all planned activities as a single action.

2. The Exemption Class for Scientific Research with no Serious or Major Environmental Disturbance Appears to Apply. Chapter 343, HRS, and § 11-200-8, HAR, provide for a list of classes of actions exempt from environmental assessment requirements. §11-200-8(A)(5), HAR. specifically exempts the class of actions which involve "basic data collection, research, experimental management, and resource evaluation activities, which do not result in a serious or major disturbance to an environmental resource." This exemption class has been interpreted to include "surveys, censuses, inventories, studies, photographing, recording, sampling, collection, culture and captive propagation of aquatic biota", such as those being proposed.

The proposed collection activities here appear to fall squarely under the exemption class #5, exempt item #5 as described under the former Fish and Game Division exemption list published in January 19, 1976. As discussed below, no significant disturbance to any environmental resource is anticipated in the sampling of Monument resources. Thus, so long as the below considerations are met, an exemption class should include the action now contemplated.

3. Cumulative Impacts of Actions in the Same Place and Impacts with Respect to the Potentially Particularly Sensitive Environment Will Not be Significant. Even where a categorical exemption appears to include a proposed action, the action cannot be declared exempt if "the cumulative impact of planned successive actions in the same place, over time, is significant, or when an action that is normally insignificant in its impact on the environment may be significant in a particularly sensitive environment." § 11-200-8(B), HAR. To gauge whether a significant impact or effect is probable, an exempting agency must consider every phase of a proposed action, any expected primary and secondary consequences, the long-term and short-term effects of the action, the overall and cumulative effect of the action, and the sum effects of an action on the quality of the environment. § 11-200-12, HAR. Examples of actions which commonly have a significant effect on the environment are listed under § 11-200-12, HAR.

A limited number of studies of this type have been undertaken to date and include an initial survey of coral disease at permanent sites (Aeby 2005), with two follow-up surveys which documented the spread and severity of a coral disease outbreaks (Aeby 2006; 2011). Removal of diseased corals could be considered a beneficial effect to the environment. With this in mind, significant cumulative impacts are not anticipated as a result of this activity, and numerous safeguards further ensure that the potentially sensitive environment of the project area will not be significantly affected. All activities will be conducted in a manner compatible with the management direction of the Monument Proclamation in that the activities do not diminish monument resources, qualities, and ecological integrity, or have any indirect, secondary, cultural, or cumulative effects. The joint permit review process did not reveal any anticipated indirect or cumulative impacts, nor did it raise any cultural concerns, that would occur as a result of these activities.

The activities would be conducted from the NOAA Ship HI'IALAKAI (PMNM-2012-009) during its July cruise. The following table lists additional activities that are anticipated to take place on this cruise pending approval of permit applications.

Table 1. Concurrent Projects Aboard NOAA SHIP HI'IALAKAI.

Permit	Purpose and Scope	Location
PMNM-2012-009 Ellis	The permit allows NOAA Ship HI'IALAKAI entry into PMNM. Personnel aboard the vessel will be permitted under separate permits.	All locations

Permit	Purpose and Scope	Location
PMNM-2011-018 Meyer	This permit allows collection of reef fish and tagging of top predators as well as acoustic receiver deployment.	All locations
PMNM-2012-036 Gleason (proposed)	The proposed action is to allow maritime heritage site survey and monitoring activities and collection of a single artifact from the Two Brothers shipwreck.	All locations
PMNM-2012-035 Godwin (proposed)	The proposed action is to allow alien marine invertebrate voucher specimen collections and monitoring.	All locations
PMNM-2012-030 Karl (proposed)	The proposed action is to allow coral disease research activities and fish connectivity studies.	All locations
PMNM-2012-032 Thomas (proposed)	The proposed activity is to allow deployment of environmental data sensors.	All locations
PMNM-2012-041 Winn-Kahng (proposed)	The proposed action is to allow water sampling collection activities.	All locations

One other proposed activity includes collections of the same coral species, *Acropora cytherea* (PMNM-2012-030; Karl), as is proposed by this Applicant for growth anomaly studies. However, the samples that would be collected during the proposed activities will be shared between the two applicants. Dr. Karl would collect the samples for genetic analysis (PMNM-2012-030) and a small portion of these same samples would be shared with Dr. Rob Toonen's lab at the Hawaii Institute of Marine Biology for zooxanthellae clade analysis (the present permit application). No other activities proposed during this research cruise involve the collection of corals.

Table 2. Concurrent Projects Aboard NOAA SHIP OSCAR ELTON SETTE

Permit	Purpose and Scope	Location
PMNM-2012-008 Dreflak	The permit allows NOAA Ship OSCAR ELTON SETTE entry into PMNM. Personnel aboard the vessel will be permitted under separate permits.	All locations
PMNM-2012-001 Co-Trustee	The proposed action is to facilitate the needs of the monk seal field camp	All locations

Permit	Purpose and Scope	Location
PMNM-2012-013 Parrish/ Van Atta (proposed)	The proposed action is conduct selected removal of predatory sharks from Hawaiian monk seal pupping sites at French Frigate Shoals.	FFS

The NOAA Ship OSCAR ELTON SETTE (PMNM-2012-008) may also be in the Monument during this time frame. However, none of the activities on this cruise overlap with coral disease monitoring and collections that are being proposed.

The culmination of these permits, and their disparate activities, occurring throughout the Monument over a 4-week period, is not anticipated to have significant cumulative impacts. Since no significant cumulative impacts or significant impacts with respect to any particularly sensitive aspect of the project area are anticipated, the categorical exemptions identified above should remain applicable.

4. Overall Impacts will Probably be Minimal and Insignificant. Any foreseeable impacts from the proposed activity will probably be minimal, and further mitigated by general and specific conditions attached to the permit. Specifically, all research activities covered by this permit will be carried out with strict safeguards for the natural, historic, and cultural resources of the Monument as required by Presidential Proclamation 8031, other applicable law and agency policies and standard operating procedures. This project is an important continuation of prior projects which had been subjected to the public review process. Visual coral surveys are non-invasive by nature and the sampling technique used is non-lethal and does not impact the ecological integrity of the coral reef ecosystem. A small biopsy is removed that heals in a matter of weeks and is significantly less impactful than natural predation on these organisms.

Conclusion. Upon consideration of the permit to be approved by the Board of Land and Natural Resources, the potential effects of the above listed project as provided by Chapter 343, HRS and Chapter 11-200, HAR, have been determined to be of probable minimal or no significant effect on the environment and exempt from the preparation of an environmental assessment.

WILLIAM J. AILA, JR.
Chairperson, Board of Land and Natural Resources

Date