

## **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:** Frank Parrish, PhD and Alecia Van Atta  
**Affiliation:** NOAA-NMFS-PIFSC/PIRO

**Permit Category:** Conservation and Management  
**Proposed Activity Dates:** June 1, 2013- May 31, 2014  
**Proposed Method of Entry (Vessel/Plane):** one of the following: NOAA vessels- Oscar Elton Sette and NOAA vessel Hi'ialikai, chartered vessel Kahana, chartered vessel Searcher, chartered flight via FWS, Pacific Air Cargo

**Proposed Locations:** French Frigate Shoals

**Estimated number of individuals (including Applicant) to be covered under this permit:** 10  
**Estimated number of days in the Monument:** 130 days

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

a.) The proposed activity would...  
include the removal of predatory Galapagos sharks from French Frigate Shoals (FFS) at select monk seal pupping sites during 2013. These activities are a continuation of previously permitted activities conducted in 2010-2012. The proposed activity would support the recovery of the Papahānaumokuākea Marine National Monument's population of endangered Hawaiian monk seals by reducing the likelihood of shark predation on seal pups at FFS. This activity, when combined with other conservation efforts, would help address the problem of low juvenile seal survival, a factor identified as one of the main causes of Hawaiian monk seal population decline in the Monument. Monitoring of shark activity at FFS, to be conducted to inform shark removals, is included in another permit application (Co-Trustees Management permit for 2013) and is not described here.

b.) To accomplish this activity we would ....  
remove Galapagos sharks (tail length of 200cm or greater) caught within 700m of select pupping sites. Sharks would be caught by the following methods: 1) hand line, 2) hand-held harpoon, 3) drum-line, and/or 4) small 10-hook bottomset and 5) the "Net Surprise". For all methods, hooked

or netted sharks will be pulled into shore or along side a small boat, tail-roped and killed with a bangstick. Shark carcasses will be examined (gross necropsy), sampled for future scientific analyses (isotope, fatty acid, genetic analysis) and any suitable shark tissue used as bait. Thereafter, remains would be handled as deemed appropriate by designated Native Hawaiian community members.

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

Conducting activities identified in the Papahānaumokuākea Marine National Monument Management Plan (December 2008, hereinafter referred to as MMP) Priority Management Needs: 3.2 Conserving Wildlife (Hawaiian monk seals), and 3.3 Reducing Threats (predation) to Monument Resources (Hawaiian monk seals), as well as the Co-Trustee's Conservation & Management Activity: Natural Resource Protection, as listed in section 6.3 of that Monument permit application.

The Co-Trustees, including NOAA, aim to accomplish natural resource protection by conducting "...management actions to promote the conservation of Monument resources which includes activities necessary to carry out protection of species, such as carrying out existing recovery plans" to fulfill our obligations under the Endangered Species Act (MMP page 11). In this application, we propose to remove sharks as a means of managing the threat of shark predation and thereby protecting Hawaiian monk seal pups, and thereby increasing the chances these pups will grow to adults and reproduce. Increased survival of pups is necessary to the species' recovery. Monitoring shark activity and removing sharks are both listed in the Hawaiian Monk Seal Recovery Plan (NMFS 2007) as necessary activities, critical to the species' recovery.

**Other information or background:**

A comprehensive 100-page Technical Memorandum titled "Shark Predation on Hawaiian Monk Seals II" details the lengthy history of shark predation of monk seal pups at French Frigate Shoals, predation mitigation and research activities undertaken to 2008, as well as a summary of the proceedings of a workshop conducted in November 2008 with various stakeholders (including the Monument, USFWS, State of Hawaii DLNR and leading shark experts) (Gobush 2010). This memorandum serves as a reference of the information, background and best-available science on the issue. To avoid an overly lengthy Conservation & Management application here, the Executive Summary of the memorandum is included below. A summary of the subsequent field season's findings (2009-2012) follows.

