

**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:** Derek Smith

**Affiliation:** Hawai'i Institute of Marine Biology/University of Hawai'i

**Permit Category:** Research

**Proposed Activity Dates:** June 1st, 2009 - August 31st, 2009

**Proposed Method of Entry (Vessel/Plane):** NOAA Research Vessel Hi'ialakai

**Proposed Locations:** Cruise itinerary is unknown at this time and therefore this permit will cover activity for all atolls in the Monument to provide flexibility.

**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...

compare the biological community structure and diversity of maritime heritage resource sites with that of the surrounding areas to determine if there are significant differences and establish the ecological baseline for monitoring future changes in these communities.

b.) To accomplish this activity we would ....

conduct non-invasive ecological surveys using point-intercept and photo transects, deploy remote-sensing data loggers to provide correlative environmental information, and sample coral colonies, marine invertebrates, and single-celled protists that harbor dinoflagellate symbionts as well as sampling the surrounding reef waters and sediment.

c.) This activity would help the Monument by ...

increasing understanding of the community ecology of marine organisms associated with maritime heritage resource sites throughout the Monument to improve ecosystem-based management of these cultural resources.

**Other information or background:** Representing early Polynesian and native Hawaiian voyages through contemporary naval battles in the Pacific Theatre, the maritime heritage sites in the Monument are unique, significant historic and cultural resources. It is critically important we properly study and interpret these resources to add an important dimension to our understanding and appreciation of our rich maritime legacy (Monument Management Plan, 2008).

Our knowledge of the dynamic ocean landscape has increased greatly in recent years as a result of the multidisciplinary approach to studying the environment. Traditionally, archaeologists have focused their studies on the material remains of past human life and activities. The quantification of these remains often resembles ecological assessment in the methodology (i.e. survey transects, measurements, etc), but the subject matter does not allow for testable, hypothesis-driven science. Many archaeologists now share the desire to develop a more scientific archaeological approach, enabling researchers to assess the correctness of their conclusions (Hunt et al., 2001). In this way, archaeology can benefit from the incorporation of ecological information to their studies. Ecological science also benefits from ongoing studies of the material remains from man-made disturbances and the effects of introduced foreign materials on the community structure at those disturbance sites. Few studies have investigated these interactions on intentionally placed objects such as artificial reefs, and even fewer have looked at community dynamics surrounding unintentionally placed objects.

We are beginning to understand that conservation and preservation efforts focused on maritime heritage resources need to include not only traditional archaeological surveys, but also ongoing ecological assessment of the biological communities specifically associated with them. Using accepted assessment techniques, it is possible to determine and enhance the levels of in situ protection by monitoring the diversity and activity of marine organisms (Pournou et al. 2001).

#### References:

Hunt, T., Lipo, C., Sterling, L., 2001. Posing Questions for a Scientific Archaeology. In: Posing Questions for a Scientific Archaeology, pp. 1-15. Westport, CT: Bergin and Garvey.

Pournou, A., Jones, A., Moss, S., 2001. Biodeterioration dynamics of marine wreck-sites determine the need for their in situ protection. *The International Journal of Nautical Archaeology*. Volume 30.2. pp299-305. 2001.

## **Section A - Applicant Information**

### **1. Applicant**

Name (last, first, middle initial): Smith, Derek, M

Title: Graduate Student

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

Derek Smith

#### **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: Dr. Ruth Gates [REDACTED]

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

Hawai'i Institute of Marine Biology/University of Hawai'i

#### **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):**

Field Assitant TBD

**Section B: Project Information**

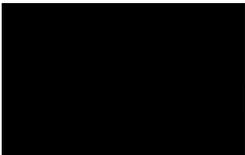
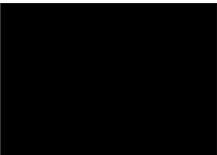
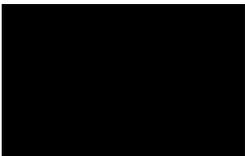
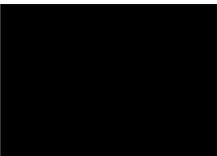
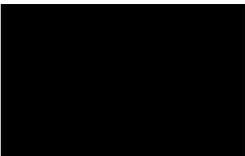
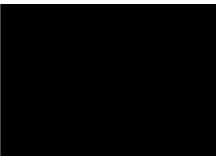
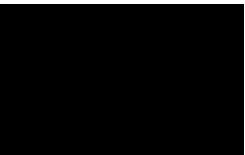
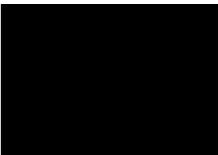
**5a. Project location(s):**

