

**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](mailto: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:** Stephen A. Karl

**Affiliation:** Hawaii Institute of Marine Biology, University of Hawaii, Manoa

**Permit Category:** Research

**Proposed Activity Dates:** 06/01/2008 - 08/31/2008

**Proposed Method of Entry (Vessel/Plane):** NOAA Ship HI'IALAKAI

**Proposed Locations:** Pearl & Hermes Atoll

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

6 scientific research divers

**Estimated number of days in the Monument:** 30

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

a.) The proposed activity would...  
physically map all individuals of the coral species *Porites lobata* and *Pocillopora damicornis* on a patch reef (175° 48.236W, 27° 49.828N) and remove a 3 cm<sup>2</sup> piece from each individual coral colony on the reef. Each individual will be genetically fingerprinted at the University of Hawaii.

b.) To accomplish this activity we would ....  
use meter transects to physically map the colony location on the reef. The meter transects are globally positioned by using an underwater GPS system which floats on the surface. Wire cutters are used to clip off a small branchlet from the colony. These samples are placed in non-toxic preservative and are non-viable upon preservation.

c.) This activity would help the Monument by ...  
assessing the genetic diversity of coral in the Papahānaumokuākea Marine National Monument. Genetic diversity of the coral has direct bearing on reef health, robustness, and resistance to disease.

**Other information or background:** This is a continuation of previously permitted research

## **Section A - Applicant Information**

### **1. Applicant**

Name (last, first, middle initial): Karl, Stephen A.

Title: Associate Researcher

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

n/a

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

██████████

Phone: ██████████

Fax: ██████████

Email: ██████████

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

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

Hawaii Institute of Marine Biology, University of Hawaii, Manoa

#### **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):**

6 research divers to be named

**Section B: Project Information**

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

<input type="checkbox"/> Nihoa Island	<input type="checkbox"/> Land-based	<b><u>Ocean Based</u></b>	
<input type="checkbox"/> Necker Island (Mokumanamana)	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> French Frigate Shoals	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Gardner Pinnacles	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Maro Reef			
<input type="checkbox"/> Laysan Island	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Lisianski Island, Neva Shoal	<input type="checkbox"/> Land-based	<input 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 type="checkbox"/> Midway Atoll	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Kure Atoll	<input type="checkbox"/> Land-based	<input 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:

Patch reef at Pearl & Hermes Atoll at 175° 48.236W, 27° 49.828N

**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:***

I propose to collect 3 cm<sup>2</sup> coral samples to assess the degree of genetic variation present in coral reefs. The goal of this project is to provide information on the genetic diversity of corals and coral reefs to better predict the health and robustness of the the living resources in the Monument. The level of genetic variation present in the coral reef has direct bearing on the coral's ability to withstand changing environemnts, anthropogenic impacts, and disease. Understanding the genetic makeup of coral reefs is invaluable when restoration efforts are needed. These data also serve as baseline information for monitoring the health of coral reefs.

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

The Findings are as follows:

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

Our overriding goal is to provide scientific information to managers so that the Papahānaumokuākea Marine National Monument can be managed and protected based on policy founded in sound science. Our divers are experienced in moving in and around coral and coral reefs so as to not cause damage. Each diver has been through intensive diving training and is a certified scientific diver with the American Association of Underwater Scientists. We have conducted these activities before and have assessed that they do not impact the reefs. The small piece of coral that we remove is smaller than what is naturally removed by fish that eat coral (e.g., parrotfish). All personel will have attended cultural training classes to better understand and respect the cultural and spirtual importance of the Papahānaumokuākea 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? In order to manage any ecosystem, fundamental information on how the ecosystems work is necessary. For example, if some coral colonies are diseased and others are not, knowing if the diseased individuals are genetically predisposed to sickness will allow managers to accurately assess risk and to better determine priorities. Our activities are minimally invasive. The size of samples taken from each individual is as small as possible while still being adequate for analysis. The monument is approximately 360,000 Km<sup>2</sup> and Pearl & Hermes is approximately 800 Km<sup>2</sup>. There is about 13,500 Km<sup>2</sup> of coral reef habitat in the Monument. Our activities will be confined to one patch reef at Pearl and Hermes which is approximately 0.0016 Km<sup>2</sup> or 0.000012% of the coral reef habitat. Negative impacts on the reef, atoll, and Monument are exceedingly small. The positive impact of the results of our research can be Monument-wide. Coral are routinely grazed by a variety of fishes where a single bite is about the same size as the sample that we will be collecting. No cumulative negative effects are likely and the colonies are likely to be fully regrown within months of our activities.

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 are no alternatives to conducting this activity within the monument. Our research is aimed at understanding how coral reefs in the Monument are genetically structured. There is no practical alternative to doing this in the Monument because it is the reefs in the Monument that will need to be managed. For example, how reefs in the main Hawaiian Islands are genetically structured is interesting, but there is no basis upon which to say that the reefs in the Monument are structured in the same way. Gathering information on a variety of reefs both in and out of the Monument will help to understand how universal our results are, but it is unlikely that all reefs are identical. If managers want to know how best to protect the reefs of the Monument, then information gained directly from those reefs is necessary.