EXECUTIVE SUMMARY

The technical memorandum is divided into three sections. Section 1 summarizes the proceedings of the second workshop on Shark Predation on Hawaiian Monk Seals sponsored by the Hawaiian Monk Seal Research Program (HMSRP) of the Pacific Island Fisheries Science Center (PIFSC) and also the Pacific Islands Regional Office (PIRO) of the National Marine Fisheries Service (NMFS). Section 2 reviews knowledge to date about shark predation on pre-weaned and newly weaned monk seals pups (*Monachus schauinslandi*) and NMFS' mitigation attempts at French Frigate Shoals (FFS) and elsewhere in the Northwestern Hawaiian Islands (NWHI), and provides

a more comprehensive picture of the issues than time-permitted at the workshop. Section 3 summarizes HMSRP's premises about the nature of shark predation based on peer-reviewed science, inferences, expert opinions and field experience. HMSRP's positions on controversial aspects of the issue are stated and a number of appendices are included that detail plans to be executed in 2009 and mitigation ideas for the future.

## Workshop II

Workshop II was held on November 5-6, 2008 in Honolulu, Hawaii. Representatives from the NMFS-PIFSC, NMFS-PIRO, Papahānaumokuākea Marine National Monument (the Monument), US Fish and Wildlife Service (USFWS), State of Hawaii Department Land and Natural Resources (DLNR), Marine Mammal Commission (MMC), and Hawaiian Monk Seal Recovery Team participated. The primary goal of this workshop was to exchange ideas and opinions from different management and scientific perspectives about the predation problem and suggest a logical course of action. Presentations describing the endangered status of the Hawaiian monk seal, the shark predation problem at FFS, and the first workshop on the issue set the stage for the second workshop's discussions. Hawaiian Institute of Marine Biology (HIMB) scientists reviewed past shark research in FFS, reported the results of their 2008 research efforts, and presented their research plan for 2009 aimed at gathering fine-scale movement data on sharks. HMSRP described 2008 mitigations activities and mitigation strategies for the future. The 2008 mitigation strategy focused solely on the application of a suite of deterrents and devices around Trig Island and translocation of weaned pups to "safe" islets, although lethal removal of select sharks had also received support at the Workshop I.

Outcomes of Workshop II included an evaluation of past research efforts, development of definitive statements about the predation problem agreed upon by all workshop participants, identification of knowledge gaps, and a prioritized list of suggested actions for upcoming field seasons. Workshop participants encouraged improved deterrent design, improved and informed removal of sharks displaying predatory behavior, and a need for analyses on past data and the collection of additional data on seal and shark behavior. Ideas, such as the use of barriers to keep sharks away from near shore areas and sonic tagging pups, were discussed and their development recommended.

## Knowledge to Date About the Shark Predation at FFS and its Mitigation

The genus *Monachus* is in crisis; with just two extant representative species, the Hawaiian monk seal offers the best chance of its persistence. However the Hawaiian monk seal population itself is heading towards extinction. Numerous threats afflict the species across its range. Shark predation on pre-weaned and newly weaned pups contributes to a unique and extreme situation at FFS that peaked in 1997-1999 and stands out from the trends observed at other sites in the NWHI. Since then, predation has declined to 6-11 pups a year, an unsustainable rate due to falling birth rates. Galapagos sharks (*Carcharhinus galapagensis*) and tiger sharks (*Galeocerdo cuvier*) both potentially feed on marine mammals; however, HMSRP has only observed Galapagos sharks attacking and killing pups in near shore water. Mitigation activities by HMSRP conducted over the last decade include harassment of sharks, intensive observation, translocation

of weaned pups, deployment of devices to deter predation and shark removal (see 2009 findings at the end of this Executive Summary below).

### HMSRP Premises, Positions and Post-workshop Developments

HMSRP has developed premises about the identity and number of sharks likely involved, shark wariness to human activity, and opinions about shark culling based on peer-reviewed science, inference, expert opinion and ample experience with the situation at FFS. Post-workshop, HMSRP systematically compared all mitigation actions proposed, detailing the potential benefits and drawbacks based on its premises, positions, Workshop recommendations and stakeholders' perspectives. A 2009 field plan was created that included: 1) logistical and financial support for HIMB shark scientists to conduct shark tagging studies at FFS, 2) the systematic application and comparison of 3 treatments (human presence, deterrents and a control) at 2 pupping sites, 3) the design and installation of a custom-made remote surveillance camera system on 1 pupping site, and 4) additional behavioral monitoring of sharks and seals.

### Summary of 2009-2012 Activities

In 2009, there were 7 incidents of shark predation on pups, and as a result 5 pups died. This represented 14.7% (5 of 34 monk seal pups born) of the annual cohort (see Table 1a & b for a comparison of pup losses at FFS over the last 5 years). On Trig islet, Galapagos shark predatory activity was directly observed on 12 occasions; 12 additional sightings were recorded via a remote camera system temporarily installed on the islet. There was also one sighting of a Galapagos shark at Gin.