<input checked="" type="checkbox"/> Nihoa Island	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input checked="" type="checkbox"/> Necker Island (Mokumanamana)	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input checked="" type="checkbox"/> French Frigate Shoals	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input checked="" type="checkbox"/> Gardner Pinnacles	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input checked="" type="checkbox"/> Maro Reef			
<input checked="" type="checkbox"/> Laysan Island	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input checked="" type="checkbox"/> Lisianski Island, Neva Shoal	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input checked="" type="checkbox"/> Pearl and Hermes Atoll	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input checked="" type="checkbox"/> Midway Atoll	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input checked="" type="checkbox"/> Kure Atoll	<input type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Other			

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

Location Description:

The following GPS coordinates bound the region surrounding each atoll where sampling will occur. The activity will be ocean based in shallow (intertidal) to deep (80 ft) coral reef waters and atoll lagoons. The exact locations are unknown, but are dependent on the presence of maritime heritage resources and the final NOAA cruise itinerary. Exact coordinates will be provided in the post cruise summary.

1	Kure Atoll		
1	Kure Atoll		
1	Kure Atoll		
1	Kure Atoll		
2	Midway Atoll		
2	Midway Atoll		
2	Midway Atoll		
2	Midway Atoll		
3	Pearl and Hermes Atoll		
3	Pearl and Hermes Atoll		
3	Pearl and Hermes Atoll		
3	Pearl and Hermes Atoll		
4	Lisianski Island		
4	Lisianski Island		
4	Lisianski Island		
4	Lisianski Island		

5	Laysan Island	[REDACTED]	[REDACTED]
5	Laysan Island	[REDACTED]	[REDACTED]
5	Laysan Island	[REDACTED]	[REDACTED]
5	Laysan Island	[REDACTED]	[REDACTED]
6	Maro Reef	[REDACTED]	[REDACTED]
6	Maro Reef	[REDACTED]	[REDACTED]
6	Maro Reef	[REDACTED]	[REDACTED]
6	Maro Reef	[REDACTED]	[REDACTED]
7	Gardner Pinnacles	[REDACTED]	[REDACTED]
7	Gardner Pinnacles	[REDACTED]	[REDACTED]
7	Gardner Pinnacles	[REDACTED]	[REDACTED]
7	Gardner Pinnacles	[REDACTED]	[REDACTED]
8	French Frigate Shoals	[REDACTED]	[REDACTED]
8	French Frigate Shoals	[REDACTED]	[REDACTED]
8	French Frigate Shoals	[REDACTED]	[REDACTED]
8	French Frigate Shoals	[REDACTED]	[REDACTED]
9	Necker Island	[REDACTED]	[REDACTED]
9	Necker Island	[REDACTED]	[REDACTED]
9	Necker Island	[REDACTED]	[REDACTED]
9	Necker Island	[REDACTED]	[REDACTED]
10	Nihoa Island	[REDACTED]	[REDACTED]
10	Nihoa Island	[REDACTED]	[REDACTED]
10	Nihoa Island	[REDACTED]	[REDACTED]
10	Nihoa Island	[REDACTED]	[REDACTED]

**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:***

The Monument's maritime heritage resources have significant historic and cultural importance, both in Hawai'i and on the world stage. Inclusion of biological assessment data to existing archaeological survey data will create a multidisciplinary dataset which has the capacity to enhance preservation and conservation efforts at these sites.

Ecological surveys conducted at the maritime heritage resource sites will be the first of their kind in the Monument. The collected empirical data will significantly increase the understanding of the community ecology of marine organisms associated with these sites throughout the Monument and improve ecosystem-based management decisions affecting these cultural resources.

The purpose of the proposed activity is to:

- 1) determine if the biological community structure and diversity of maritime heritage resource sites varies significantly from one another and as compared to the surrounding areas
- 2) establish the ecological baseline for these sites to contextualize future monitoring efforts at these sites.

