

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: Kathleen Gobush

Affiliation: National Marine Fisheries Service, Pacific Islands Fisheries Science Center

Permit Category: Research

Proposed Activity Dates: June 1, 2009- September 30, 2009

Proposed Method of Entry (Vessel/Plane): OES

Proposed Locations: French Frigate Shoals

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

7

Estimated number of days in the Monument: 120 days

Description of proposed activities: (complete these sentences):

a.) The proposed activity would...
include monitoring of shark activity at select pupping sites and the removal of predatory Galapagos sharks from these areas.

b.) To accomplish this activity we would
monitor shark presence around pupping sites by observation from the ground, an observation tower, and/or patrolling near shore waters from a small boat. Galapagos sharks observed in predatory behavior would then be caught by: 1) hand line fishing from the shoreline or a small boat 2) hand-held spear gun or hand-held harpoon 3) using a variation of bottom long line gear modified for fishing sharks 4) drum-line technique and/or 5) trolling with a lure. For all methods, disposing of hooked sharks would occur with a bang stick.

c.) This activity would help the Monument by ...
mitigating shark predation on nursing pups at FFS, a significant cause of death to this crucial age class, thus improving the likelihood of recovery of this important subpopulation of monk seals. Effects from the removal of a limited number of Galapagos sharks will be ephemeral and are not likely to have a serious impact on the greater

Galapagos shark population at French Frigate Shoals or on the coral reef ecosystem (see Section 7a below).

Other information or background:

Studies conducted over the last 10 years have shown that shark predation has been a significant factor contributing to nursing pup mortality at FFS, particularly at Trig and more recently at Gin Islands. This predation on nursing pups is believed to involve a small number of site-specific Galapagos sharks (*Carcharhinus galapagensis*), as indicated by research initiated in 1997-1998. In 1998, a number of individually identified Galapagos sharks patrolled Trig Island repeatedly within the same season, and exhibited distinct predatory behavior. In 2000-2004, Galapagos sharks remained the only species identified attempting to prey on nursing pups in shallow water, <2 m in depth, at Trig Island. Observational studies, bite radii, and teeth spacing of shark injuries to nursing pups also indicate that the preponderance of pup wounds were inflicted by Galapagos sharks. Although Galapagos sharks have been previously reported to prey on pinnipeds, (Compagno 1984), they most commonly forage on fish and cephalopods (Compagno 1984, Wetherbee et al. 1996). However, this opportunistic predator may have adopted the intense pup-predating behavior as routine, in response to unusually high numbers of pup carcasses associated with adult male seal aggression at Trig in 1997-8, when coincident sharp peaks in both activities were evident. Subsequent management actions have adequately controlled male seal aggression, whereas high predation rates have remained a constant threat over the last decade. A decrease in annual cohort size apparently due to an aging seal population exacerbates the impact of this shark induced-mortality.

The decision to focus removal efforts specifically on Galapagos sharks is consistent with our experience as they are the only shark species we have identified to charge, injure and kill pre-weaned pups over the last decade (this includes 3436 hours of observation at FFS). Thus, we currently have no data to substantiate the involvement of other likely predators, namely Tiger sharks (*Galeocerdo cuvier*). Accordingly, we do not feel it is prudent at this time to attempt to manage the interactions of other shark species with pre-weaned pups. However, given the catholic diet of tiger sharks, we recognize that their involvement cannot be categorically excluded and should be investigated. NMFS is currently collaborating with HIMB shark ecologists to address this issue.

Direct observation or confirmation of a shark kill is often rare due to crepuscular/nocturnal predation and wariness to humans. Therefore, many of the pup mortalities attributed to shark predation must be inferred from circumstantial evidence. We apply conservative criteria when inferring a shark-induced mortality to these disappearances. The disappearance of a healthy pup (greater than a week old), which is not coincident with inclement weather/seas or aggressive male seal behavior, and whose mother is typically searching and vocalizing is considered to be a shark-induced death. Furthermore, an intensive behavioral study in 1988 on 30 mother-pup pairs at FFS demonstrated that only pups less than a week old died due to high seas/ wave wash (Boness 1990). Intense predation on nursing pups was initially observed at Trig and neighboring Whaleskate Island in 1997-99, when 18-28 mortalities occurred annually.