Also in 2009, we conducted research on possible shark deterrents, monk seal pup behavior and facilitated research on shark movement patterns. We compared shark presence and predatory behavior toward pups across two experimental treatments: 1) acoustic playback and a moored boat, and 2) continuous human presence, versus a control. We rotated treatments on a one-week basis at two pupping sites. We detected presence of large sharks with a remote camera system. Observations of shark activity at FFS decreased in successive seasons during intensive and systematic daytime monitoring in 2001 to 2003 yet mortality of monk seal pups was unchanged (NMFS 2004). This finding suggested that sharks preying on monk seal pups at FFS grew wary of daytime human activity in the area, preferring to hunt at night when humans were absent. Thus, we reasoned that a continuous human presence on pupping islets or the application of visual implements and acoustic playbacks that mimic human activity might repel sharks from the immediate area. The acoustic playbacks also had the potential function as a negative stimulus and to startle or repel sharks. However, sharks were present during 12 of 57 days of video examined, spread across all treatments. Shark presence at Trig did not differ significantly among treatments ( $R^2 = 0.05$ ,  $n = 57$ , Likelihood ratio  $\chi^2_{22} = 2.6$ ,  $p = 0.27$ ). (Gobush & Farry 2012).

For the pup behavioral study, we collected 132 hours of scan sampling observations (on a 15-minute interval, totaling 528 scans), primarily of mother-pup nocturnal activity (between 1800 to 1000 hours). 14% of the time (75 scans), pups was in the water; 84% of these water entries were

into the wave wash. While in the water (wave wash or farther), pups were with their mothers 100% of the time and on 97.3% of those occasions/scans they were within 1 meter of her (for 2.7% of the occasions/scans they were within 2 meters of her). The maximum distance a seal pup ventured into the water was 50 meters from shore at Gin (1 occasion/scan) and 20 meters from shore at Trig (3 occasions/scans). These findings support the idea that seal pups enter the water infrequently at night and primarily do so to thermoregulate in the company of their mothers rather than to swim far into the ocean alone.

HMSRP logistically and financially supported a Galapagos and tiger shark tagging study conducted by Carl Meyer, PhD. of HIMB. Across the pupping season (May-August), 189 bottomsets were made; totaling 1570 hooks and 6850 soak hours. These bottomsets used large tuna heads and shark tissue as bait. Bycatch was minimal and limited to elasmobranch species. In total 68 Galapagos and 40 tiger sharks were tagged with sonic tags; additional individuals were tagged with spaghetti tags. Four Galapagos sharks were tagged near islets with monk seal pups (5.9% of the sampled population captured in a stratified fishing scheme that attempted to evenly fish across shallow and deep lagoonal areas and deep areas outside the breaking reef at FFS). This tagging research represents the greatest effort in terms of time devoted to sampling the shark population FFS to date (aside from commercial fishing in 1999). This research suggests that 1) using a small bottomset is a very effective way of capturing sharks and avoiding bycatch; 2) very few sharks utilize the shallow waters around the pupping sites. (Dale et al. 2010).

In 2010, there were 9 incidents of shark predation on pups, and as a result 6 pups died. This represented 16.2% (6 of 37 pups born) of the annual cohort (Table 1a & b). On Trig islet, Galapagos shark predatory activity was observed on 2 occasions during onsite monitoring by staff and/or recorded with the remote video camera. To increase the chance of observing sharks, staff camped on Trig as much as was feasible; however shark sightings remained rare, especially after the removal of a Galapagos shark at Trig on 13 July 2010 (see description below).

Two shark fishers were hired to fulfill the objectives of the PNMM permit granted in June 2010. Beginning on 10 July, the shark fishers focused their efforts at Trig because this was the islet with the greatest number of nursing pups to protect for the entire season. At Trig Island, monitoring of sharks occurred via camping and video recording. The removal effort initially focused on off-shore activities. Bottomsets and drumlines were deployed according to the permit's provisions with staff observing from island ready to alert the fishers (who were in their small boat monitoring the off-shore gear) of any near-shore shark activity. No near-shore Galapagos shark activity or shark incidents at Trig were observed between July 9 and August 23, 2010.