In order to assess the biological community structure and diversity and the possible factors influencing them , three major objectives have been identified:

- 1) determine the abundance, species richness, and distribution of biological organisms
- 2) measure the abiotic environmental factors affecting community structure
- 3) characterize the genetic diversity of coral and associated endosymbionts

**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?

All personnel listed on this permit will have attended cultural briefings before the cruise on the significance of the Papahānaumokuākea Marine National Monument. My research is focused on providing information that will contribute to the capacity to better understand, conserve, and protect the Papahānaumokuākea Marine National Monument. I will conduct non-invasive surveys and take small non-lethal biopsies of each animal sampled. These protocols are specifically designed to minimize impact and preserve the integrity of life and the ecosystems in the monument.

b. How will the activity be conducted in a manner compatible with the management direction of this proclamation, considering the extent to which the conduct of the activity may diminish or enhance Monument cultural, natural and historic resources, qualities, and ecological integrity, any indirect, secondary, or cumulative effects of the activity, and the duration of such effects? The proposed activity will help fulfill the goals of multiple strategies and activities as set forth in the Monument management plan, including:

MCS-1.1, 1.2, 1.5, and 1.6  
MH-1.2, 3.1, 3.2, 3.3  
HMC-1.1 and 1.2

My sampling technique will not impact the ecological integrity of the coral reef ecosystem or any maritime heritage resource site. The use of photo transects as well as traditional point-intecept transects minimizes disturbance of the area being surveyed. The small biopsies that are removed from each coral colony heal rapidly (weeks) and represent significantly less impact than that caused by natural predators (fish bites).

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 maritime heritage resources in the Monument are unique in the world and are the oldest yet found in the Hawaiian Islands. As this research aims to add valuable ecological information about these sites to improve decisions affecting their management, the research can only be conducted on the sites themselves.

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

The ecological assessment provided by this research will provide context for improved management and conservation of critical cultural and historic resources. All survey and sampling methods are non-lethal and have very minor effects on the organisms being studied.

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

The ecological surveys and collections will be performed simultaneously with archaeological surveys being conducted by the NOAA Maritime Heritage Program. These surveys are part of the Maritime Heritage Action Plan as listed in Strategy MH-1. Therefore, the duration of the proposed activity is no longer than the duration of the activities necessary to meet the goals of the existing management plan.

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

My faculty advisor is an internationally-recognized coral reef biologist and my graduate faculty committee consists of an internationally-recognized evolutionary biogeographer and a Monument maritime heritage archaeologist, all of whom have extensive experience working in

the Monument. All proposed scientific methods and analysis are reviewed and approved by this committee. I do not foresee any potential impacts from the outlined activity.

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 NOAA Maritime Heritage Program has offered logistic and budgetary support for the ecological assessment data of the maritime heritage sites in the Monument. The genetic analysis conducted for this project will be performed at the Hawai'i Institute of Marine Biology which houses all the facilities and infrastructure needed to perform the data analysis which is supported by funding from a partnership with the Papahānaumokuākea Monument office.

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.

All proposed ecological survey methods and procedures are currently accepted as ways to assess the abundance, species richness, and distribution of marine organisms. These methods are non-invasive and do not pose any long term impacts on the study sites. The research focusing on molecular biology and DNA analysis only requires small biopsies in order to get the necessary sample material. I understand all life is sacred in the Monument and that coral represents the first life in Hawaiian culture. The sampling is non-lethal and will not have an ongoing or long term impact on the organisms or the environment.

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.

The applicant can not foresee any other factors that find issuance of the permit inappropriate.

### **8. Procedures/Methods:**

To fulfill the indentified objectives of this research, the following procedures and methods will be used:

1) Methods to determine the abundance, species richness, and distribution of biological organisms include:

a) point-intercept quadrats sampled along existing permanently installed archaeological survey transects and/or haphazardly-placed transects

b) band transects sampled along existing permanently installed archaeological survey transects and/or haphazardly-placed transects

c) photo quadrats sampled along existing permanently installed archaeological survey transects and/or haphazardly-placed transects. Photo quadrats will also provide an archival photo record of the maritime heritage resource sites

2) Methods to measure the abiotic environmental factors affecting community structure include:

the placement of small data loggers capable of recording long-term information of environmental factors such as salinity, temperature, turbidity, current speed and direction, light intensity, and other metrics. Wherever possible, these loggers will be placed on existing archaeological survey installations (i.e. datums, permanent transect pins, etc) but not directly on any maritime heritage resource. When no existing survey structure exists to attach these loggers, a small reef pin or nail will be used to secure the logger for ongoing data collection