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 negative impacts that we might have are nearly non-existent. When we returned to sites that we have worked at in previous years there is no indication that we had been there before. The coral colonies that we have sampled appear normal and do not look different from ones that were not sampled. The data that we are collecting, however, will help to understand what role genetics plays in ecological integrity. How genetically diverse are the reefs in the Monument and is that genetic variability sufficient to maintain a healthy reef? The data that we are collecting will help managers understand what constitutes a normal, healthy reef and thereby better monitor the integrity of coral reefs in the Monument.

The Papahānaumokuākea Monument is a sacred place in native Hawaiian culture, and coral, in particular, plays a central role in the Hawaiian's understanding of how the world was created. As said in the first few lines of the Hawaiian creation chant, the Kumulipo: "Born was the male, born was the female, born was the coral polyp, from which the coral came forth." Stewardship of natural resources is a central theme in the relationship that Native Hawaiians have with the environment and, thus, there is no difference between a natural and cultural resource. Our research is very much in line with this practice. What we are doing will place stewardship practices on a foundation of knowledge and insight into how best to manage and protect coral reefs of the Papahānaumokuākea Monument. Just as Native Hawaiians learned when and where important food fish were spawning and then protected these times and areas, we will be learning fundamental aspects of the biology of coral reefs. This knowledge will then be used to protect and manage the resources of the Monument in the same way Native Hawaiian fishers (lawai'a) protected and managed resources of their ahupua'a.

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

It is anticipated that sampling every individual on the reef will take a minimum of 4 and a maximum of 6 days. We are minimizing the number of divers in the water at any time so as to minimize the possibility of impacting the reef. This then requires that we spend more time at the site. The ship is deployed for a specified amount of time for all researchers to complete their studies. Our research activities will only be done at Pearl & Hermes.

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 a certified SCUBA diver for 34 years. I have been an AAUS certified scientific diver for 28 years. My curriculum vita lists 50+ scientific publications on ecology, genetics, and conservation. I have conducted this same research in the Monument two prior years. We have been conducting similar research in Kaneohe Bay, Oahu for two years.

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.

Detailed budget information is available upon request from the Monument Permit Coordinators, and sufficient funding exists to complete the research outlined herein. This research is currently, or has been previously, funded by a combination of the following agency sources:

- 1) NWHIMNM-HIMB partnership
- 2) National Science Foundation
- 3) The University of Hawaii

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

We are using standard field survey techniques that have proven successful both generally and specifically in the Monument. The genetic approaches have been previously proven appropriate and capable of uniquely identifying individuals. Any negative impacts of our study are minimal and temporary and should not alter the Monument's cultural, natural and historic resources, qualities or ecological integrity. The positive impacts of our study will help guide appropriate stewardship practices to preserve and manage the qualities and integrity of the Monument's cultural and natural and historic resources. Our data is necessary to provide a strong scientific understanding of coral reef ecosystem processes upon which proper management protocols can be designed. These data also are invaluable in providing a base-line with which to monitor the success of management efforts.

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; we are using a NOAA ship supplied by the Monument

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

I have fully complied with all previous permit requirements and have no past, current, or pending obligations or restrictions applicable to this permit. I have fully disclosed my intentions in this permit application. To my knowledge, there are no other factors that would make the issuance of a permit inappropriate.

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

Map all individuals of *Porites lobata* and *Pocillopora damicornis* by intensive sampling of a patch reef at Pearl & Hermes.

The coordinates of each individual colony will be recorded in a GIS database, using a Global Positioning System Intelligent Buoy system.

All individuals and the surrounding area will be photographed to be included in the GIS database, using high-resolution digital photography.

Genotype all individuals of both species on the reef.

Small samples (less than or equal to 3 cm<sup>2</sup>) of each individual will be collected during the mapping effort and will subsequently be genotyped at a minimum of 10 microsatellite loci. These genetic markers are capable of producing a genetic fingerprint that is unique for each individual.

Development of genetic tools

To identify all individuals on the reef (i.e., genets and ramets), we have developed a microsatellite-enriched library for both species following procedures that have been successful for corals in my laboratory (Severance et al. 2004). Primers to a minimum of 10, unlinked microsatellite loci per species are being developed and tested on a sample of individuals (~15), to confirm reliability and variability. The few previous genetic studies of corals using microsatellite loci have found a significant amount of per locus variation. Our study on *Montastrea* spp. (Severance and Karl 2004, 2006) in the Caribbean found an average of 21 alleles per locus and an average heterozygosity of 63%; more than enough variation to accurately genetically identify individuals.

Coral samples will be collected by carefully removing a less than 3-cm<sup>2</sup> piece either at the base or edge of the colony. After collecting, samples will be stored in 95% EtOH or salt saturated DMSO and are non-viable upon preservation. DNA will be extracted following standard procedures (Severance et al. 2004) in the laboratory at HIMB.

Surveying and sampling

We will near-saturation survey and sample *Porites lobata* and *Pocillopora damicornis* on a small patch reef. Initial sampling will target clearly separated individual colonies. Sampling is expected to amount to no more than 500 individuals of *P. lobata* and 1,500 individuals of *P. damicornis*. We began sampling the patch reef at Pearl and Hermes in 2007. We collected 500 samples (the maximum number permitted) but surveyed only about one quarter of the reef. Our efforts this year would be to complete the survey. I anticipate that we will not need to collect the maximum number of individuals indicated above, but it is important that, if necessary, the permit allows us to collect every individual on the reef.

The Intelligent GPS Buoy System (GBS) consists of four buoys with underwater acoustic receivers connected to above water GPS units. The divers carry a small, depth-recording acoustic transmitter with which the receivers can triangulate a position. Although the system has demonstrated sub-meter accuracy (~20 cm), each coral colony also will be photographed and referenced relative to a minimum of three GPS points on the reef.

Pearl & Hermes is an ideal spot because it is coral rich, accessible and has numerous localized patch reefs. This allowed us to select a moderately small reef where we can survey all

individuals in a discrete area without having to sample an inordinate or unmanageable number of individuals. This years activity will complete the survey started in 2007 on the reef located at 175° 48.236W, 27° 49.828N.

Divers will set up temporary transect makers at each side of the patch reef. All colonies of *Porites lobata* and *Pocillopora damicornis* along the transect line will be located using the underwater GPS system, photographed with a size standard, and sampled by removing a small (less than 3 cm<sup>2</sup>) piece near the base or edge of the colony. Great care will be taken to minimally impact the individual. At the end of the dive, samples will be transferred to numbered vials and preserved with 95% Ethyl alcohol or salt saturated DMSO, thus being rendered non-viable. Samples will be transported at the end of the cruise to the Hawaii Institute of Marine Biology. DNA will be extracted from each sample using standard procedures. DNA will be used in polymerase chain reaction amplification of 10 highly variable simple sequence loci. These loci are capable of uniquely identifying all genets.

The NOAA vessel *Hi'ialakai* will be used as transport to the NWHI. At each site, divers will be taken to the collecting site in an AMBAR Marine jet boat. The jet boat will be anchored in the sand near the reef. No other areas will need to be accessed. No assistance from Monument staff will be needed to maintain equipment or collect data or samples.

Severance, EG and SA Karl. 2006. Contrasting population genetic structures of sympatric mass-spawning Caribbean corals. *Marine Biology* 150:57-68.

Severance, EG, AM Szmant, and SA Karl. 2004. Microsatellite loci isolated from the Caribbean coral, *Montastraea annularis*. *Mol. Ecol. Note.* 4:74-76.

No other current permits. Previous permits in 2006: US Fish and Wildlife Service #12521-06029, State of Hawaii, Department of Land and Natural Resources #DLNR>NWHI06R009, 2007 Monument Permit number to be provided.

**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:

Lace coral

Lobe coral

Scientific name:

*Pocillopora damicornis*

Porites lobata

# & size of specimens:

1,500 - 3 cm<sup>2</sup>; Pocillopora damicornis

500 - 3 cm<sup>2</sup> pieces of Porites lobata

no colonies smaller than 4 cm in diameter will be sampled. Previous surveys indicate that most colonies are considerably larger than this (i.e., 10-15 cm minimum in diameter).

Collection location:

175° 48.236W, 27° 49.828N

Whole Organism  Partial Organism

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

given the small size, most of the individual samples will be used up in the process. Any samples that remain will be maintained at HIMB.

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

All samples are preserved in a non-viable state.

• General site/location for collections:

HIMB, Coconut Island, Oahu, Hawaii

• Is it an open or closed system?  Open  Closed

N/A

• Is there an outfall?  Yes  No

N/A

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

N/A

• Will organisms be released?

N/A

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

Via the NOAA Ship HI'IALAKAI in NaCl (salt) saturated dimethyl sulfoxide (not toxic according to Directive 67/548/EC; MSDS attached) or ethanol (MSDS attached).

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

All researchers at HIMB have coordinated and share samples where appropriate. Rappe, Gates, and Toonen are the only other researchers working on coral in a compatible way. We have

discussed our common goals and have agreed to share samples when appropriate. To my knowledge, no other research of this type is being conducted in the Monument.

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

Standard open-circuit SCUBA and snorkling equipment. Underwater GPS system. This system consists of 4 buoys that float on the surface equipped with hydrophones and GPS units. Divers carry a sonic transmitter that the buoys use to triangulate the divers' location. Surveying will use underwater cameras, rulers, meter tapes, and wire cutters. All equipment will be removed each day and no equipment will be left on the reef at the end of surveying.

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

Car Battery - MSDS attached. 200 proof ethanol - MSDS attached.

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

None

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

Sample analysis will take approximately 1 year to be followed by data analysis and publication. We expect this research to be published within the next two years.

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

Severance, EG and SA Karl. 2006. Contrasting population genetic structures of sympatric mass-spawning Caribbean corals. *Marine Biology* 150:57-68.

Severance, EG, AM Szmant, and SA Karl. 2004. Microsatellite loci isolated from the Caribbean coral, *Montastraea annularis*. *Mol. Ecol. Note.* 4:74-76

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