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.
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:** Shauna Kēhaunani Springer  
**Affiliation:** Nā Maka o Papahānaumokuākea & Conservation International – Hawai‘i

**Permit Category:** Native Hawaiian Practices  
**Proposed Activity Dates:** July 2015  
**Proposed Method of Entry (Vessel/Plane):** Vessel  
**Proposed Locations:** Nihoa, Mokumanamana, Mokupapapa (French Frigate Shoals), Puhahonu (Gardner Pinnacles)

**Estimated number of individuals (including Applicant) to be covered under this permit:** Twenty eight (28) individuals are to be covered under this permit, co-listed under the Research application submitted by Dr. Chris Bird and Polynesian Voyaging Society

**Estimated number of days in the Monument:** 14 days

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

1. The proposed activity would…

The proposed activity aims to examine the basic ecology of ‘opii populations and intertidal ecosystems within the NWHI by integrating Hawaiian knowledge systems and modern science. We will make keen observations of the environment and interactions by understanding connections with atmospheric and seasonal cycles from a Native Hawaiian perspective and to reconnect kanaka maoli to these resources. Through a collaboration with Na Mamo o Muole'a, The Nature Conservancy, Hawai‘i Institute of Marine Biology, Nā Maka o Papahānaumokuākea, Conservation International-Hawaii, Texas A&M and the NOAA Papahānaumokuākea Marine National Monument; a standard ‘opii monitoring protocol which is inclusive of Hawaiian methods of monitoring, has been developed (and is continuously being refined) to monitor populations within select locales on Hawai‘i Island, Maui, Kaho‘olawe, Moloka‘i, Kaua‘i and the NWHI. This would be the seventh year collecting data at locations within the NWHI.

We also aim to examine maternal investment of ‘opii (Cellana exarata, C. sandwicensis) and hà‘uke‘uke (Colobocentrotus atratus) across the NWHI to better understand natural population dynamics of these culturally-significant marine invertebrate species. We propose to investigate...
the environmental factors (temperature, chlorophyll-A, wave exposure) that drive spatial variation in egg number, size, and quality and how these differences in maternal investment contribute to larval fitness. This activity builds on existing population genetics research implemented on previous intertidal cruises to Papahānaumokuākea and will contribute critical information of the relationships between environmental parameters, intertidal habitat quality, and broodstock quality of ‘ōpīhi and hāʻukeʻuke in the NWHI. We will compare the findings to Main Hawaiian Island populations to identify spatial and temporal marine resource management strategies that prioritize protecting populations that produce high quality eggs and larvae. Through long-term monitoring of maternal investment and environmental parameters, we can develop predictions of how spatial and temporal changes in temperature, wave exposure, and chlorophyll-A levels will affect the quality of reproductive output and subsequent recruitment within and among populations.

Consistent with proclamation 8031, these activities will strengthen cultural and spiritual connections to the Northwestern Hawaiian islands and foster the expansion and perpetuation of Native Hawaiian ecological knowledge and research methodologies. This knowledge may be critical as it is observed by local Hawaii residents that ‘ōpīhi stocks are generally diminishing in size and number in the main Hawaiian islands, therefore more data in this area may help to curb the decline. The continuation of ‘ōpīhi data collection, and comprehensive intertidal surveys (including fishes, algae and invertebrates) using Native Hawaiian ecological knowledge and methodologies coupled with western science will help to contribute to the overall health of Papahanaumokuakea.

b.) To accomplish this activity we would ….

To accomplish this activity we will utilize Native Hawaiian protocol and practice, based on traditional knowledge and methodologies, to assess the environment, which will be integrated with the scientific ecological data. Native Hawaiian observations include using all senses by using your “eight eyes” makawalu (Kanahele) to note activities in the sky, land, and ocean and to connect these elements to our daily lives. Not only is it important to make observations of these elements and how they relate to natural resources, it is also vitally important to reconnect to our cultural spirituality by consuming intertidal resources that are critical to the survival of kanaka maoli. Documenting activities and recording connections between these events will highlight relationships and possible dependencies between reoccurring events and activities over seasons and between years.

• Sky observations include looking at cloud formations, noting wind direction/strength and what times it changes, visibility of the horizon, bird activity, other weather related observations such as rain or rainbows, the rising and setting of the moon and sun, the moon phase, and stars.

• Land observations include looking at any plants that are flowering, seeding or fruiting, new growth, animals reproducing, precipitation and soil moisture, bird arrival and departure and any other animal behaviors. Land observations from the main Hawaiian Islands during the expedition may also be useful to help remember activities in the NWHI during that time. For
example, we notice hala fruiting here on the main islands and can relate that in the Northwestern Hawaiian Islands, this is the season when juvenile iwa are still in the nest.