A maximum of two long-term data loggers will be placed at any site; one in the vicinity of the maritime heritage resource and one in the adjacent sampled reef area

3) Methods to characterize the genetic diversity of coral and associated endosymbionts include:

performing a very small biopsy (<1cm) of selected coral species and other marine invertebrates. This impact is minimal to the coral colony and is significantly less damaging to the coral than the bites of marine organisms that feed on coral in the area (e.g. parrotfish). This sampling strategy is extremely minimal and in no way poses a threat or significant impact to the colony sampled. For other marine invertebrate hosts, a clipping of one of the tentacles will be taken, which is non-lethal to the organism. Analysis of foraminiferan hosts involves taking the entire organism (which is approximately 1- 5 mm in size)

Marine invertebrates and Foraminifera will be collected using SCUBA with a chisel, pliers, or scissors and placed into plastic collection bags. The samples will be frozen and transported to the R/V Hi'ialakai. The tissue from all samples will be placed into individual 1.5 ml microcentrifuge tubes containing DNA preservation buffer which destroys the integrity of the living material and poses no threat for the spread of living organisms. The remaining calcium carbonate skeleton and tissue will be bleached to kill all living material. The samples and skeletons will be stored at the Hawai'i Institute of Marine Biology for downstream analyses upon return to Honolulu.

All SCUBA operations will be conducted off small vessels launched from the R/V Hi'ialakai.

**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:  
See Appendix 1

Scientific name:  
See Appendix 1

# & size of specimens:  
See Appendix 1

Collection location:  
See Appendix 1

Whole Organism  Partial Organism

**9b. What will be done with the specimens after the project has ended?**

DNA and the remaining material will be archived at the Hawai'i Institute of Marine Biology.

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

• General site/location for collections:  
HIMB

• 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?**

Samples will be stored in 1.5 ml microcentrifuge tubes containing DNA preservation buffer that destroys living material. Remaining skeletons will be bleached to destroy left-over living material and stored in sealed bags. These samples will remain on board the R/V Hi'ialakai and then transported to the Hawai'i Institute of Marine Biology upon return to Honolulu.

**11. Describe collaborative activities to share samples, reduce duplicative sampling, or duplicative research:**

Samples that overlap with other Gates Lab research will be shared. All ecological assessment information will be shared with the Monument Maritime Heritage Program.

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

Scuba equipment  
underwater slate and paper  
meter tapes  
camera and underwater housing  
photoquadrat tripod  
data loggers  
pliers  
hammer  
chisel  
small reef pin/nails  
fishing collection bag to hold samples  
plastic collection bags  
DNA preservation buffer  
ethanol  
bleach  
MQ water  
razor blades  
laptop computer

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

bleach  
ethanol  
DNA preservation buffer (contains guanadinium isothiocyanate, 2-mercaptoethanol)

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

Small, temporary data loggers capable of recording long-term information of environmental factors such as salinity, temperature, turbidity, current speed and direction, light intensity, and other metrics will be used.

Wherever possible, data loggers will be placed on existing archaeological survey installations (i.e. datums, permanent transect pins, etc) but not directly on any maritime heritage resource. When no existing survey structure exists to attach these loggers, a small reef pin or nail will be used to secure the logger for ongoing data collection.

A maximum of two long-term data loggers will be placed at any site; one in the vicinity of the maritime heritage resource and one in the adjacent sampled reef area.

**14. Provide a time line for sample analysis, data analysis, write-up and publication of information:**

Field surveys and collections, laboratory work, and data analysis will be completed by the end of 2010. Manuscript submission may occur during the study, but will be completed in 2011.

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

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.

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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

## Smith Permit 2009: Appendix 1

### Sampling Strategy and Collection Request for 2009

The samples taken from corals will be a very small biopsy (<1cm). This impact is minimal to the coral colony and is significantly less damaging to the coral than marine organisms that feed on coral in the area (e.g. parrotfish). This sampling strategy is extremely minimal and in no way poses a threat or significant impact to the colony sampled. For other marine invertebrate hosts, a clipping of one of the tentacles will be taken which is non-lethal to the organism. Analysis of foraminiferan hosts involves taking the entire organism (which is approximately 1- 5 mm in size).