Thirty-four days of fishing occurred at Trig with 413 bottomset hook hours and 519.5 drumline hook hours (Table 3). One Galapagos shark was captured via the bottomset on the third day of fishing; the male shark (165cm total length) (see Table 2 for the number of Galapagos sharks culled at FFS by HMSRP over the last 10 years). The shark was euthanized with a bang stick, sampled (muscle, liver, stomach contents, skin clipping) and skin and teeth retained and preserved for Native Hawaiian community members. Remaining tissue was used as bait for subsequent fishing efforts. Bycatch was minimal and all non-target fishes caught were released

alive (3 ulua, 1 whitetip shark and 3 tiger sharks). It is also noteworthy that tiger shark hooking at Trig occurred throughout the 34 days of fishing reported here and this tiger shark presence was not coincident with predation activity. Our direct observations, video recordings and low catch success at Trig in 2010 given near identical bottomset procedures as Meyer used in 2009 provide continued support for the long-standing hypothesis that a small subset of Galapagos sharks is primarily responsible for the predation of pups (see also Dale et al. 2010).

The fishers also surveyed the waters around Trig and the Gins to document the micro-geography around these islets (depths, substrate and currents). Incidentally, the water depth 400 m from Trig Island was only 12-14 feet, not 25 feet as indicated by nautical charts. We discovered that the water depth was more adequate for bottomset fishing at approximately 700m from Trig; thus, we request this distance for fishing later in this application.

Also in 2010, we invited 3 members of the Native Hawaiian community on our cruise to drop off the fishers (5 July through 11 July). The vessel's course was based on the suggestions by the members of the Native Hawaiian community, which included timed arrival at select islands. The course included a visit to Ka'ula rock to perform the Mano i'a Harvest Ceremony at approximately noontime on July 6, with the ship stationed off a cave on the northwest side of the rock. Hawaiian greetings were chanted from the vessel during two morning circumnavigations around Nihoa Island, as well as at Mokumanamana during the night as the ship passed by en route to Tern Island, FFS. The stay at Tern Island, FFS was extended by a few hours beyond the scheduled drop-off of supplies and personnel to perform a second Manu i'a Harvest Ceremony. Our shark staff, monk seal staff, as well as the Refuge manager and other Fish & Wildlife staff participated in the ceremony, led by the members of the Native Hawaiian Community.

In 2011, there were 6 incidents of shark predation on pups, and as a result 5 pups died. This represented 13.5% (5 of 37 pups) of the annual cohort (Table 1a & b). Staff camped for a total of 84 days, 51 days on Gin and 33 days on Trig. The focus of monitoring was at Gin during the first half of the season because more pups were born there than at Trig. Our staff sighted Galapagos sharks twice; a shark with no distinctive fin marks was observed attempting to attack a pup in the nearshore and a second individual with a "notched" fin was captured and removed (see below). The remote camera system was installed at Trig; however, it was non-functional despite several attempts at fixing it throughout the season. No Galapagos sharks were directly sighted at Trig in 2011.

Handlines were first deployed at Gin on 7 June, after a shark-inferred disappearance of a pup there, and continued until 12 July. Thereafter fishing occurred at Trig from 14 July to 29 July 2011. Staff used handlines for a total hook soak time of 680 hours (Table 3). A large female Galapagos (274 cm total length) was removed at Gin on 7 July 2011 with a handline (no boat used) and tuna bait set approximately 30m offshore on the northeast side of the islet (23°44'09.58, 166°09'55.33) (Table 2). This shark was not seen until it took the bait. Skin, jaw and specimens were taken and frozen; remains were used subsequently as bait. Non-target species caught and released alive included 4 grey reef and 5 tiger sharks. Also 1 ulua spun line around itself and died. We added a swivel to the handline gear to prevent this occurrence from happening in the future.

In July (2011), the HMSRP coordinated with the Office of Hawaiian Affairs (OHA) to reach out to the Hawaiian community to build upon the relationships formed with cultural practitioners initiated in 2010. Our primary objective was to continue to promote an increased mutual understanding and respect between our Program and members of the community. We aimed to provide an opportunity for Hawaiian community members to accompany our staff on the monk seal camp pickup cruise to the NWHIs, spend time with our staff at FFS, and experience our seal and shark predation mitigation work first-hand. At recent cultural working group meetings, it was voiced that the community would benefit from this type of participation by a more senior representative of the community. Thus, OHA, along with Auntie Pua Kanahale of Hawaii Island, facilitated the selection of Mr. Leighton Tseu. He boarded the OES on July 30; we hosted him at FFS from August 1 until August 17; he returned to Honolulu on August 20. The Galapagos shark's skin and jaws were distributed to G. Umi Kai for cultural and educational purposes upon our return from FFS (September 2011).