- Ocean observations include noting the tide (high/low and time), waves and currents, identifying and looking at the behavior of invertebrates, limu (algae) and fish in the intertidal environments, noting any spawning or aggregation of species, and noting any juveniles and newly recruited species. (see observation datasheet).

Through these types of observations, one can discover how different the intertidal zone changes between seasons (Kauwela-summer/Hoʻoilo-winter). At sites in the MHI, the limu (Crustose Coralline Algae (CCA) and macroalgae) zone expands during the winter, due to the large waves that are generated by winter storms, and decrease during the calm summer months. This allows other organisms such as ‘opiihi and haʻukeʻuke to expand their habitable zone as well. New recruits for ‘opiihi and haʻukeʻuke were observed during the winter season about 1-2 months after a peak spawning event, but wasn’t observed during the summer season. The peak spawning period was determined by conducting a gonad study for both ‘opiihi and haʻukeʻuke. These are just a few examples that demonstrate how both western and traditional knowledge can complement each other to obtain both quantitative and qualitative data.

The scientific research methods include laying belt transects to assess class size, population density, community structure, species range, distribution, and rugosity for all organisms within the intertidal zone. A minimum of 20 ‘opiihi population/intertidal surveys at each island/atoll will be conducted. Statistical analysis of the data will be analyzed at the Hawai‘i Institute of Marine Biology & Texas A&M labs. Data analyzed will be useful to local and governmental managers to make effective decisions on managing the resources. See Bird’s 2015 Research application for reference.

As an extension of the scientific research methods, we will collect ‘opiihi and hāʻukeʻuke to examine maternal investment of these intertidal species on various areas in the intertidal zone. There is no feasible method to successfully spawn ‘opiihi or ascertain the sex of ‘opiihi other than through dissection. We will collect individual ‘opiihi, extract the gonad tissue, and freeze the eggs for future biochemical analyses. For hāʻukeʻuke, we will spawn individuals on shore to ensure that we only collect females. Spawning of hāʻukeʻuke will be induced by injecting 0.5 M KCl. Eggs of each female will be counted, then a subset will be placed in filtered seawater on glass slides under cover slips resting on clay feet to prevent flattening. Eggs will be measured on board the research vessel with a large field microscope. We will use ImageJ software to measure egg diameter and calculate egg volume from the measurements. Egg samples will be frozen at -80°C for future biochemical analyses at the University of Hawai‘i at Mānoa (Moran lab, Edmondson Hall). To ensure responsible and ethical practices, we will refrain from collecting ‘opiihi and hāʻukeʻuke if populations appear too small to sustain collections.

Consumption of intertidal resources including invertebrates, limu will further support cultural practice and relationship between participants and our islands. Consumption feeds physical, spiritual, and cultural health rooting us in our ancestral ties and customary practices. Consumption allows us to be nurtured and nourished by place and genealogy. Our islands and
the resources thriving here are older siblings and customary relationships are based on the reciprocal practice of being fed and cared for by our older siblings while we care for and “feed” them in return. Our presence, activities, oli, observations, surveys, etc feed and care for place further supporting the physical, spiritual and cultural health of our islands and ourselves. Consumption also allows us to interact with place and understanding the network involved to produce a meal, which feeds a community.

Prior to departure to NWHI, the Nā Maka o Papahānaumokuākea will conduct a cultural orientation which will include the harvesting, preparation and consumption of food to introduce and ground all the participants to the importance of feeding a community and the relationship between the natural environment (genealogy) and ourselves.

The research team will work together to apply this integrated monitoring approach. The research team will be comprised of cultural researchers / practitioners, scientists, and managers. To ensure the success of these field studies, the team will conduct appropriate protocol and offer ho'okupu (cultural offerings) to maintain the spiritual integrity of the sites that are visited.

c.) This activity would help the Monument by …

This activity will not only add to the current knowledge of the marine environment in the NWHI, it will help to gain a better understanding of the resources by looking at the resources through a Native Hawaiian cultural lens ensuring a holistic approach to interaction and care. It will also help the monument by continuing to re-establish Native Hawaiian ancestral consciousnes and awareness with regard to the health and condition of the marine resources. Native Hawaiian protocol and methodology is integrated with western scientific protocol and methodology to better understand the status of intertidal marine resources and helps the Monument strengthen its management of cultural resources and ensures the strong participation of Native Hawaiians in the region's long-term protection. By providing opportunities to conduct cultural research, (cultural) researchers will assist in the recovery of important Native Hawaiian marine management practices and support the use of Native Hawaiian traditional ecological knowledge. Additionally, the permitted cultural practitioners and researchers will be key to the development of an eventual cultural access and monitoring plan for the NWHI.