**As the itinerary for the research cruise has not been scheduled, a sampling strategy that provides the freedom to sample at all the atolls is included. Realistically, only a few of the atolls will be visited and so the collection number will be much less than outlined below.**

*1. Collections to identify and define the types of symbiotic dinoflagellates harbored by corals associated with maritime heritage resource sites and the surrounding area (collectively referred to as the 'study site').*

Corals belonging to the genus *Pocillopora* have been chosen for this study because they are sensitive to environmental and habitat disturbance. *Porites lobata*, *Porites compressa*, and *Montipora capitata* have also been chosen for this study because they are common and are widely distributed within the Hawaiian archipelago and throughout the Pacific. These species are also being developed as models for work focusing on functional aspects of the symbiosis being conducted at HIMB. In addition, ongoing sampling for this objective is important for understanding the changes in the symbiont community that occur over time.

I am requesting a permit to cover the collection of thirty coral samples per study site (15 inside the maritime heritage resource site and 15 from the surrounding area) representing each species for all ten atolls. In reality, the number of samples collected at each location in the Monument will be much lower as not all species are present at all sites and not all atolls have formally identified maritime heritage resource sites at the time of submission of this permit application. As such, I have designed a sampling strategy that provides me the flexibility to take advantage of existing identified sites as well as newly discovered sites throughout the Monument. In addition, the cruise schedule of the R/V Hi'ialakai has not been determined and therefore I am listing all ten atolls within the monument for this objective. However, it is very unlikely that we will visit all of the atolls within the specified period.

## **Coral Species**

### **Nihoa**

#### **For each study site:**

<b>Coral Species</b>	<b>Common Name</b>	<b>Sample Number</b>
<i>Pocillopora meandrina</i>	Cauliflower Coral	30
<i>Pocillopora damicornis</i>	Lace Coral	30
<i>Porites lobata</i>	Lobe Coral	30
<i>Porites compressa</i>	Finger Coral	30
<i>Montipora capitata</i>	Rice Coral	30

### **Necker**

#### **For each study site:**

<b>Coral Species</b>	<b>Common Name</b>	<b>Sample Number</b>
<i>Pocillopora damicornis</i>	Lace Coral	30
<i>Pocillopora meandrina</i>	Cauliflower Coral	30
<i>Porites lobata</i>	Lobe Coral	30
<i>Porites compressa</i>	Finger Coral	30
<i>Montipora capitata</i>	Rice Coral	30

### **French Frigate Shoals**

#### **For each study site:**

<b>Coral Species</b>	<b>Common Name</b>	<b>Sample Number</b>
<i>Pocillopora damicornis</i>	Lace Coral	30
<i>Pocillopora meandrina</i>	Cauliflower Coral	30
<i>Porites lobata</i>	Lobe Coral	30
<i>Porites compressa</i>	Finger Coral	30
<i>Montipora capitata</i>	Rice Coral	30

### **Gardner**

#### **For each study site:**

<b>Coral Species</b>	<b>Common Name</b>	<b>Sample Number</b>
<i>Pocillopora damicornis</i>	Lace Coral	30
<i>Pocillopora meandrina</i>	Cauliflower Coral	30
<i>Porites lobata</i>	Lobe Coral	30
<i>Porites compressa</i>	Finger Coral	30
<i>Montipora capitata</i>	Rice Coral	30

### **Maro**

#### **For each study site:**

<b>Coral Species</b>	<b>Common Name</b>	<b>Sample Number</b>
<i>Pocillopora damicornis</i>	Lace Coral	30
<i>Pocillopora meandrina</i>	Cauliflower Coral	30
<i>Porites lobata</i>	Lobe Coral	30
<i>Porites compressa</i>	Finger Coral	30
<i>Montipora capitata</i>	Rice Coral	30

## Laysan

### For each study site:

<b>Coral Species</b>	<b>Common Name</b>	<b>Sample Number</b>
<i>Pocillopora damicornis</i>	Lace Coral	30
<i>Pocillopora meandrina</i>	Cauliflower Coral	30
<i>Porites lobata</i>	Lobe Coral	30
<i>Porites compressa</i>	Finger Coral	30
<i>Montipora capitata</i>	Rice Coral	30

## Lisianski

### For each study site:

<b>Coral Species</b>	<b>Common Name</b>	<b>Sample Number</b>
<i>Pocillopora damicornis</i>	Lace Coral	30
<i>Pocillopora meandrina</i>	Cauliflower Coral	30
<i>Porites lobata</i>	Lobe Coral	30
<i>Porites compressa</i>	Finger Coral	30
<i>Montipora capitata</i>	Rice Coral	30