These losses equated to 38-69% of pups born at those sites, clearly an unsustainable rate of loss. Since then, 15-37% of the annual cohort is consistently believed to be lost to sharks before weaning, based on our conservative criteria. An increase in human activity during the pupping season or a decrease in sharks involved in the activity may have led to the observed drop in predation. However current levels, albeit less than the late 1990's peak, cannot be absorbed by the shrinking monk seal population and recovery expected. Forty-one pups were born in 2008 at FFS, greatly reduced from the 109 born in 1997 when shark predation was first considered a significant issue. Of the 41 pups born in 2008, 8 were lost to shark predation (20%) and 3 disappeared after the regular field season (cause of death unknown, shark-related loss not ruled out) resulting in only 28 pups surviving to weaning, the lowest on record.

At this time, likely avenues for reducing predation include limiting predation opportunities by removing prey (pup translocation), deterring predation using artificial devices or harassment, and/or removing predators. HMSRP has pursued all three fronts over the last decade but has had limited success in permanently curbing predation of nursing pups below 20%, suggesting that an increased effort in all three areas is needed to make progress. Recommendations received by shark and seal experts and numerous stakeholders in attendance at two recent workshops devoted to this issue (January 8-9 and November 5-6, 2008) support this notion.

We seek to conduct shark removals in conjunction with other likely alternatives (deterrent deployment and weaned pup translocation), not in place of them. The most likely alternative is to deploy deterrents at select pupping sights where it is geographically feasible. However, reliance on deterrents alone in 2008 was met with limited success. Beginning in 2001, we attempt to translocate pups at weaning from sites with historically high shark observations and incidents; this option is not possible during the nursing period. Therefore, we would like to again deploy deterrents (proposal submitted under a separate permit) and translocate weaned pups, complimenting this activity with the option to remove Galapagos sharks that we observe near pupping sites.

Other alternatives include: doing nothing, applying deterrents alone, moving mother and pup pairs, and installing barriers to shark or seal movement. However, all of these alternatives have serious shortcomings and many are not feasible for 2009 based on limited knowledge to date of their impacts on the ecosystem.

To do nothing has been deemed imprudent by a panel of experts attending two Workshops convened to discuss this issue. The Recovery Plan, as created by the HMS Recovery team, mandates mitigation of shark predation as a high priority. To be consistent with our program's mission and the Monument's mission, it is important that we make all attempts to positively influence the recovery of the HMS with respect to all sources of mortality, including shark predation. No one method alone has proven effective; therefore we seek to apply both nonlethal and lethal means of mitigation at this time.

A 'deterrent alone' approach is insufficient because thus far our designs have not proven to conclusively alter the presence of patrolling Galapagos sharks around pupping sites or to influence their predation success atoll-wide. The success of a suite of deterrents deployed in 2008 was equivocal. The total number of confirmed and inferred shark-related mortalities did not decrease as compared to the previous year when no deterrents were applied (2007) because of low efficacy and/or displacement of predatory activity to sites where deterrents were absent. As we continue to test and attempt to improve deterrent efficacy and feasibility, an additional method for protecting pups is needed.

Moving mothers and pups to 'safer' islands (e.g. from Trig to East or Tern) is not preferable because it will increase seal density at the receiving island possibly making it more attractive to sharks. Recent analysis has shown that seal density and shark predation are positively related (from 2000-2006 data): when the number of mother-pup pairs on Trig surpassed a threshold of 14, shark predation was observed to be more frequent. Furthermore, it is unknown if relocated mothers will continue to parent. A care facility for abandoned pups is also a prerequisite for such management activity. In sum, though we intend to further investigate moving mother-pup pairs, it is not yet an option for our program.

Creating barriers, such as fencing or penning to either keep sharks away from near shore areas or keep mothers and pups within near shore areas has the potential to negatively influence the normal movement patterns of both pregnant female seals and basking or nesting green turtles. Furthermore, constructing barriers around all pupping sites may not be geographically feasible due to currents and wave surge. The design, materials and maintenance of such structures requires thoughtful investigation and testing rendering it unfeasible at this time