In 2012, there were 5 incidents of shark predation on pups recorded (3 at Trig, 1 at East and 1 at Gin), and as a result 2 pups died (Table 1a & b). This represented 6.5% (2 of 31 pups) of the annual cohort that was observed at FFS by the end of the field season (2 August). Three additional pups disappeared between FWS's observation of them in May and NMFS arrival on 18 June. Information about these pups' disappearances was limited and thus, their cause of death was deemed 'unknown' but may have been shark-caused.

Staff camped at Trig for a total of 28 days between 27 and 28 June. Camping did not occur at the Gins because shark predation was not evident there until 17 July, when the last remaining pup there was nearly weaned. No Galapagos sharks were directly sighted in 2012. The remote camera system was installed at Trig and functional until it began malfunctioning on 12 July. Shark activity has not been observed on the limited footage viewed to date.

Handlines were first deployed at Trig on 27 June, the day after a pup disappeared, and continued until 28 July. Staff used handlines from shore for a total of 479 hook hours; however no Galapagos sharks were caught (Table 3). Bycatch included 6 tiger sharks and 2 white tip sharks; all were released alive and unharmed. Two additional large sharks took bait but were not hooked; their species was not identified.

NMFS translocated 10 pups at weaning from Trig, Gin, Round and Shark islets to Tern Island where predation risk is relatively low. Ten pups remain nursing, and thus, are still vulnerable to predation. The relatively short HMSRP field season this year means that the information on the mortality causes of 3 early-season pup losses is missing; likewise information on any late-season pup losses will be absent. So, though the impact of shark predation on pups this year may appear low; field effort to document such events was substantially less than other years.

Table 1a. The number of monk seal pup deaths and the number that died due to shark predation (confirmed and inferred kills) in the NWHI, listed by atoll, across the past 5 years. Total pup deaths per location by year in bold; pup deaths attributable to shark predation in parentheses.

Location

Year	FFS	LAY	LISI	PHR	MDY	KUR
2007	7(6)	2(0)	0(0)	1(0)	3(0)	0(0)
2008	8(6)	2(0)	1(0)	0(0)	1(0)	2(0)
2009	7(5)	0(0)	1(0)	0(0)	0(0)	0(0)
2010	9(6)	3(0)	1(0)	2(0)	0(0)	1(0)
2011	9(5)	3(0)	1(0)	3(0)	2(0)	5(0)
2012	6(2)	0(0)	1(0)	0(0)	0(0)	1(0)

Table 1b. The number of monk seal pups impacted by sharks (injured, confirmed and inferred kills) in FFS, listed by islet during the past 5 years. Islets with no recorded shark incidents on pups across all 5 years are omitted.

Year	Location			
	Trig	Gins	Round	East
2007	5	3	1	0
2008	4	4	0	1
2009	5	1	0	1
2010	4	1	0	1
2011	3	3	0	0
2012	3	1	0	1

Table 2. The number of sharks removed by NMFS to date and the number of pups impacted by shark predation at FFS between 1997 and 2011.

Year	Galapagos sharks removed*	Pups impacted by sharks
1997	0	27
1998	0	16
1999	0	28
2000	1	12
2001	5	17
2002	2	12
2003	2	14
2004	0	14
2005	2	13
2006	0	17
2007	0	9
2008	Not attempted**	9
2009	Not attempted**	7
2010	1	6
2011	1	6
2012	0	5

\* All Galapagos sharks were removed from Trig with the exception of 1 from Gin in 2011.

\*\* Shark deterrent testing occurred in this year and shark removals were not attempted.



Table 3. NMFS shark removal effort in 2010-2012 at Trig and/or Gin islets, FFS.

Year	Galapagos caught	Hook hours	Days with hooks in water	Primary method(s)	Bycatch
2010	1	932.5	34	bottomset/drumline	3 tiger, 1 whitetip, 3 ulua
2011	1	680	50	handline	5 tiger, 4 grey reef, 1 ulua
2012	0	479	24	handline	6 tiger, 2 whitetip