## Pearl and Hermes

### For each study site:

<b>Coral Species</b>	<b>Common Name</b>	<b>Sample Number</b>
<i>Pocillopora damicornis</i>	Lace Coral	30
<i>Pocillopora meandrina</i>	Cauliflower Coral	30
<i>Porites lobata</i>	Lobe Coral	30
<i>Porites compressa</i>	Finger Coral	30
<i>Montipora capitata</i>	Rice Coral	30

## Midway

### For each study site:

<b>Coral Species</b>	<b>Common Name</b>	<b>Sample Number</b>
<i>Pocillopora damicornis</i>	Lace Coral	30
<i>Pocillopora meandrina</i>	Cauliflower Coral	30
<i>Porites lobata</i>	Lobe Coral	30
<i>Porites compressa</i>	Finger Coral	30
<i>Montipora capitata</i>	Rice Coral	30

## Kure

### For each study site:

<b>Coral Species</b>	<b>Common Name</b>	<b>Sample Number</b>
<i>Pocillopora damicornis</i>	Lace Coral	30
<i>Pocillopora meandrina</i>	Cauliflower Coral	30
<i>Porites lobata</i>	Lobe Coral	30
<i>Porites compressa</i>	Finger Coral	30
<i>Montipora capitata</i>	Rice Coral	30

**Total number of coral samples will not exceed 1000 biopsies**

**Estimate of actual collection: < 300 coral biopsies**

**2. Collections to define the diversity and distribution of symbiotic dinoflagellates associated with maritime heritage resource sites and the surrounding areas.**

This objective of the research focuses on the types of symbiotic dinoflagellates found in a diversity of corals and other marine invertebrates and foraminifera associated with maritime heritage resource sites and the surrounding areas. This data can be compared with work initiated in the Gates Lab in 2005 from locations that cross the archipelago.

**1. Marine Invertebrates:**

**Total is 5 colonies per species per study site (27 species X 5 colonies X 10 atolls)**

<b>Coral Species</b>	<b>Common Name</b>
<i>Acropora humilis</i>	Finger Staghorn Coral
<i>Acropora cytherea</i>	Table Coral
<i>Acropora nasuta</i>	Branching staghorn coral
<i>Pocillopora damicornis</i>	Lace Coral
<i>Pocillopora meandrina</i>	Cauliflower Coral
<i>Pocillopora eydouxi</i>	Antler Coral
<i>Pocillopora ligulata</i>	Cauliflower Coral
<i>Porites brighami</i>	Brigham's Coral
<i>Porites lichen</i>	Lichen Coral
<i>Porites lobata</i>	Lobe Coral
<i>Porites duerdeni</i>	Thick Finger Coral
<i>Porites solida</i>	Solid Coral
<i>Montipora capitata</i>	Rice Coral
<i>Montipora patula</i>	Sandpaper Rice Coral
<i>Montipora flabellata</i>	Blue Rice Coral
<i>Leptastrea bewickensis</i>	Bewick Coral
<i>Pavona varians</i>	Corrugated Coral
<i>Pavona duerdeni</i>	Porkchop Coral
<i>Fungia scutaria</i>	Oval Mushroom Coral
<i>Gardineroseris planulata</i>	Honeycomb coral
<i>Cyphastrea ocellina</i>	Ocellated Coral
<i>Leptoseris mycetoseroides</i>	Ridge Coral
<i>Psammocora niertrazi</i>	Nierstrasz' Coral

**Other Invertebrate hosts**

<i>Aiptasia pulchella</i>	Glass, Tube, Rock Anemone
<i>Palythoa caesia</i>	Pillow Zoanthid
<i>Sarcothelia edmondsoni</i>	Blue Soft Coral
<i>Cassiopea sp.</i>	Upside-Down Jellyfish

**Total number of marine invertebrate samples will not exceed: 1000**

**Estimate of actual final collection: 500 (This is due to most of the species listed above found at only some of the atolls and sites, but gives the freedom for opportunistic sampling)**

## **2. Foraminifera**

**Total is 40 foraminifera per species per atoll (3 species X 20 colonies X 10 atolls)**

*Amphisorus hemprichii*

*Marginopora kudakajimaensis*

*Sorites sp*

**Total number request of foraminifera samples for diversity study: 1200**

**Estimate of actual final collection: 800**