The scientific research methods will build on the valuable long-term monitoring data collected on previous intertidal research cruises. The additional method will provide baseline knowledge of how environmental factors influence the egg quality of ‘opihi and hā’uke’uke populations in the NWHI. These activities align with continuing research of recruitment, intertidal habitat quality, and population connectivity implemented on previous PMNM intertidal cruises. Monitoring maternal investment of these populations in the NWHI will provide critical information about how climate change effects such as sea level rise and increased sea surface temperatures can affect the ability of these populations to produce healthy eggs and larvae. Overall, this study will shed light on the effects of climate change on natural populations of these two culturally-significant marine invertebrates. On a larger scale, this study will allow maternal investment to be investigated across the entire biogeographic distribution of Hawaiian ‘opihi and
hāʻukeʻuke populations. We will better understand differences of maternal investment between remote populations in the NWHI and the Main Hawaiian Island populations experiencing greater levels of anthropogenic pollution and overharvesting.

**Other information or background:** We will also be collaborating with the Polynesian Voyaging Society (PVS) on their proposed activities and project titled: Collaboration of Science and Culture: a multidisciplinary expedition to the Northwestern Hawaiian Islands. This collaboration brings together researchers, Native Hawaiian Practitioners, educators, and Hawaiʻi conservation leaders to conduct activities within PMNM using a modern-day research vessel (Searcher) and a traditional voyaging canoe (Hikianalia) as a complementary platform. Applicants under the PVS proposal will participate in the activities under this permit and Dr. Bird’s research permit and vice-versa. Those under this permit will participate in the activities under the PVS permit which include: increased navigation and waʻa (canoe) training, improved understanding of target reef fish species, raised awareness of interconnectedness through filming and photographic documentation, amplified expedition experiences through social media and classroom outreach and integrated perspectives of environmental exploration and knowledge.

Additionally this project is also supported by the following activities in the Monument Management Plan, (NHCH-2.1, 2.2, 2.3, 2.5, 2.6, 3.4, 4.2, 5.3 and NHCI – 3.1 and 3.2) all of which call for the identification of Native Hawaiian research priorities and access opportunities.

NHCH-2.1: Continue to compile information and conduct new cultural historical research about the NWHI.
NHCH-2.2: Support Native Hawaiian cultural research needs.
NHCH-2.3: Facilitate cultural field research and cultural education opportunities annually.
NHCH-2.5: Incorporate cultural resources information into the Monument Information Management System.
NHCH-2.6: Continue to facilitate Native Hawaiian cultural access.
NHCH-3.4: Identify and integrate Native Hawaiian traditional knowlege and management concepts into Monument management.
NHCH-4.2: Develop and implement specific preservation and access plans, as appropriate, to protect cultural sites at Nihoa and Mokumanamana.
NHCH-5.3: Integrate Native Hawaiian values and cultural information into the Monument permittee education and outreach program.

NHCI-3.1: Engage the Native Hawaiian community to identify how traditional knowledge will be integrated into Monument activities.
NHCI-3.2: Use and integrate Native Hawaiian traditional knowledge in Monument management activities.

Most marine invertebrates go through a microscopic, free-swimming larval stage early in their lives; thousands to millions of these larvae are produced, but few survive to become adults. Recruitment to adult populations is determined by the number and the quality of larvae that survive, arrive, and settle, and there has been considerable interest in identifying and conserving source populations that contribute disproportionately to the larval pool (Cowen et al. 2006). One
factor that can strongly influence adult reproductive output, larval fitness, and subsequent recruitment is maternal investment (Marshall & Keough 2007). There is wide agreement that within species, per-offspring maternal investment varies greatly (Bernardo 1996, Marshall & Keough 2007, Marshall & Keough 2008), but much less is known about how environmental factors drive this variation or how it affects subsequent larval performance (George 1995, Marshall & Keough 2008). Temperature can affect larval survivability, pelagic larval duration, and dispersal distance. Colder temperatures allow for greater maximum dispersal distance (‘O Connor et al. 2007). Describing the links between environment, maternal investment, and larval fitness is key to understanding population dynamics, because populations that produce large and high quality larvae may contribute more successful settlers into new areas than populations producing low quality larvae, even if low quality larvae are more numerous (Marshall & Keough 2007). Identifying these links will allow resource managers to identify populations likely to produce high quality eggs that yield high quality larvae that can successfully recruit over broad areas. Our results will inform the optimal design of marine protected areas for conservation of these two ecologically- and culturally significant species.

Literature cited: