Final Environmental Assessment

Issuance of a Conservation and Management Permit to the

National Marine Fisheries Service

Pacific Islands Fisheries Science Center Protected Species Division and

Pacific Islands Regional Office Protected Resources Division

For Conducting Hawaiian Monk Seal Conservation and Management Activities in

Papahānaumokuākea Marine National Monument

April, 2011

Prepared by the National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Pacific Islands Fisheries Science Center and National Ocean Service, Office of National Marine Sanctuaries

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Acronyms and Abbreviations

BE	Biological Evaluation
EA	Environmental Assessment
EPA	Environmental Protection Agency
ESA	Endangered Species Act of 1973
FFS	French Frigate Shoals
FWS	United States Fish and Wildlife Service
FONSI	Finding of No Significant Impact
HIMB	Hawaii Institute of Marine Biology
HMSRP	Hawaiian Monk Seal Research Program
HMSRT	Hawaiian Monk Seal Recovery Team
MHI	Main Hawaiian Islands
NEPA	National Environmental Policy Act of 1969
NOAA	National Oceanic and Atmospheric Administration
NMFS	National Marine Fisheries Service
NWHI	Northwestern Hawaiian Islands
OMAO	Office of Marine and Aviation Operations
PEA	Programmatic Environmental Assessment
PIFSC	Pacific Islands Fisheries Science Center
PIRO	Pacific Islands Regional Office
PMNM	Papahānaumokuākea Marine National Monument
PRD	Protected Resources Division
SPA	Special Preservation Area
USCG	United States Coast Guard

EXECUTIVE SUMMARY

This Draft Environmental Assessment (EA) was prepared in accordance with the National Environmental Policy Act of 1969 (NEPA; 42 United States Code §4321, et seq.), as implemented by the Council on Environmental Quality regulations (40 Code of Federal Regulations Part 1500-1508), and National Oceanic and Atmospheric Administration (NOAA) Administrative Order (NAO) 216-6, which describes NOAA policies, requirements, and procedures implementing NEPA.

NOAA's Office of National Marine Sanctuaries (ONMS) proposes to issue, together with the the U.S. Fish and Wildlife Service and the State of Hawai'i, an annual conservation and management permit to Dr. Frank Parrish and Ms. Alecia Van Atta of the National Marine Fisheries Service (NMFS) Pacific Islands Fisheries Science Center (PIFSC) and Pacific Islands Regional Office (PIRO) Protected Species Team to enter Papahānaumokuākea Marine National Monument (PMNM or Monument) to conduct Hawaiian monk seal conservation and management activities through observation and monitoring and utilization of various fishing techniques to lethally remove Galapagos sharks exhibiting aggressive behavior in nearshore areas where preweaned pups are located (hereinafter referred to as the "proposed action").

The purpose of the proposed action is to improve Hawaiian monk seal recovery by increasing juvenile survivorship and the reproductive potential of the subpopulation at French Frigate Shoals Atoll (FFS) within the Monument consistent with NMFS's mandate to protect and recover endangered species and their habitat and the Monument co-trustees' mandate to protect and manage marine resources. The scope of the proposed action involves activities to reduce predation by Galapagos sharks exhibiting predatory behavior around Hawaiian monk seal preweaned pups at FFS by undertaking several different approaches including monitoring and lethal removal of sharks. The proposed action would be conducted at select islets at FFS including Tern, Gin, Little Gin ("the Gins"), Trig and Round Islands. The need for the proposed action is to reduce a source of juvenile Hawaiian monk seal mortality which may assist with increasing survivorship and the reproductive potential of the juvenile subpopulation within FFS.

The proposed action analyzed in this EA includes (1) monitoring Galapagos sharks adjacent to seal pupping areas and (2) conducting fishing activities to lethally remove up to 19 Galapagos sharks observed near seal pupping areas over the 2011 field season. Proposed fishing methods include handline, harpooning, and use of a surprise net (also called the "stealth tangle net"). All such fishing activities would be shore based, and occur only within shallow waters at FFS. This analysis presents information on the anticipated effects to the physical environment resulting from the proposed action, as well as potential effects to the biological environment, including marine mammals, sea turtles, Galapagos sharks, birds, and corals. With mitigation measures incorporated into the proposed action to prevent seal and turtle entanglements or hookings, no significant impacts would occur.

NOAA has further determined that the proposed action would not have reasonably foreseeable direct or indirect effects on any coastal use or resource of the State's coastal zone. NOAA has determined that the proposed action may have positive cumulative effects on monk seal survival and does not foresee direct or indirect significant negative effects to other marine components of the ecosystem. NOAA anticipates a Finding of No Significant Impact

1 Purpose and Need

1.1 Purpose of the Action

The proposed action consists of ONMS' proposal to issue an annual conservation and management permit to Dr. Frank Parrish and Ms. Alecia Van Atta of the NMFS PIFSC and NMFS PIRO Protected Species Division. The permit would allow the following activities at FFS: (1) entrance into the PMNM; (2) observation and monitoring of both Hawaiian monk seals and Galapagos sharks; and (3) utilization of various shore-based fishing techniques to lethally remove up to 19 Galapagos sharks exhibiting aggressive behavior in nearshore areas where preweaned pups are located. Proposed fishing methods include handline, harpoon, and use of a surprise net. All such fishing activities would be shore based, and occur only within shallow waters at FFS.

The purpose of the proposed action is to improve Hawaiian monk seal recovery by increasing juvenile survivorship and the reproductive potential of the subpopulation at FFS within the Monument consistent with NMFS's mandate to protect and recover endangered species and their habitat and the ONMS mandate to protect and manage marine resources. The proposed action meets goals and objectives identified in the Hawaiian Monk Seal Recovery Plan, which delineate reasonable actions that are necessary to recover and protect listed species.

The scope of the proposed action involves activities to reduce predation by Galapagos sharks exhibiting aggressive, predatory behavior around Hawaiian monk seals at FFS by undertaking several different approaches including monitoring and lethal removal of sharks. The proposed action would be conducted at select islets at FFS including Tern, the Gins, Round and Trig Islands. The need for the proposed action is to reduce a source of juvenile Hawaiian monk seal mortality which may assist with increasing survivorship and the reproductive potential of the juvenile subpopulation within FFS.

1.1.1 Context

Monk seals have great significance on regional, national, and even global scales. The genus *Monachus* comprises the Hawaiian monk seal (*Monachus schauinslandi*), the Caribbean monk seal (*Monachus tropicalis*) and the Mediterranean monk seal (*Monachus monachus*), all thought to be among the oldest of all existing seal genera on an evolutionary time scale. The Caribbean species was hunted to extinction for meat, skins, blubber, and museum and zoo specimens. The last wild Caribbean monk seal was seen in 1952, and the species was declared extinct in 2008 (73 FR 32521; June 9, 2008). The Mediterranean monk seal population numbers in the low hundreds and has been reduced to scattered and isolated small groups from North Africa to Greece. This species is the victim of political circumstances in that the remnant small groups reside in the waters of several countries that have failed to achieve a comprehensive and effective recovery program. The outlook for long-term persistence of the Mediterranean monk seal is bleak (NMFS 2007a).

The Hawaiian monk seal, then, may be the best – and perhaps only – chance of saving the genus *Monachus*. Despite the species' low and declining numbers, circumstances in Hawaii may potentially support the recovery of the species because:

- the population has not been segmented into isolated fragments among which dispersal cannot occur, such as in the Mediterranean monk seal;
- its core habitat in the Northwestern Hawaiian Islands (NWHI) is highly protected by the designated Monument mission and regulations
- the species is capable of recovering naturally in the main Hawaiian Islands (MHI), if conflicts with human use and land use can be resolved; and
- the Hawaiian monk seal occurs entirely within the United States and its Exclusive Economic Zone, eliminating the political impediments to recovery involved with the necessity of intergovernmental cooperation. However, this means that the United States government bears total responsibility for the continued existence of the species (NMFS 2007a).

1.1.2 Recovery

The HMSRP lists several criteria for reclassification of the monk seal population from "endangered' to "threatened". The population will be considered for reclassification if:

- aggregate numbers exceed 2,900 total individuals in the NWHI;
- at least five of the six main subpopulation in the NWHI are above 100 individuals and the MHI population is above 500; and
- survivorship of females in each subpopulation in the NWHI and in the MHI is high enough that, in conjunction with the birth rates in each subpopulation, the calculated population growth rate for each subpopulation is not negative.

With the rapidly declining population in the NWHI due to all factors, especially food limitation for juvenile pups and shark depredation on pre-weaned pups, and the limited acceptance of monk seals by humans in inhabited areas in the MHI (competition for use of popular beaches), every pup born is critical for population recovery.

1.2 The Need for Action

The total abundance of Hawaiian monk seals in the NWHI has declined by 75% since the late 1950s. The causes of decline have varied over time and from place to place, but since the early 1990s the decline has been driven, in large part, by low rates of juvenile survival. Archipelago-wide many of these young animals have failed to thrive due to malnutrition, and only about one of every five live to reach maturity. The age structure of the population is therefore biased toward continually aging individuals, with little recruitment into the breeding population. The total population estimate throughout the Hawaiian Archipelago as of 2008 is 1,146 seals, with 100 to 150 in the MHI. Estimated abundance is declining by 4.1% annually (approximately 50 seals per year). At present rates, the Hawaiian monk seal species will decrease to less than 1,000 individuals within five years and will be, for all purposes, extinct within 50 years (Harting et al., *in prep.*). FFS, the atoll with the largest pupping population, has been experiencing a 75% decline in beach counts and 35% decline in pup births since 1989 (decreasing from 120 pups in 1990 to 41 pups in 2008) (Figure 1). On top of decreasing births, 12% to 21% of the pups continue to be lost to shark predation (for every year since 2000) (NMFS 2008) (Figure 2).

History teaches us that the monk seal will continue to face new and unforeseen challenges in the future, including loss of habitat in the NHWI, such as occurred with the disappearance of Whaleskate Islet in FFS in 1998 to 1999 and the finding that islet sizes at FFS were at least 50% smaller in 2004 than in 1963 (Antonelis et al. 2006). Climate change and associated rising waters may also contribute greatly to loss of habitat. But after two decades of poor survival of juvenile seals and precipitous drops in overall numbers and numbers of pups, it is clear that this problem must be addressed immediately.

A recent and troubling trend is the loss of pre-weaned pups to Galapagos shark (*Carcharhinus galapagensis*) predation in FFS since the late 1990s. Losses peaked in 1997 through 1999, with 19 to 31 mortalities recorded each year; the trend then stabilized at 8 to 12 losses each year since 2000, equal to 12% to 21% of the annual cohort born at the atoll (Harting et al. *in prep.).*

Reducing shark predation on seal pups is one of four key activities highlighted in the Recovery Plan for the Hawaiian Monk Seal, published by NOAA in compliance with the Endangered Species Act (ESA) in the summer of 2007. The primary activities identified in the Recovery Plan pertinent to this action (NMFS 2007) are:

- Continue monitoring shark activity and predation events.
- Remove problem sharks.
- Develop general criteria (and site-specific plans) for shark removal.
- Maintain needed permits for shark removal and/or other intervention.
- Be prepared for rapid response to predation events.
- Have trained staff and gear for intervention.
- Characterize trends in shark abundance, movement patterns, and predation losses throughout the NWHI in relation to these interventions and conduct shark behavior research.

Selective fishing to remove predatory Galapagos sharks has occurred for over ten years. Shark removal activities were initiated in 2000 and continued each year thereafter until 2007, with a total of 12 Galapagos sharks removed during from 2000-2007 by HMRSP staff. Shark removal activities were also conducted via PMNM permit in 2010 with a total of one Galapagos shark lethally removed from FFS.

Monument permits to deploy electromagnetic, visual and auditory devices to deter Galapagos sharks within select areas at FFS were issued in 2008 and 2009. Treatments included 24-hour human presence, visual and auditory devices aimed to deter shark activity, and a control (no humans, no deterrents) at two pupping sites. Through the systematic application of these treatments, no significant difference in shark incidents existed across treatments (Trig only- Pearson's Chi square 3.5, p= 0.17, 94 days; Trig & Gin- Pearson's Chi square 2.5. p= 0.28, 140 days). The pattern of shark incidents appeared to be independent of device/deterrent placement at Trig. For example, a 36-day period with no shark incidents occurred in 2008 with the maximal deterrent effort and a 41-day period with no shark incidents occurred in 2009 with alternating deterrent effort. The number of pups attacked at Trig Island differed little when compared over the three years. In 2007, a year with no devices, five (27.8%) pups were attacked. In 2008, a year with

devices for most of the season (until they failed to operate), four (25%) pups were attacked. In 2009, a year with devices for part of season (i.e. devices were deployed during the 'device treatment', totaling 28 days), six (31.3%) pups were attacked. Sharks were sighted on 10 of 35 days during the human presence treatment at Trig and Gin islets, demonstrating that sharks' wariness to humans is variable, unpredictable, possibly individualistic and unreliable at these locations. The hypothesis that a lower percentage of pups born will succumb to shark predation when devices/deterrents are deployed compared to previous years was not supported. The hypothesis that fewer shark incidents will occur when humans are present or devices are deployed versus control periods was also not supported.

1.2.1 The Decline and Specific Threats to Survival of the Hawaiian Monk Seal Population in the NWHI

The Hawaiian monk seal population in the NWHI is declining at almost 4% per year (NMFS 2007), primarily due to reduced juvenile survival. Survival rates, particularly of pups and juveniles, must increase for the species to recover. A primary goal of the HMSRP is to increase juvenile survival, including survival of pre-weaned pups, to levels sufficient to slow the rate of population decrease to ultimately assist in reversing the current downward trajectory of the population. Hawaiian monk seal pups are generally born between May and September, based on historical data. This section summarizes information about temporal and spatial variability in juvenile monk seal survival, and, importantly, predictability of survival rates.

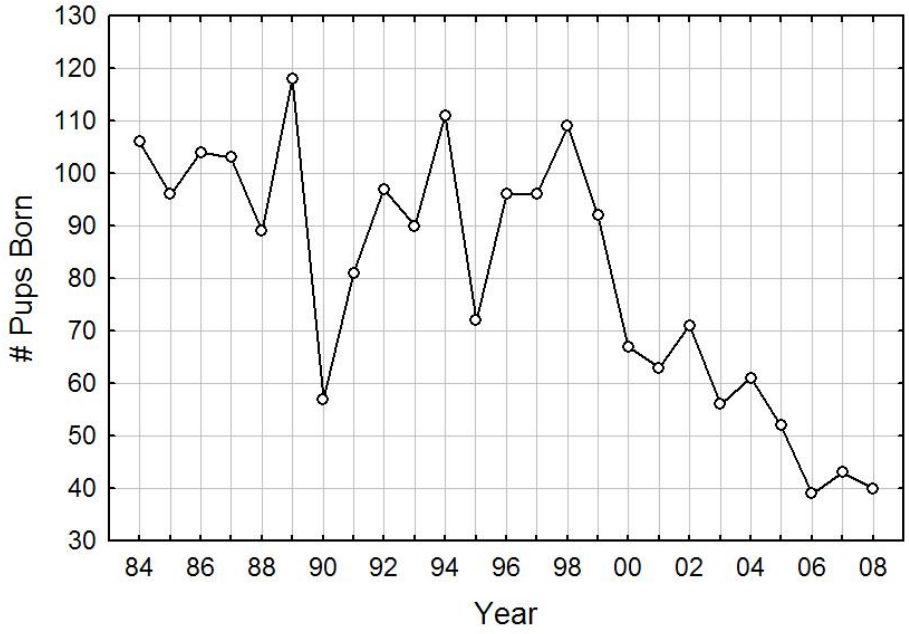

Figure 1. Number of monk seal pups born per year at all FFS sites, 1984-2008.

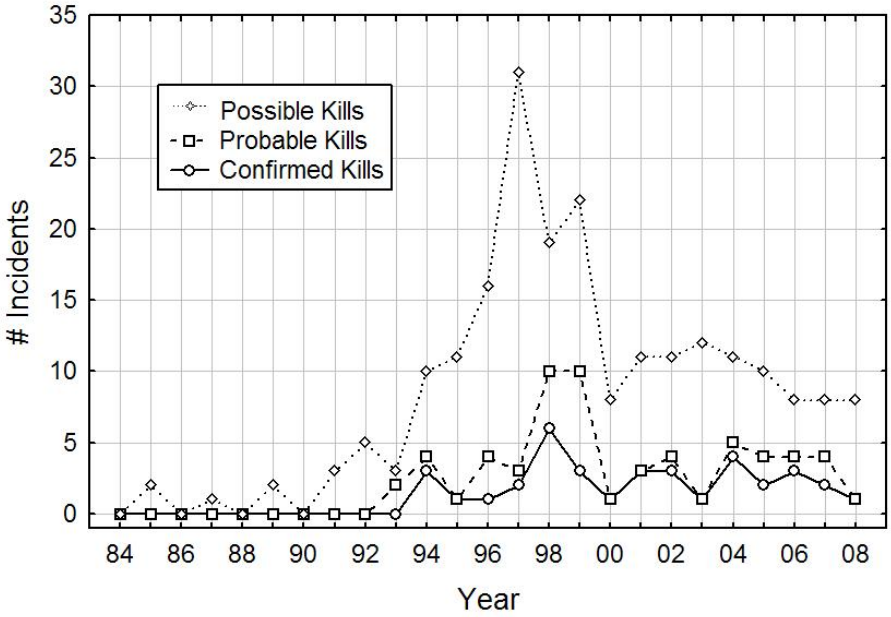

Figure 2. Number of predation mortalities (confirmed and inferred) at all FFS sites 1984-2008.

Individual subpopulations of monk seals show similar patterns in age-specific survival across the NWHI. Juvenile, subadult, and adult survival rates do vary significantly over time though general patterns are apparent (NMFS 2007). Survival during the five- to six-week nursing period tends to be quite high (>90%) at all NWHI subpopulations except at FFS because of maternal attendance, protection and provisioning and few other threats to survival at this stage of life (Johanos et al. 1994). After weaning, juvenile survival rate is relatively low to age 2 years, intermediate to age 4 years, and then relatively high for mature seals (until approximately age 17), after which a decline is observed as seals approach old age.

The causes of these patterns and declines are numerous and complex, and are thoroughly reviewed in the HMSRP (NMFS 2007). A crucial threat that is contributing to the high rate of population decline in the NWHI is apparent food limitation, especially for younger animals (Craig and Ragen 1999; Yochem et al. 2004). Survival of juveniles recently weaned through age three has declined most dramatically, with smaller body sizes of juveniles consistent with signs of starvation. This condition may be due to competition with other apex predators such as some shark species, other monk seals, less efficient foraging skills of young seals, and changes in ocean productivity reducing the availability of prey. This situation contrasts with the MHI, where pups tend to wean much larger than in the NWHI, and thin animals are rarely observed.

Among the six primary breeding sites in the NWHI, FFS (Figure 1) has experienced the most precipitous decline, with beach counts, as well as number of pups born generally falling from 1989 through 2008 (Baker 2008) (Figure 1). Although FFS was once the most populous site, with over 400 individuals in the late 1980s, the estimated abundance in 2006 was only 246 seals (NMFS, unpublished data). The primary factor in the FFS subpopulation's decline has been poor juvenile survival exacerbated by lower reproductive rates due to lower numbers of breeding females and young females entering the breeding cohort, as at other sites. However, at FFS malnutrition as well as shark predation is responsible for poor juvenile survivorship, with the latter greatly affecting pre-weaned pup survival.

Since about 1997, a marked increase in Galapagos shark predation on pre-weaned monk seal pups born at FFS has occurred (Hawn 2000; Hayes 2002; NMFS 2003, NMFS 2004, NMFS 2005). For example, at Trig and Whaleskate Islets within FFS, the number of predation mortalities from sharks (including both confirmed and inferred losses) peaked in 1997 through 1999 (Figure 2). During this period, 19 to 31 pups, representing 38-69% of the cohort, suffered predation each year by Galapagos sharks (confirmed and inferred losses). Additional individual pups were maimed by shark bites, including amputation of body parts, potentially reducing diving and foraging ability, as well as reproductive potential, as maimed animals presumably have a lower potential to mate. Overall, from 1996 through 2006, pre-weaned pup survival was lower at FFS than at other breeding sites in all years but one. Definitions of criteria for and categorization of shark predation of Hawaiian monk seal pups is included in Appendix A.

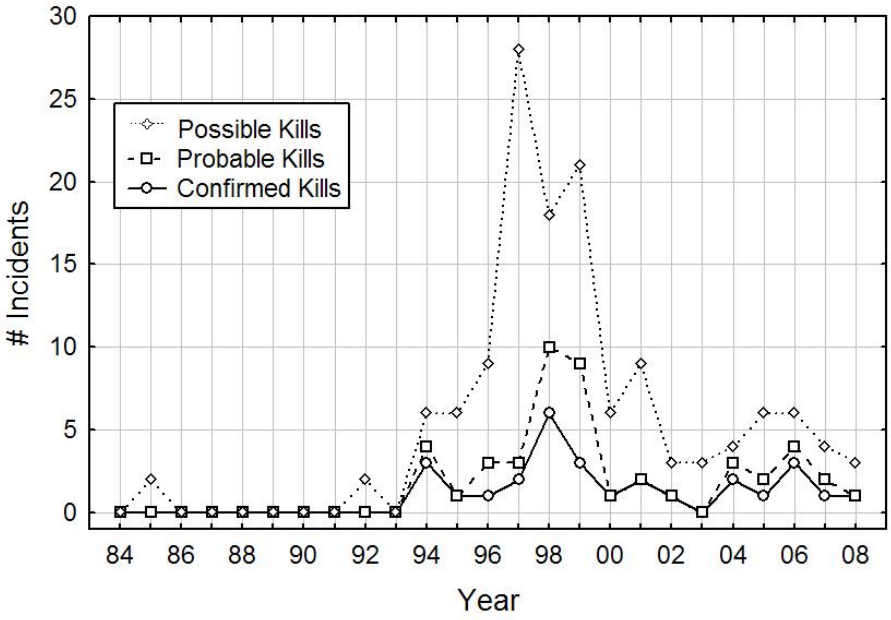

Figure 3. Shark mortalities (confirmed and inferred) at Trig Islet 1984-2008.

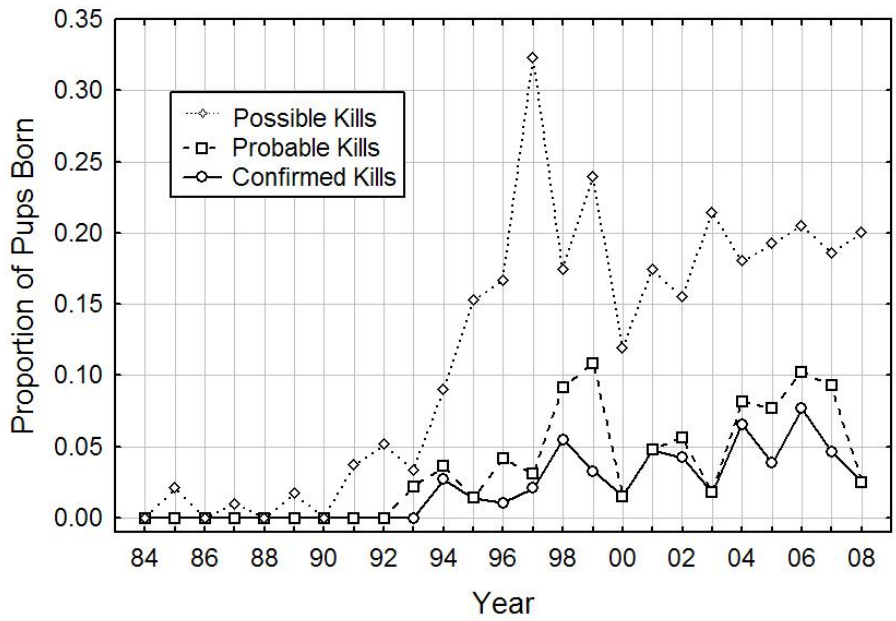

Figure 4. Proportion of pups born at FFS attacked by sharks (confirmed and inferred) 1984-2008.

Subsequent to this peak of losses in 1997 through 1999, pre-weaned pup mortalities from Galapagos sharks declined, though to a level of loss that is unsustainable for this severely declining subpopulation of this critically endangered species. From 2000 through 2008, the number of pre-weaned pup losses (confirmed and inferred) at FFS atoll-wide was relatively stable at eight to twelve pups per year. However, with fewer pups being born at FFS in recent years (41 in 2008 compared to more than 100 in the late 1980s), the lower numbers of pups lost to predation exacted an increasingly heavy toll on smaller cohorts (Figure 4). From 1997 through 2008, 200 of 801 pups born at FFS were involved in shark incidents (Becker *per comm*. February 2009).

In 2007, at least 8 of the 43 pre-weaned pups born at FFS were lost due to shark predation and one severely-bitten pup was expected to die post-season due to extent of its wounds. In 2008, 12 pre-weaned pups died or disappeared (30%) out of 41 births in FFS, with eight of the losses due to sharks (confirmed or inferred). The disappearances of three of these pups were categorized as unknown because they were born late in the season after routine data collection had ceased, though shark-predation cannot be ruled out. Shark incidents (confirmed and inferred) affected 25% of the pups born in 2008 on Trig Islet (NMFS 2008). Shark depredations were catastrophic on the two Gins Islets in 2008, with four losses to sharks out of 6 births, with an additional non-lethal but multiple bite wound attack on a pup (Farry et al. 2009 *in prep*). One pup disappeared after the regular season; its cause of death was categorized as unknown (see description above). In 2010, 36 monk seal pups were born, 17 weaned and successfully survived and 8 were lost to shark predation at FFS (2 pups died from other causes, and nine pups were still nursing at the end of the 2010 camp season) (NMFS, unpublished data). This level of mortality cannot be sustained at FFS, where the total population and annual pup production are projected to continue declining for the foreseeable future due to a consistently unbalanced age structure (Ragen and Lavigne 1999, Harting 2002).

A standing hypothesis developed by experts familiar with this predator-prey system at FFS is that a small number of Galapagos sharks are involved in pre-weaned pup predation. This hypothesis is currently being tested by researchers from the Hawaii Institute of Marine Biology (HIMB) using an

acoustic tagging study at FFS (Antonelis et al. 2006, NMFS 2008, NMFS 2009 *in prep*). Based on tagging and other distinguishing features of individual sharks, a minimum of 14 identified Galapagos sharks were observed patrolling or pursuing pre-weaned pups at Trig Islet in 1998. One of the previously sighted and tagged Galapagos sharks from 1998 was again sighted around Trig islet during the pupping season and was identified with the killing of a pre-weaned pup that year (Harting et al. *in prep*.).

Additional information on the HMSRP and uncertainty, risks and benefits faced by NMFS in its mandate to recover the Hawaiian monk seal is detailed in the Environmental Assessment entitled, "Programmatic Environmental Assessment of the Program for Decreasing or Eliminating Predation of Pre-Weaned Hawaiian Monk Seal Pups by Galapagos Sharks in the Northwestern Hawaiian Islands – Pacific Islands Fisheries Science Center (PIFSC), Protected Species Division (PRD), Hawaiian Monk Seal Research Program (HMSRP) Honolulu, Hawaii – March 13, 2009," (NMFS, 2009) and is incorporated here by reference.

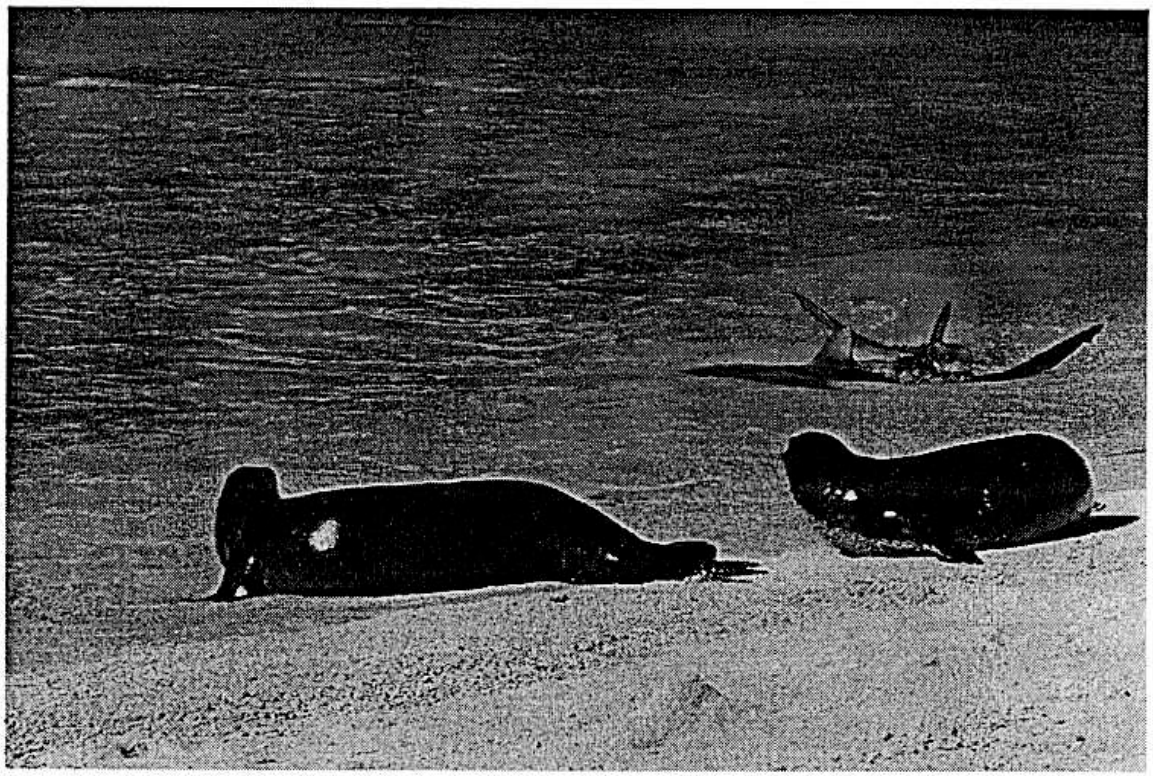

Figure 5. Adult female Hawaiian monk seal (seal on left) turns to protect her pup against attack by Galapagos sharks

Based on the losses occurring in 1997 through 1999, personnel attempted to haze predatory Galapagos sharks away from pupping and pups in FFS, especially Trig Islet, in 1998 through 2001. This management strategy proved unsuccessful in decreasing predation on pre-weaned pups and may have precipitated increased wariness by sharks toward humans (Harting et al. *in prep*.). This wariness may have contributed to a decrease in day predation and an increase in night predation (when observation of attacks is not possible) effectively maintaining the overall number of shark incidents relatively at a constant level though the observed, confirmed attacks are rare (Figure 3). Selective fishing to remove predatory Galapagos sharks was initiated in 2000 and continued each

year thereafter until 2007, with a total of 12 Galapagos sharks removed during from 2000-2007 by HMRSP staff. The experimental removals were based on the assumption that only a limited number of sharks were involved, specifically those that had discovered the high density of mother-pup pairs at Trig Island after Whaleskate islet had disappeared and also the numerous pup carcasses at beaches, resulting from male aggression in 1997-1998. In addition, in July and October 1999, over 50 Galapagos sharks were removed from FFS by commercial fishers, partially operating in the deep lagoonal area of the atoll. This 1999 removal was associated with the greatest drop in pre-weaned pup losses to shark predation to date (Vader 2003, Harting et al. *in prep*.) (Figure 4).

1.3 Hawaiian Monk Seal Recovery Plan Actions Not Included within Scope of EA

The HMSRP also conducts other actions in support of Hawaiian monk seal recovery that are not included within the scope of this EA. The program includes monitoring monk seal population abundance, assessment, and dynamics; foraging studies; disentangling seals from marine debris; conducting disease and health assessments; and conducting limited translocation of weaned juveniles to areas within the NWHI, especially from Trig Islet to Tern Islet within FFS and FFS to Nihoa, with historical lower probability of shark attack. In the past, the HMSRP has also deployed shark deterrent devices at islets in FFS including electromagnetic, auditory, and physical deterrents (e.g. floats and buoys), and translocated weaned juveniles with evidence of starvation to care facilities in Oahu for a year before releasing them back into the NWHI (NMFS 2007b). These actions are not included within the scope of this EA.

NEPA documentation is currently underway for evaluation of a program for emergency translocation of mother/pre-weaned pup and pregnant females in the MHI. This is not included in the scope of this EA. Another NEPA document is currently being prepared for translocation of weaned pups within the NWHI and from the NWHI to the MHI and is therefore not within the scope of this EA.

2 Proposed Actions and Alternatives

The scope of this EA is limited to assessment of the potential environmental effects of conducting conservation and management activities related to salvaging the reproductive potential of weanling and juvenile female Hawaiian monk seals. As limited control of predatory sharks in selected areas is included in the proposed program for enhancing juvenile survival; these actions are included within the scope of the proposed expanded monk seal research activities. Therefore the existing and expanded program for controlling predatory sharks is also included within the scope of this EA.

This EA focuses on proposed strategies to reduce shark attacks on pre-weaned pups, within FFS. The proposed shark removal program addresses the actions identified in the 2007 Recovery Plan through:

- Continuing monitoring;
- Continuing to remove of problem sharks with traditional shore-based fishing methods; and
- Continuing and expanding the HMSRP research and cooperation with other researchers regarding shark population dynamics, monk seal losses and shark predatory behavior.

To date, this program is covered annually under permits from the NMFS Office of Protected Resources (OPR), and the Monument. Permits must be requested every year for the work planned for the next season. This EA covers all aspects of the proposed action (shark monitoring and removal program).

2.1 No Action Alternative

Under this alternative, no permits would be issued to monitor, observe or conduct activities to facilitate the survival of juvenile Hawaiian monk seal pups. Personnel would not be deployed to FFS to conduct shark monitoring activities, Galapagos shark predation on juvenile monk seals would go unrecorded and unobserved and the objectives of the HMSRP which aim to increase juvenile monk seal survivorship would not be met. The only activities at FFS that would occur would involve regular seal monitoring activities (e.g. tagging and monitoring at all Islands and Atolls within the NWHI which are conducted under separate PMNM permits.

Under the no action alternative, activities in the HMSRP would continue including translocation of weaned pups from areas in the NWHI where pups are at increased risk for starvation and/or shark predation to areas with less risk; has conducted captive care programs both in the NWHI and MHI for fattening yearlings to get them past that first critical year before release back into the NWHI, and conduct medical interventions on seals found ill in the NWHI (NMFS 2007b). Again, the aforementioned activities are covered under separate PMNM permits.

2.2 Alternative 1: Issue one Conservation and Management Permit to Implement Monitoring Program

Under alternative one, monitoring pups at FFS would occur. A monitoring plan would be implemented by HMSRP and involve monitoring seal populations, and Galapagos shark populations within FFS. As part of their monitoring of the Hawaiian monk seal population, observers would document the presence of Galapagos sharks in the vicinity of pupping areas.

Under this alternative, PMNM would issue one conservation and management permit to allow the monitoring of Hawaiian monk seal survival and shark behavior. A suite of monitoring activities would occur at FFS under alternative 1 including shark observation and monitoring through establishing overnight camps at select islands within FFS, continued operation and maintenance of remote viewing cameras installed on Trig Island, and erection of an observation tower for observation and monitoring purposes on Trig Island.

Alternative one would encompass three main components:

1. Erection of an observation tower to monitor shark presence;
2. Shark observation/monitoring including camping overnight; and
3. Continued maintenance and operation of remote viewing cameras.

2.2.1 Methods: Shark Observation/Monitoring

2.2.1.1 Observation Tower

The first proposed method is to passively monitor shark presence and movement patterns at three main pupping sites (Trig Island, Round Island and the Gins) with historically high shark incidence. Observation is proposed to be conducted using systematic surveys from a 12-foot tower, the ground, and/or patrolling in small boats. The tower is a 12-foot structure made of scaffolding that would be erected on Trig, located approximately 40 meters from the south end of the island. Under the proposed action, a 12-foot portable observation tower made from scaffolding with a 4-foot x 6-foot base may be erected primarily to use for visual monitoring. When stored, the tower has a less than 25 sq. ft. “foot print”. In past seasons, when the observation tower in place in 2000 through 2004, it was observed that shark presence decreased as time progressed, indicating that the tower itself may function as a visual deterrent. Therefore, the program proposes installing the portable tower again to serve this purpose. The tower would primarily be erected in the daytime, but may, on occasion, be used at night for monitoring purposes. The program may also choose not to erect the tower.

The geography and land mass of other pupping sites prohibits observation tower installation because of the relatively large footprint and little available land mass; therefore, surveys would be conducted from the ground or small patrolling boat at these sites. Any installation of a remote camera recording system(s) would allow shark observation during days and times when NMFS personnel are not present.

On the rare occasion when a Galapagos or tiger shark is sighted within the vicinity of pupping sites (including exhibiting predatory behavior or attacking), identifying characteristics and behaviors would be recorded on a standardized data form. This standardized form is based on worksheets used in “time scan sampling” in the tower observation procedure (2000-2004) and an International Shark Attack File questionnaire created by the Elasmobranch Society. Historically, “time scan sampling” involved intensive, continuous observation of shark activity in the nearshore waters surrounding major pupping sites (a detailed description of the monitoring protocols are available in previous reports or upon request). Observations were historically conducted from both the ground and from the elevated tower on Trig Island.

2.2.1.2 Overnight Camping

NMFS personnel may request permission for camping (2-14 nights at a time) in order to collect information during crepuscular periods. During overnight observations, the shark monitoring team may employ night-vision goggles to enable observations in low-light conditions (nocturnal and pre-dawn hours). No more than four people would overnight at study sites, campsites would involve minimum requirements typically used for backpacking (e.g., food, small, low profile tents and sleeping bags) and all waste material would be removed and transported to Tern Island for disposal in an appropriate manner. Such short camps have been successfully completed at Trig Island, the Gins and Round Island in the past without causing harm to the environment or the wildlife. Seal monitoring would occur approximately 5 days per week at Trig Island, and a minimum of 3 days per week at Round Island and the Gins.

In order to conduct monk seal population assessment activities (under separate PMNM permit), NMFS personnel would continue to visit Trig Island Round Island and the Gins on a daily or near-daily basis so that missing pups, shark-injured pups, or elevated shark activity would be immediately detected. If sharks are observed, monitoring intensity would be immediately increased to evaluate the predation risk.

2.2.1.3 Remote Viewing Camera

Remote viewing cameras may be of a variety of technical specifications (mounting, pole diameters, etc.). The existing remote viewing camera at FFS consists of a mounted camera atop a pole and is designed to avoid, minimize, and mitigate any impacts to wildlife from its operation. The technical specifications identified for the proposed temporary remote viewing camera consists a 10–foot aluminum bracketed pole with a power supply at its base. The pole is padded with foam-type material (as designed in consultation with the United States Fish and Wildlife Service (FWS)) to mitigate the potential of any injury should a bird fly into the pole). The pole was designed with no guy-wires, but, rather, utilizes brackets and a weighted base to allow the structure to stand erect in heavy winds, etc. All electronic wiring is protected inside of the pole itself. The installation of a remote camera recording system(s) would allow shark observation during days and times when NMFS personnel are not present.

2.3 Alternative 2: Issue one Conservation and Management Permit to Monitor and Lethally Remove Galapagos Sharks Using Various Shore-Based Fishing Methods (Proposed Action)

The proposed action would continue to use the actions described in alternative one combined with limited fishing and lethal removal of Galapagos sharks exhibiting predatory behavior toward monk seal pups. Under the proposed action, a variety of fishing methods would be utilized. These methods are discussed below.

2.3.1 Methods: Fishing

2.3.1.1 Introduction

Up to 19 Galapagos sharks in shallow waters near pupping sites are proposed for removal under the proposed action. A crew of 2 to 4 familiar with safe and effective methods for shark

fishing/removal would be tasked with conducting boat surveys and removing Galapagos sharks that (1) they encounter in the vicinity of pupping sites and (2) exhibit aggressive behavior toward seals. Boat surveys would occur during daylight hours at select times/days around each main pupping site on a regular basis throughout the field season. Additionally, if observers sight a shark from shore of a pupping site (ground or observation tower if/when erected on Trig islet) they would alert the fishing crew who would commence shore-based fishing at that time. If the fishing crew deems a removal personally unsafe or unfeasible, they would attempt to harass the shark away from shore by herding the shark into deeper water by throwing dead coral rubble and being physically present in the nearshore area where the shark is sighted.

Sharks would be removed by one or a combination of three shore-based fishing techniques:

- Handline
- Spear gun or harpoon
- Surprise Net

2.3.1.2 Handline

For the handline technique, a hook would be baited with dead tuna or mackerel, and fished from shore in water <2 m and up to 20 meters from shore. Once a shark has been targeted for removal, the hook would be baited. Bait soak time would be limited to one hour following the last sighting of a targeted shark to reduce the possibility of attracting additional sharks to the area. Currents would be noted, and the bait would be placed in an area that would avoid excessive risk of scent emanating from the bait to attract other sharks or put seals at additional risk. Gear would be tended to ensure that only Galapagos sharks are hooked.

2.3.1.3 Spear or harpoon from shore

A spear gun or harpoon may be used from shore when a shark is observed to be very close to the shoreline. A barbed shaft, shot from a spear gun or delivered by hand, would be attached to wire cable and connecting line that would be used to retrieve sharks to the beach for euthanasia. The spear gun may be powered by elastic bands, as commonly used by sport divers, or by a small caliber (.44) cartridge. In all instances, the spear or barbed head of the spear would be tethered by line so that the shark can be brought to shore for euthanasia.

2.3.1.4 Surprise Net

2.3.1.4.1 Description of equipment

The surprise net to be used by PIFSC would be based upon a system developed by scientists at the Sea Mammal Research Unit (SMRU), Scottish Oceans Institute, University of Saint Andrews, Scotland (Figure 2). Faced with difficulties capturing animals in some situations and the desire to minimize disturbance, SMRU developed a radio-controlled net deployment apparatus. This technology was created to enable the subtle deployment of tangle-nets in front of animals in shallow nearshore areas, and is used to capture harbor seals and grey seals, which are very wary of human presence and readily flee into the water at human approach. The device is a barrier/tangle net which is compressed into a long, horizontal, submerged tube anchored along the bottom, and deployed in an arc enclosing a prescribed area of shoreline or nearshore waters. The bottom of the net is weighted, and the top of the net is a hose which can be inflated with air and which is attached to

portable air cylinders. Inflation of the hose is controlled remotely via solenoid switches and valves between the cylinders and the hose. When the hose is inflated the top of the net rises quickly from the bottom to the surface, trapping the desired animals between the arc of the net and the shore. The target animals become tangled if they attempt to swim through the net, or if they remain untangled they can be captured by pulling the net in to shore.

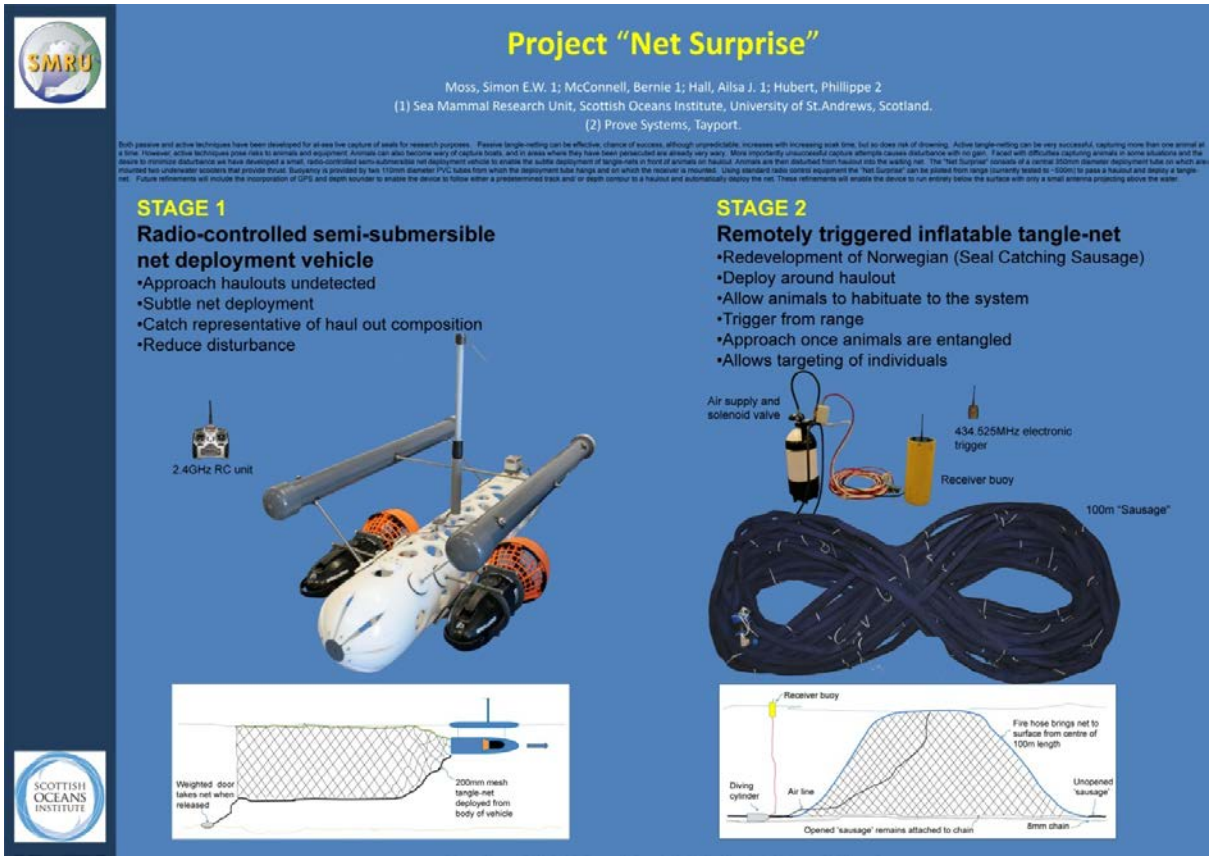

Figure 2. Prototype Surprise Net (Stage 2 Only)

The NMFS/PIFSC version of the surprise net consists of a central 350mm diameter deployment canvas or heavy mesh tube containing the tangle net. The deployment tube is attached to a heavy (8mm) anchor chain of equal length to the tube, and the ends may be attached to Danforth anchors on the shore to increase stability. The tube is held together longitudinally by velcro. Each tube (and therefore each surprise net) is 30 m long (note, much shorter than the 100m depicted in Fig 2). The tangle net (folded within the tube) is constructed of nylon, multifilament fiber (4" diameter stretch mesh), suspended from a 2" diameter inflatable hose. Each end of the hose is attached to a diving cylinder (also encased in the deployment tube) via air line and a regulator and pressure relief valve. The diving cylinder supplies air to provide thrust and quick deployment of the tangle net. Receivers with small antennae are connected to the diving cylinders via solenoid valves, and can be remotely triggered from the beach using standard radio equipment. The height of the net would be 5 m from bottom chain to surface float line. Precise location of the receiver is to be determined, either attached to a floating buoy or on the shore.

The PIFSC version would not include a remote-controlled deployment vehicle (Stage 1 in Fig. 2); the net would be deployed manually.

2.3.1.4.2 Deployment methods

The deployment tube would be used in discrete areas of the nearshore habitat in islet sectors where sharks have been observed to patrol or pursue pups. The tube would be laid by hand or via small boat in a semi-circle configuration, arcing out approximately 5-10m from the shoreline, with each end on shore. Up to two tubes may be deployed at once. The duration of deployment at any one location would vary according to the amount and locations of observed predatory shark activity, but would not exceed 72 continuous hours. At times when no personnel are present at the deployment site, all valves would be shut to prevent accidental deployment. The tube would be removed from the water if inclement weather and accompanying higher currents and/or wave surge is forecast.

Specific sites of deployment would vary according to the location of mother/pup seal pairs, which would determine the vicinity in which predatory sharks are patrolling. At Trig Island, based on observed predatory events in past years, we anticipate most activity to be at the southeast area of the island (Fig. 3).

Figure 5. Trig Island Showing Typical Surprise Net Deployment Site (Red Dots Inscribe 30m Arc of Net)

Deployment at Gin Island would most likely be on the west or northwest side of the island. Deployment at Little Gin would likely occur on the west side of the island

All deployments would occur on sandy bottom or coral rubble bottom. No living coral would be within the arc of the net. If mother/pup pairs (and patrolling sharks) are adjacent to deep water or living coral areas, the net would be deployed at the sandy/coral rubble area in closest proximity to

the mother/pup pair. Because the height of the net would be 5 m all deployment would be in water no deeper than 5 m.

2.3.1.4.3 Triggering net and shark capture

The surprise net would be triggered by personnel on shore only when a Galapagos shark which has exhibited predatory behavior is within the arc of the net. Predatory behavior has been defined in Appendix A of the EA, incorporated by reference here. Moreover, the net would not be triggered if any seals or turtles are within the arc of the net, either in the water or on shore. If the net surrounds a shark, or if the shark becomes entangled, the net would be pulled in to shore from the ends manually by field personnel. The shark would be euthanized with a 0.44 caliber bang stick. Post catch procedures would follow those described in 2.3.1.6 below.

2.3.1.5 Fishing size limits

The only shark species that is likely to be confused with the Galapagos shark is the grey reef shark. The maximum size of 20 grey reef sharks caught across the NWHI was 159 cm (total length) in a 2003 study. In order to avoid confusion between the Galapagos shark and grey reef shark, size limits for euthanizing would be set at 200 cm total length.

2.3.1.6 Post-catch euthanasia and procedures

Any sharks captured via the fishing methods described above would be brought to the beach, adjacent to the vessel, or aboard and euthanized with a 0.44 caliber bang stick. As agreed upon by FWS and NMFS (August 18, 2001), information concerning the removal of each shark would include environmental conditions at the time of removal, criteria used to determine the shark targeted for removal, identifying tags and physical features of the shark removed, history of previous shark sightings, removal methodology, and method of euthanasia. Information and materials collected from each shark carcass would include morphometric measurements, genetic samples, stomach contents, vertebrae and reproductive status. Tissue samples from sharks would be analyzed to quantify compounds of potential concern at acceptable detection limits to include total metals, polychlorinated biphenyls, organochlorine pesticides, percent lipid and moisture, and fatty acid profile analysis for detection of possible monk seal consumption. Teeth and ventral (belly) skin would be retained and made available for cultural purposes. Vertebrae and skin samples would be collected for isotope to detect marine mammal consumption and genetic analysis. Stomach contents would be retained for diet analysis; genetic screening for monk seal DNA may occur on unidentified digesta if necessary. Preservation of samples would be as follows: vertebrae samples in 95% ethanol or frozen and tissue samples for DNA analysis in a 20% dimethyl sulfoxide solution or frozen. After all samples and data have been collected, shark carcasses would be discarded following appropriate Monument disposal protocols and Native Hawaiian protocols.

Native Hawaiian cultural protocols, based on extensive practitioner input, would be included in all shark removal efforts. Ongoing consultation with Hawaiian practitioners would advise fishing personnel on traditional fishing techniques, along with the feasibility for an on-site practitioner to conduct activities, including the collection of shark parts for cultural use (remains to be determined).

It is anticipated that bycatch would be non-existent, as removal methods would be shore-based and consist of targeted efforts by handline, spear gun or harpoon, and targeted use of a surprise net.

2.4 Alternatives Considered but Rejected from Further Analysis

The following alternatives either (1) do not meet the purpose and need of the proposed action, or (2) involve significant unknowns or uncertainties in terms of their impacts. Because of this, they were considered but rejected from further analysis under this EA.

2.4.1 Reducing or Eliminating the Program

This document does not consider reduction in or elimination of the existing program because the National Marine Fisheries Service is mandated by both the Endangered Species Act and the Marine Mammal Protection Act, consistent with the Hawaiian monk seal recovery plan (National Marine Fisheries Service 2007), to implement and continue actions identified in the recovery plan. Since reducing or eliminating the program would not meet the purpose and need for this action, it was not considered further.

2.4.2 Large-Scale Shark Culling to Minimize Predation and Competition

Although these actions might be effective in the NWHI for reducing predation by sharks, they would run contrary to the purpose and goals of the Monument. In addition, experience with shark predation on endangered and threatened species, and other species such as desert tortoise and Caspian terns elsewhere suggests that a highly focused, selective removal of targeted individual predators tends to be less controversial but still be effective (National Marine Fisheries Service 2007, unpublished data). Because the purpose and need of the program could be met via alternatives that would not result in large scale culling of Monument resources, this alternative was not considered further.

2.4.3 Use of Barriers with Electromagnetic Devices

Physical barriers such as netting or wire mesh to exclude sharks from nearshore areas have been discussed at several workshops as a possible means to reduce or eliminate presence of Galapagos sharks from pupping areas. Barriers would require openings to allow passage of non-elasmobranch species. Such openings could be fitted with electromagnetic devices to selectively discourage or prevent elasmobranchs from transiting through them. At this time, this action is rejected from further analysis because a number of feasibility pilot studies must be conducted before such structures could be erected at FFS, and more extensive evaluation of possible impacts is necessary.

2.4.4 Use of Lights for Deterring Predatory Sharks

The potential for adverse effects on green sea turtle and sea birds may be unacceptable because lights may disorient these species. The effectiveness of lights as a shark deterrent is still questionable, and it has been found to attract sharks in some cases. Since this method would have undesirable effects on protected species and may not meet the purpose and need for this action, use of lights as a deterrent was not further considered as an alternative to the proposed action.

2.4.5 Translocating Mother/Pup Pairs

Translocating mother/pup pairs to areas of historically low shark activity has been suggested. However, the potential for separation of pups from mothers, abandonment of pups by mothers, and/or driving pups into the water must be examined before this type of action can be considered

further. In addition, an increase of mother-pup density on Trig islet was associated with increased shark incidents in the past, suggesting that the impact of increasing density at receiving sites needs also to be examined before such translocations could occur within FFS (Harting *in prep*). The danger to mother and pup of attempting translocations on a larger scale likely prohibits this option as well. Therefore, the translocation of mothers and pre-weaned pups was not further considered in this EA.

2.4.6 Attaching Deterrent Devices of Acoustic Tags to Preweaned Pups

Although this might be considered in the future, marking pups with magnetic shark point-source deterrents and/or with acoustic tags for collecting data was not considered at this time as the effect on mother/pup bonds and pup health and development are unknown. Due to this uncertainty, this alternative was not further considered in this EA.

2.4.7 Rebuilding Whaleskate Islet and/or Creating a Manmade Reef at Trig Islet

These actions were considered by the HMSRP to reduce shark access to pre-weaned pups and provide more pupping beaches to potentially decrease pup density on Trig Islet. The feasibility of such actions is unknown. It is also unknown if breeding females would use any created beaches for pupping or if they do use them, if shark access to pre-weaned pups would be reduced. Due to this uncertainty, rebuilding pupping beaches of mothers was not further considered in this EA.

3 Affected Environment

The Monument is situated in the northwestern portion of the Hawaiian Archipelago, located northwest of the Island of Kaua‘i and the other main Hawaiian Islands. A vast, remote, and largely uninhabited region, the Monument encompasses an area of approximately 139,797 square miles (362,075 square kilometers) of the Pacific Ocean. Spanning a distance of approximately 1,200 miles (362,075 square kilometers), the 115-mile-wide (100 nautical mile/185.2 kilometer) Monument is dotted with small islands, islets, reefs, shoals, submerged banks, and atolls that extend from subtropical latitudes to near the northern limit of coral reef development (Monument Management Plan, 2008). The affected environment, including a description of all the main islets and atolls is described in detail in the Monument Management Plan and is incorporated by reference into this EA (Monument Management Plan 2008). Because the proposed action would occur in the French Frigate Shoals area, a detailed description specific to French Frigate Shoals is included below. The following categories are not affected by the proposed action and are therefore not further included in the analysis: Terrestrial invertebrates, soils, ocean circulation, and educational/recreational opportunities.

3.1 Biological Environment

Trig Island, Round Island and the Gins are similar in their respective nearshore marine communities to other islets in FFS in that they reflect the characteristics of tropical atolls with coral reefs, sandy expanses, and shallow lagoons. Seabirds, endangered Hawaiian monk seals, and threatened Hawaiian green turtles depend on this environment for food resources and habitat. The diverse fauna has been the subject of research during the 1970s and early 1980s (Grigg and Pfund 1980, Grigg and Tanoue 1984).

Recently, the Northwestern Hawaiian Islands Reef Assessment and Monitoring Program (NOW-RAMP) expedition of August-October 2000 greatly expanded knowledge on all of the NWHI marine communities. The assessment reported that the marine ecosystem in the NWHI, with the exception of the waters around Midway, is one of the most pristine in the world.

The diverse marine community in the NWHI includes 45 species of coral (Maragos and Gulko 2002) and at least 133 species of fish. Nineteen species of cetaceans have been observed in Hawaiian waters, generally in the deeper waters around FFS.

3.1.1 Hawaiian Monk Seals

The Hawaiian monk seal is the most endangered pinniped in U.S. waters and it second only to the northern right whale as the nation’s most endangered marine mammal (Marine Mammal Commission 1999). It was designated depleted in 1976 under the Marine Mammal Protection Act, and was listed as endangered under the ESA following a 50% decline in beach counts from the late 1950s to the mid-1970s. Beach counts conducted in the 1950s were of aerial surveys of the leeward islands only, and during the beach counts researchers estimated that approximately one third of the population remained at sea (Kenyon and Rice 1959; Rice 1960). The historical abundance of the Hawaiian monk seal is unknown, although the first estimate of monk seal numbers was made in 1958, when a total of 1,206 seals were counted.

The Hawaiian monk seal breeds only in the Hawaiian Archipelago and Johnston Atoll, with most monk seals inhabiting the remote, largely uninhabited atolls and surrounding waters of the NWHI.

More than 90% of all pups are born at six major breeding colonies located at FFS, Laysan Island, Pearl and Hermes Reef, Lisianski Island, Kure Atoll and Midway Islands. A few births also occur annually at Necker, Nihoa and Ni‘ihau Islands and in the main Hawaiian Islands. Although monk seals occasionally move between islands, females generally return to their natal colony to pup. Since 1990, there has been an apparent increase in the number of monk seal sightings and births in the Main Hawaiian Islands (Forney et al. 2000).

The largest monk seal sub-population is currently found at FFS, but this was not always the case. Human disturbance caused by the U.S. Navy from 1942 through 1948, and by the USCG from 1944 through 1952 on East Island, depressed that sub-population. The US Coast Guard remained on Tern Island (but not East Island) until 1979. Following the departure of the Coast Guard from FFS, a dramatic increase occurred in seals hauling out on Tern Island. In 1986, the mean count at FFS (excluding pups) was 284 (NMFS, unpublished data), approximately six to eight times higher than the number had been in the late 1950s.

The factors responsible for poor juvenile survival at FFS are being investigated. Refer to section 1.2.1 for more data regarding the decline and specific threats to the survival of the Hawaiian monk seal population in the NWHI. In addition to shark predation, evidence suggests that decreased prey availability is the major factor. As early as 1991, researchers detected an exceptionally high proportion of juvenile and subadult seals in emaciated condition (Gilmartin 1993a). Pups and immature seals born at FFS in the early 1990s tended to be smaller than seals of the same age at Laysan Island, and smaller size at weaning was correlated with lower survival from weaning to age two. After 1995, the decline in weaning sizes at FFS moderated, and early survival has generally improved slightly since 1999. Nonetheless, the survival rates of pups and juveniles continue to be well below their historic rates.

Several factors, alone or in combination, may have caused the food limitation that has affected monk seals at FFS. Ecosystem-wide productivity decreased in the late 1980s and early 1990s, probably due to a decadal scale oscillation in oceanographic conditions. This appears to have resulted in declines in the abundance of coral reef fishes at FFS. Monk seal population growth during the 1960s, 1970s, and 1980s may have brought the sub-population to carrying capacity. Hence, while the impact of oceanographic events may have affected monk seals throughout the NWHI, the combination of a population at carrying capacity and decline in fish abundance may have magnified the impact of ocean productivity oscillations at FFS. In addition, during the last three decades, lobster fishing occurred on banks near FFS. While monk seals are known to eat lobsters, the importance of lobster in the monk seal diet has not been quantified and is the subject of ongoing studies.

Specific mortality agents, perhaps indirectly related to food limitation and resultant poor physical condition, have reduced survival of juvenile seals at FFS. Data from 1984 to 1994 suggest that the number of severe injuries attributable to shark predation increased substantially after 1987, especially at Trig Island within the atoll. Most FFS pups were born at Trig Island after the main pupping islet in the atoll, Whaleskate Island, gradually eroded and eventually disappeared between 1994 and 1999. Adult male aggression also accounted for some of the juvenile mortality during the 1990s. Three males killing pups at or near the time of weaning were removed by euthanasia (one in 1991) or by translocation to Johnston Atoll (two males in 1998). Entanglement in marine debris also contributes to an unknown amount of mortality. In addition to poor survival of juveniles, the onset of reproduction is later and the mean fecundity for mature females is lower at FFS compared to Laysan Island. The factors causing this low reproductive performance are unknown, but may be

related to the nutritional factors described above. Low fecundity coupled with the expected paucity of reproductively active females in coming years indicates that a prolonged decline in abundance at FFS is likely. The respective importance of the various causes of the decline at FFS is not known with certainty. Regardless of the underlying causes, the high mortality of juveniles and the consequent loss of reproductive potential would significantly impede recovery of this subpopulation.

3.1.2 Green Sea Turtles

The NWHI are the primary nesting grounds for the Hawaiian population of the green turtle, while the main Hawaiian Islands are the primary foraging grounds. Although scattered low-lever nesting occurs throughout the Hawaiian archipelago, over 90 percent of the nesting is at a few sandy islets within FFS including East and Tern Island (NMFS and U.S. Fish and Wildlife Service 1998). Nearshore waters contain adults that migrate to breed at these key sites. Mating occurs in the water, yet both males and females arrive on land to bask. Approximately 200 to 700 adult green turtle females nest on FFS annually. Since protection by state law in 1974 and by the ESA in 1978, the nesting population of the Hawaiian population of green turtle has increased dramatically (Balazs and Chaloupka 2004).

3.1.3 Galapagos Sharks

The distribution of Galapagos sharks is circumtropical and they occur most commonly around oceanic islands such as those found at FFS. Galapagos sharks are not considered economically important because of their typical remote habitat, but some localized harvesting near inhabited locations may occur (Compagno 1984). Galapagos sharks are usually abundant around oceanic islands. This common but habitat-limited tropical shark occurs close inshore to well offshore near or over the insular of continental shelves; it may occur in shallow water approximately 2 m in depth or range into the open ocean adjacent to islands from the surface to depths of 180 m; juveniles seem to be restricted to shallow water less than 25 m in depth; adults occur in water of varying depths; and they seem to favor clear and rugged coral and rocky bottoms (Compagno 1984). Litter size ranges from 4-16 pups, mating and parturition apparently occur early in the year, and gestation is estimated to be about 12 months (Weatherbee et al. 1996). Galapagos are known to prey on a variety of different food types which include teleosts, cephalopods, crustaceans and pinnipeds, including monk seals (Compagno 1984, Weatherbee et at. 1996, Craig et al. 1999).

Population size of Galapagos sharks at FFS is difficult to determine; however a likely range is determinable. DeCrosta (1984) estimated the population at that time to be 703 individuals based on the area within the180 m depth contour of the atoll. The primary Galapagos shark population estimate at FFS of 703 individuals based on the area within the 180 m depth contour of the atoll. The population size estimate of Galapagos sharks was conducted using bottomset fishing methods (approximately 32 hooks) by DeCrosta (1984). However, the Galapagos shark population has likely grown with an ecological release associated with the restriction of longline fishing in the Monument since then (Holzworth et al. 2006). Based on data from towed-diver surveys conducted in 2000 through 2003 (Holzworth et al. 2006), the population can be estimated at 4,380 individuals (based on an area of 1540 km^2, 80% of shark biomass as Galapagos shark species, and average Galapagos shark weight of 0.15 metric tons), though this may an overestimate because Galapagos sharks are attracted to towed divers (Parrish et al. 2008). Based on an ECOPATH model approach, the population is estimated at 1,604 individuals (J. Parrish, NMFS PIFSC EOD *per comm, March*

2009). Thus, the available data and population estimates suggests a stable or increasing population, though survey methods were admittedly not consistent across studies.

Galapagos sharks in the Hawaiian Archipelago are typically found in deeper waters (NMFS 2008) and experts have suggested that some Galapagos sharks frequenting the shallow waters of pupping beaches at FFS may be exhibiting distinctive and atypical behavior. Movement patterns of FFS Galapagos sharks have not been extensively studied yet and their dispersal across the NWHI Archipelago is not known. Thus, the FFS Galapagos shark population may or may not behave, feed and travel in patterns typical for the species. The Hawaii Institute of Marine Biology (HIMB) preliminary studies using acoustic tagging indicate that Galapagos sharks are likely more abundant outside the barrier reef in deeper waters and are site-attached. Four Galapagos sharks caught and tagged at Trig Islets subsequently visited pupping sites (at least one of four possible pupping sites) on numerous occasions, spending a significant amount of time in shallow waters (Wetherbee & Lowe 2003). However, all four sharks also spent a fraction of their time outside the atoll and individual movement histories were highly variability. Only one of 13 Galapagos sharks tagged outside the FFS atoll was found to subsequently enter the atoll. A tagging program conducted in Oahu produced similar findings, with only two of 25 sharks detected in shallow waters for a limited duration of time.

3.1.4 Coral Reefs

FFS consists of 67 acres (0.27 square kilometers) of total emergent land surrounded by approximately 230,000 acres (931 square kilometers) of coral reef habitat, with a combination of sand, rubble, uncolonized hard bottom, and crustose coralline algae in the windward and exposed lagoon areas, and patch and linear coral reefs in more sheltered areas (NOAA 2003b). Within the NWHI, FFS is the center of diversity for corals (more than 41 species, including the genus *Acropora*, which is all but absent elsewhere in Hawaii) and reef fishes (178 species).

3.1.5 Invasive Species

Marine alien species can be defined as nonnative aquatic organisms that have been intentionally or unintentionally introduced into new ecosystems, resulting in negative ecological, economic, or human health effects. Twelve marine alien invertebrates, fish, and algal species have been recorded in the NWHI. Alien species may be introduced unintentionally by vessels, marine debris, or aquaculture, or intentionally, as in the case of some species of groupers and snappers and algal species. Eleven species of shallow-water snappers (Family *Lutjanidae*) and groupers (Family *Serranidae*) were purposely introduced to one or more of the main islands of the Hawaiian Archipelago in the late 1950s and early 1960s. Two snappers, the bluestripe snapper (taape, Lutjanus kasmira) and the blacktail snapper (L. fulvus), and one grouper, the peacock grouper (Cephalopholis argus), are well established and have histories of colonization along the island chain that are reasonable well documented (Randall 1987). Bluestripe snappers have been by far the most successful fish introduction to the Hawaiian coral reef ecosystem. The population has expanded its range by 1,491 miles (2,400 kilometers), until it has now been reported as far north as Midway in the NWHI. These records suggest an annual dispersal rate of about 18 to 70 nautical miles (33 to 130 kilometers). The other two species have been recorded only as far north as FFS and are present in much lower numbers than bluestripe snappers.

Because the island ecosystems have evolved with little contact with the rest of the world, they are particularly vulnerable to the introduction of invasive species. Invasive plants and introduced

mammals are a primary threat to nesting seabirds, indirectly by altering the ecosystem and directly by altering eggs and chicks. A variety of alien plants, animals, and most likely fungi and bacteria have made it to the NWHI. Some of them have proven to be particularly invasive and dangerous to native species. These include such plants as Sandbur, golden crownbeard (*Verbesina encelioides*), and ironwood (*Casuarina equisetifolia*), and such animals as the gray bird locust (*Schistocerca nitens*), house mouse (*Mus musculus*), and several ant species. Much of the routing management of this area revolves around eradicating or controlling existing invasives and preventing the introduction of new ones.

3.1.6 Birds

The NWHI provide vital habitat for more than 14 million nesting seabirds and breeding species, including 99% of the world's Laysan albatross (*Phoebastria immutabilis*) and 98% of the world's black-footed albatross (*P. nigripes*) populations. With the erosion and disappearance of Whale-Skate Island, Tern Island, and East Island are the most important for bird breeding within FFS. No endemic land birds live within FFS. Of the 18 seabird species nesting at FFS, the black footed albatross, Laysan albatross, red-footed booby (S*ula sula*), masked booby (*Sula dactylatra*), brown noddy (*Anous stolida*), black noddy (*A. minutus*), and frigate bird (*Fregata minor*) regularly nest on Trig, Round, Little Gin, and/or Gin Islands. No endangered birds populate FFS. The short-tailed albatross (Phoebastria albatrus) has been sighted on six occasions at FFS since 1938 (FWS 2000), with the most recent sighting at Tern Island in 2002 (FWS unpub. data).

3.2 Physical Environment

3.2.1 Topography

FFS is an atoll, open to the west and partially enclosed by a crescent-shaped reef to the east. It lies about midpoint in the Hawaiian Archipelago. The largest land area in the shoals is Tern Island (about 34 acres), and a number of smaller islets, including Whaleskate (which eroded away in the late 1990s), the Gins, Round, East, Shark, and Trig, are scattered along the westerly reef of the crescent (totaling 44 acres).

The lagoon at FFS is unusual in that it contains two exposed volcanic pinnacles representing the last vestiges of the high island from which the atoll was derived, as well as nine low, sandy islets. The sand islets are small, shift position, and disappear and reappear. These islets provide highly important habitat for the world's largest breeding colony of the Hawaiian monk seal and nesting sites for 90 percent of the threatened green turtle population breeding in the Hawaiian Archipelago.

3.2.2 Air Quality & Climate

FFS has a tropical climate dominated by northeasterly tradewinds. Most of the precipitation occurs during the winter months, and storms typically occur from October through March (Blumenstock and Price, 1967). The mean annual temperature is 76.4 F. The warmest months are August and September, and the coolest months are February and March. Surface tradewinds prevail from an easterly direction and the annual mean wind speed is 12.4 knots. Wind speeds are higher from November through March and lower from April through October. Trig Island, Round Island and the Gins are exposed to storm waves that break on the atoll's northern fringing reef margin and re-form across the reef flat. The island receives direct impact from these re-formed waves along the northern, eastern, and western shores. The southern, or leeward, shoreline of Trig Island is more

sheltered by the interior expanse of the shoals. FFS has no sources of air pollution. Occasionally small boats used near the shore release exhaust, but this activity does not detract from the island's extremely high air quality.

3.2.3 Noise

French Frigate Shoals has no sources of anthropogenic (human-caused) noise pollution, with the exception of seasonal, once-a-week aircraft operations on Tern Island, and small boat noise.

3.3 Social Environment

3.3.1 Land Use

The FWS facility at Tern Island is used to house researchers and provide storage for research equipment. There are no facilities on Trig Island, Round Island or the Gins. Short overnight camping activities have occurred on the islets (Trig Island, Round Island and the Gins) for multiple nights at a time in the past. Small groups of researchers typically conduct short stays of 2-14 nights at a time. Researchers sleep in low-profile tents and remove all waste for proper disposal at Tern Island upon conclusion of their stays. Day trips to the aforementioned islets within FFS have also occurred for researchers conducting monitoring activities on sharks, monk seals, birds and turtles. Such short camps have been successfully completed at Trig Island on numerous occasions in the past without causing harm to the environment or the wildlife. Seal monitoring would occur approximately 5 days per week at Trig Island, and a minimum of 3 days per week at Round Island and Gin/Little Gin Island.

In the past, monitoring equipment has been installed on Trig Island, including a 12-ft high photographic observation tower utilized during daylight hours, and the placement of a temporary remote viewing camera system. When stored and not in use, the observation tower has a "footprint" less than 25 sq. ft.

3.3.2 Archaeological/Historic Resources

Archaeological and cultural resources are present in the NWHI. Archeological remains exist at Nihoa and Necker (Mokumanamana) Islands at the eastern end of the chain. Historic records indicate at least seven ships lost at FFS. To date, three shipwreck sites have been discovered and surveyed within the FFS area, none are close to Trig Island, Round Island and Gin / Little Gin Island.

3.3.3 Economic Considerations

Monument and station operations contribute to the local and state economy through expenditures on food, supplies, equipment, contracting of vessels and aircraft charters, wages for staff, and occasional contracts for infrastructure maintenance at FFS. On-site personnel at FFS have played in important role in search and rescue operations and have responded to vessel groundings. Environmental disasters and loss of human life have been prevented by the ability of on-site personnel to respond to emergencies.

3.3.4 Aesthetics

Trig Island, Round Island and the Gins are barren islands that have no vegetation and are composed entirely of coral sand and rubble. However, the wildlife on these islands have conspicuous aesthetic value. Green sea turtles and monk seals haul out on the sand beaches and several species of seabirds occur on the interior of these small islands.

4 Evaluation of Environmental Consequences

The following impacts apply to the alternatives that involve conducting active conservation and management activities on monk seals in the NWHI. Alternative one (section 2.2) is the current program to monitor seal populations. The proposed action (alternative two; section 2.3) comprises the monitoring activities described in alternative one, coupled with conducting lethal shark removal activities using various shore-based fishing techniques. The impacts to Hawaiian monk seals, cetaceans, and ESA listed species associated with the presence of biologists monitoring the seal population and shark predation levels have been evaluated in detail in the Environmental Assessment on the Effects of NOAA Fisheries Permitted Scientific Research and Enhancement Activities on Endangered Hawaiian Monk Seals (Permit No. 10137) and are incorporated here by reference. The Finding of No Significant Impact (FONSI) was signed on June 30, 2009. The aforementioned EA was adopted by the Office of National Marine Sanctuaries for the issuance of Monument research and conservation and management permits. The FONSI was signed on August 3, 2009.

Therefore, the analyses of impacts under the current program of monitoring and translocating Hawaiian monk seals to areas of lower predation have already been found to have no significant impacts per NEPA and are not likely to jeopardize the continued existence of the species per ESA. Therefore, the impact analyses will focus on the impacts of Alternative 2.2 (proposed action).

4.1 Biological Environment

4.1.1 Hawaiian Monk Seals

Alternative one (monitoring and observation activities) would allow the continuation of data collection and observations of Galapagos shark, Hawaiian monk seal, and shark-seal interactions at FFS. This would be beneficial to the HMSRP as monitoring activities would continue within FFS and there would be no gap in the data collection activities that have occurred within FFS since the early eighties. Alternative one would also allow additional opportunities for field personnel to witness and record shark attacks on seal pups, note their location and record estimated shark size and distance from shore.

In addition to monitoring and observations, alternative two (proposed action) would have beneficial impacts by providing the greatest potential benefit to the recovery of the endangered Hawaiian monk seal by mitigating the loss of preweaned pups at Trig, Round Island, and the Gins in FFS. The proposed action would also yield scientific information to evaluate the use of various fishing methods to reduce shark predation and enhance monk seal recovery without significantly affecting the marine ecosystem.

On July 24, 2007, the NMFS PIRO consulted on proposed shark fishing procedures at French Frigate Shoals—procedures which included monitoring seals and deploying anchored equipment. In the analysis, NMFS PIRO determined that 1) disturbance from humans and equipment to protected species is temporary and insignificant and does not exceed those actions previously consulted on; 2) the likelihood of an entanglement or hooking with a protected species is discountable; 3) the likelihood of a vessel colliding with a monk seal is discountable; and 4) a potential exists for beneficial effects from the project to monk seals. The PIRO concurred that the

project was Not Likely to Adversely Affect ESA-listed Hawaiian monk seals and would have no effect on designated critical habitat.

On May 7, 2010 the PIFSC re-initiated consultation under the ESA to include use of the surprise net to lethally remove sharks at FFS. The PIRO concurred that use of the surprise net, along with the harpoon, spear gun and handline fishing techniques to mitigate the high predation rate by Galapagos sharks on Hawaiian monk seals is Not Likely to Adversely Affect ESA-listed Hawaiian monk seals or designated critical habitat. It is noted that both the 2007 and 2010 consultations were conducted for their impacts to Hawaiian monk seals *and* green sea turtles – information on the consultation on green sea turtles is broken out in section 4.1.2 below.

The no action alternative would result in the continued loss of pups and directly contribute to the already declining numbers of endangered monk seals. The indirect effect of not conducting limited removal of aggressive sharks would likely alter biodiversity from a predictable decline in the number of monk seals at FFS.

4.1.2 Green Sea Turtles

Alternative one would have no short or long-term significant adverse impacts on sea turtles, their breeding habitat or the turtle "haul-out" beaches within FFS. Alternative one would involve small groups of personnel walking on beaches and sitting in the observation tower on Trig Island to collect data and observe shark-seal interactions. There may be short term negligible impacts on basking green turtles as a result of monitoring activities. The Environmental Assessment on the Issuance of a Permit for Field Research and Enhancement Activities on the Endangered Hawaiian Monk Seal (FONSI signed June 30, 2009), includes monitoring activities on Hawaiian monk seals and states, "Green sea turtles which are asleep and basking on the beach are generally unaware of unobtrusive human presence such as observing seals. However, some activities may awaken basking turtles, causing them to move into the water. Impacts to green sea turtles would be minimized by personnel being aware and avoiding resting turtles whenever possible." In order to avoid nesting and hatchling turtles, no personnel would walk the beaches from dusk to dawn where nests are known to occur; therefore monitoring activities on beaches where sea turtles occur would be negligible.

Alternative two would involve shore-based fishing techniques including use of a harpoon, spear-gun, handline and surprise net. On July 24, 2007, the NMFS PIRO consulted on proposed shark fishing procedures at French Frigate Shoals—procedures which included working in green sea turtle habitat, monitoring seals and deploying anchored equipment. In the analysis, NMFS PIRO determined that 1) disturbance from humans and equipment to protected species is temporary and insignificant and does not exceed those actions previously consulted on; 2) the likelihood of an entanglement or hooking with a protected species is discountable; 3) the likelihood of a vessel colliding with a green turtle is discountable; and 4) a potential exists for beneficial effects from the project to monk seals. The PIRO concurred that the project was Not Likely to Adversely Affect ESA-listed green turtles, and would have no effect on designated critical habitat.

On May 7, 2010 the PIFSC re-initiated consultation under the ESA to include use of the surprise net to lethally remove sharks at FFS. The PIRO concurred that use of the surprise net, along with the harpoon, spear gun and handline fishing techniques to mitigate the high predation rate by Galapagos sharks on Hawaiian monk seals is Not Likely to Adversely Affect ESA-listed green turtles or their designated critical habitat.

Impacts of the no action alternative would result in no additional human presence around turtles above and beyond the separately permitted turtle monitoring program. The no action alternative would also result in the continued loss of pups and directly contribute to the already declining numbers of endangered monk seals as no monitoring, observations or Galapagos shark removal activities would take place within FFS.

4.1.3 Galapagos Sharks

Alternative one would have no impact on Galapagos sharks as it only involves primarily land-based intensive monitoring of Galapagos sharks, Hawaiian monk seals, and shark-seal interactions.

The proposed action is expected to have less than significant effects on Galapagos sharks as removal of a small fraction of the greater FFS Galapagos shark population would not have a significant impact on its function or survivalabilty. Research removals and recent commerical take (1999), all involving the removal of tens of Galapagos sharks at a time, did not appear to have adversely impacted the population. Removal of up to 19 Galapagos sharks during the 2011 field season compared to the aforementioned population estimates (discussed in Section 3) of 703 (DeCrosta 1984); 4,380 (Holzworth et al. 2006); or 1,604 (J. Parrish, NMFS PIFSC EOD per comm, March 2009) is a small fraction (0.01 – 5.7%) of the FFS Galapagos shark population, whichever estimate is used; therefore removal of 19 Galapagos sharks is not expected to have significant effects on the estimated population at FFS.

The no action alternative would result in the continued loss of pups and directly contribute to the already declining numbers of endangered monk seals. The indirect effect of not conducting limited removal of aggressive sharks would likely alter biodiversity from a predictable decline in the number of monk seals at FFS.

4.1.4 Birds

Alternative one is expected to have negligible short and long-term effects on birds within FFS. The potential exists that seabirds could fly into the temporary observation tower and / or remote camera with resultant injury or mortality however, erection of the temporary observation tower occurred annually during 2000-2004 (over 3000 hours) with no bird strikes. Any adverse impacts therefore are likely to continue to be negligible.

As in past years, the remote viewing camera would be constructed in consultation with FWS to ensure it would not entangle or kill any birds. The pole would likely be padded with foam-type material designed to minimize bird strikes. The pole would also be designed with no guy-wires (which would pose an entanglement hazard), but, rather, would utilize brackets and a weighted base to allow the structure to stand erect in heavy winds. As in past years, in order to monitor effects on birds, recorded footage would be examined periodically to determine if wildlife is interacting with the equipment.

NMFS personnel monitor all installations daily for any adverse impact on wildlife. In the unlikely event that a seabird does hit the tower, the tower would be taken down and reported to Monument managers.

No effects are anticipated as a result of the proposed action, all fishing activities would be shore-based and opportunistic and therefore constantly monitored by personnel. Use of the spear gun, harpoon, handline and surprise net are not expected to cause any short or long-term impacts to

birds. In the past, no bird interactions have resulted from the use of the aforementioned shore-based fishing methods.

The no action alternative would not result in any impacts to birds above and beyond the separately permitted seabird monitoring program which consists of annual monitoring activities (e.g. counting, banding, etc.) on birds within FFS.

4.1.5 Coral Reefs

Alternative one (monitoring and observation activities) would have no short or long-term impacts to coral reefs. All monitoring and observational activities are conducted from land and do not require interaction with coral reefs.

The proposed action may have less than significant impacts as small boat operations (anchoring), placement of the surprise net, and fishing line (handline) have the potential to impact coral reefs if they are not carried out properly. The Monument has additional mitigation measures including "Best Management Practices for Small Boat Operations at Tern Island (PMNM BMP #013)" that require small boat operators to operate at low speeds in shallow waters in order to avoid striking coral reefs. Per Monument permit condition(s) small boats would only be anchored on sandy substrate and anchors would never be dropped on coral reefs. The surprise net and any handlines would be operated well away from coral reef areas and monitored at all times. With the aforementioned mitigation measures in place, negligible short or long-term impacts to coral reefs are expected.

The no action alternative would have no impact to coral reefs as no activities would be conducted within FFS.

4.1.6 Alien & Invasive Species

Alternative one would have negligible short or long-term impacts in the additional introduction / spread of alien and invasive species. Tern Island in FFS is not a quarantine island, and therefore quarantine procedures including freezing clothing and equipment are not required. Trig Island, the Gins and Round Islands are uninhabited, comprised mainly of sand and coral rubble and have very low potential to sustain alien and invasive species because they are extremely resource-limited (no soil or water). Regardless, strict procedures are used to minimize the potential introduction of alien and invasive species by research activities conducted at remote, uninhabited field sites. All tents would be placed and all work would be conducted on the perimeter of the island. Per standard procedure for permittees conducting activities on uninhabited islands, stringent Best Management Practices (BMPs) would be used to ensure that no species are introduced to the islands. These BMPs are included in the PMNM permit as an attachment entitled, "Special Conditions and Rules for Moving Between Islands / Atolls and Packing for Field Camps" (PMNM BMP #007). These BMPs include:

- 48-hour freezing of all non-sensitive food and equipment;
- Removal of all packaging materials which may harbor foreign plants or animals;
- Packing all food, personal effects, and small equipment in plastic bags which are in turn placed in sterilized 5-gallon plastic buckets;

- Packing all large equipment in either plastic cases or pallet tubs, all of which are fumigated prior to landing;
- All soft gear (daypacks, straps, nets, bags, bedding, tents, clothing, footwear) used at each field site is either new or has not been used at any other location;
- No use of any fresh food item which either may become established (tomatoes, sunflower, mustard, or alfalfa seeds) or foods which may harbor molds or fungi would be used.

The proposed action would have negligible short or long-term impacts in the additional introduction / spread of alien and invasive species. The addition of shore based fishing activities to lethally remove Galapagos sharks would not raise the risk the spread or introduction of alien and invasive species. Similar to alternative one, the aforementioned BMPs would be implemented as per standard procedure for all permittees conducting activities on uninhabited islands within PMNM.

The no action alternative would have no impact in the additional introduction / spread of alien and invasive species, as no permit would be issued to conduct shark removal, or seal-shark monitoring activities within FFS. The no action alternative would also result in the continued loss of pups and directly contribute to the already declining numbers of endangered monk seals as no monitoring, observations or Galapagos shark removal activities would take place within FFS.

4.2 Physical Environment

4.2.1 Topographical and Physical Features

Negligible impacts on the topographical or physical features of Trig Island are expected as a result of the temporary erection of the 12-foot observation tower and the remote monitoring camera system. Both the tower and remote camera system would temporarily be installed on Trig Island which consists of mostly sand and rubble and would not permanently alter the physical features of Trig Island. Beneficial impacts are expected as a result of collecting data and observing shark-seal interactions through utilization of the tower during daylight hours and reviewing data collected from the remote viewing camera system.

The proposed action would have negligible impacts on the topography or physical features of Trig Island within FFS. Along with the observation tower and remote viewing camera, personnel would be conducting limited fishing activities from shore. The proposed action would not involve any construction, dredging, or alteration of Trig Island or the other islets within FFS (namely Gin or Round Islands), and therefore would have negligible impact.

The no action alternative would have no effect on the topography of the aforementioned islets within FFS, as no tower or camera would be constructed. However the no action alternative would result in the continued loss of pups and directly contribute to the already declining numbers of endangered monk seals as data would not be collected on seal-shark interactions through utilization of the observation tower and / or the remote viewing camera.

4.2.2 Air Quality

Exhaust from small boats may have short-term less-than significant impacts through the implementation of alternative one. A maximum of three small boats would be utilized under alternative one to conduct activities at the aforementioned islands. Small boats would be utilized for both day and overnight trips. In the past there has been no observable impact to the environment

from small boat activities within FFS. In addition, Monument permits contain conditions requiring the use of small boat engines that meet Environmental Protection Agency (EPA) emissions requirements.

The proposed action would not increase impacts on air quality through the use of small boats. Small boats would be used at the same frequency regardless of whether personnel are authorized to implemented activities under alternative one or the proposed action.

The no action alternative would not have impacts on air quality as no personnel would visit Trig, the Gins, and Round Islands to conduct monitoring and fishing activities. Small boats would continue to be used within FFS as part of the respective Hawaiian monk seal and green sea turtle monitoring programs. The no action alternative would also result in the continued loss of pups and directly contribute to the already declining numbers of endangered monk seals as no monitoring, observations or Galapagos shark removal activities would take place within FFS.

4.2.3 Noise

Alternative one would have negligible effects as it would not significantly increase noise pollution above and beyond daily seabird noise. Small groups of NMFS personnel would conduct observation, monitoring and camping activities. There would be no additional construction or other types of anthropogenic noise as a result of implementing alternative one.

The proposed action would also have negligible effects as it would not significantly increase noise pollution through the addition of opportunistic, shore-based fishing activities.

The no action alternative would not have impacts on noise as no personnel would visit islands within FFS to conduct monitoring and fishing activities. The no action alternative would also result in the continued loss of pups and directly contribute to the already declining numbers of endangered monk seals as no monitoring, observations or Galapagos shark removal activities would take place within FFS.

4.3 Human Environment

4.3.1 Land Use

Alternative one may have less than significant short-term impacts, as it would utilize a number of personnel and time spent at FFS to conduct observation and monitoring activities, therefore visits to Trig Island, Round Island and the Gins (daily and overnight camping) which would increase the level of human presence and, therefore the potential to disturb wildlife. It is possible that sea turtles and monk seals, which do not conspicuously respond to human presence and activity, may nonetheless relocate due to the combination of previous and proposed conservation and management actions at the site. Although it’s not possible to predict where wildlife from Trig Island, Round Island, or the Gins might move, they could relocate to sub-optimal or optimal habitat.

It is important to note that personnel are specially trained to avoid disturbing all wildlife and special precautions are taken to ensure all activities cause the lowest possible impact. All camping activities would be conducted utilizing minimal equipment (backpacks, low profile tents) and all waste would be removed for proper disposal on Tern Island. Both daily monitoring trips and short camps have been successfully completed at Trig Island, Round Island, and the Gins on numerous occasions in the past without causing harm to the environment or the wildlife.

The proposed action would not increase the number of personnel visiting islands within FFS above and beyond the number of personnel discussed in alternative one; therefore no additional significant short or long-term effects would occur.

The no action alternative would have no impacts to land use within FFS as it would not increase the level of human presence at Trig Island, Round Island or the Gins. The no action alternative would also result in the continued loss of pups and directly contribute to the already declining numbers of endangered monk seals as no monitoring, observations or Galapagos shark removal activities would take place within FFS.

4.3.2 Archaeological/Historic Resources

Alternative one would have no impacts to archaeological or historic resources as all observation and monitoring activities would be conducted well away from areas where shipwrecks have been documented. In addition, all activities would be conducted away from areas where additional shipwrecks or downed planes are typically found.

Similar to alternative one, the proposed action would have no effect on archaeological or historic resources as all fishing activities are shore-based and would be conducted away from known shipwreck sites and areas where shipwrecks are known to occur. In addition, should any cultural or maritime heritage resources be located during the proposed action, all work would cease and a Native Hawaiian cultural expert or maritime archaeologist would be contacted.

The no action alternative would also have no impact on archaeological and historic resources. The no action alternative would also result in the continued loss of pups and directly contribute to the already declining numbers of endangered monk seals as no monitoring, observations or Galapagos shark removal activities would take place within FFS.

4.3.3 Economic Considerations

Alternative one would have beneficial impacts to the economy as it would increase revenues to local businesses for air and vessel charters and expenditures on fuel, food supplies and equipment by NMFS personnel working within FFS.

In addition, the proposed action would also slightly increase beneficial impacts on the economy as it would also require the purchase of fishing gear, including the surprise net. Sufficient funding is available to conduct the proposed action within FFS. If Galapagos shark predation spreads to other islands and atolls throughout the NWHI, costs associated with monitoring and mitigating the problem would increase and additional funding would be necessary.

The no action alternative would have no impact to the economy as nothing additional would be purchased to conduct shark-seal monitoring and fishing activities. The no action alternative would also result in the continued loss of pups and directly contribute to the already declining numbers of endangered monk seals as no monitoring, observations or Galapagos shark removal activities would take place within FFS.

4.3.4 Aesthetics

Alternative one would have short-term less than significant impacts on aesthetics with the construction of the 12-foot observation tower and the remote viewing camera at Trig Island. A slightly higher, human-constructed observation tower and remote viewing camera within a marine

monument may seem unsightly to people. The tower and camera would be erected and used seasonally (May – October), the observation tower would be utilized during daylight hours. The benefits of having an observation tower and a remote viewing camera to record shark-seal interactions far outweighs the short-term less than significant impacts on aesthetics. The proposed action would not have additional impacts on aesthetics beyond the construction of the temporary observation tower and the remote viewing camera.

The no action alternative would have no impact on aesthetics within the PMNM as no tower or camera would be constructed.

5 Cumulative Effects

Cumulative impacts resulting from the proposed action would be insignificant, if at all measurable. One activity that was conducted in the same area in 2002, 2003 2007, and 2010 was the lethal removal of Galapagos sharks. An EA was prepared for this action (NMFS 2002b) with a finding of no significant impact. Less than five sharks were removed in 2002 and 2003, with none removed in 2007 and one removed in 2010 (NOAA, Monument Permit Report). This activity had beneficial, but no significant, effects in the reduction of mortality of pre-weaned monk seal pups due to predation by sharks.

The only potential for cumulative effects with continuation of the limited removal of sharks would involve potential effects on the Galapagos shark population at FFS. As previously discussed, the expected take of 19 Galapagos sharks would not adversely impact the greater FFS Galapagos shark population as assessed in ECOPATH/SIM models (NMFS 2008, NMFS 2009.)

Other projects that could potentially contribute to cumulative impacts on marine resources in conjunction with the proposed action are summarized in Table 1. The table includes short descriptions of these projects. Four of these projects have been categorically excluded from further analysis under NAO 216-6 because their potential adverse impact on marine biological resources have been analyzed and found to be not significant. A fifth project (project number 3: “Hawaiian Monk Seal Research and Monitoring Activities”) had an EA prepared for this action entitled, “Environmental Assessment on the Effects of NOAA Fisheries Permitted Scientific Research and Enhancement Activities on Endangered Hawaiian Monk Seals” (Permit No. 10137). The Finding of No Significant Impact (FONSI) was signed on June 30, 2009. A sixth project (project number 6: “Marine Turtle Research Program”) had a programmatic environmental assessment (PEA) prepared for this action entitled, “Programmatic Environmental Assessment of the Marine Turtle Research Program at the Pacific Islands Fisheries Science Center (NMFS 2006).” The FONSI was signed on July 7, 2006.

A review of Table 1 indicates that all of the projects are proposed to concurrently occur with the proposed action. Projects 4 and 5 cover the support vessels that would be utilized to carry out the proposed action. Project 6 occurs at all islands within FFS with the majority of the project occurring at Tern and East Island. Projects 1 and 2 would tag and study the movement of top predators including Galapagos sharks; project 4 and 5 would facilitate research and conservation and management activities in the Monument. With the exception of project 3 and 6, none of the proposed actions in Table 1 would occur around Trig Island, Round Island, or the Gins, and therefore would offer no potential for cumulative impacts when considered together with the proposed action.

Table 1: Relevant Projects within the PMNM

Number	Project Name	Time Frame	Purpose and Scope
1	Movements of Top Predators (Jacks, Grouper and Wahoo) throughout the Monument (C. Meyer)	June – September 2011	The proposed action is to issue a research permit to tag additional predator specimens and download data from 21 existing underwater receivers in Monument, and deploy 8 additional receivers. This project occurred from 2005 – present.
2	Movements of Sharks within FFS Atoll (C. Meyer)	June – September 2011	The proposed action is to issue a research permit to equip large sharks with electronic tags and monitor their movements using acoustic receivers and satellites. This project occurred from 2005-present.
3	Hawaiian Monk Seal Research and Monitoring Activities	June – December 2011	The proposed action is to issue a research permit to continue monitoring, translocation and research activities on the Hawaiian monk seal (*Monachus schauinslandi*) throughout the Monument. This project occurred from 1980 – present
4	Support for Permitted Activities Aboard NOAA Ship OSCAR ELTON SETTE	June – December 2011	The proposed action is to issue a conservation and management permit to NOAA Ship OSCAR ELTON SETTE to serve as a support platform for the above activities throughout the Monument. This project occurred from 2003 – present.
5	Support for Permitted Activities Aboard NOAA Ship HI‘IALAKAI	June – December 2011	The proposed action is to issue a conservation and management permit to NOAA Ship HI‘IALAKAI to serve as a support platform for the above activities throughout the Monument. This project occurred from 2004-present.
6	Marine Turtle Research Program	January – December 2011	The Marine Turtle Research Program is conducted in the NWHI under the PMNM Conservation and Management, Manager’s permit to conduct research and monitoring of green sea turtles throughout FFS. This project occurred from 1972 – present.

The “Hawaiian Monk Seal Research and Monitoring Activities” project (project number 3 on table 1) has conducted research and monitoring activities on the Hawaiian monk seal since 1980, and is planned to continue during the 2011 field season concurrent with the proposed action. The project includes takes of Hawaiian monk seals and incidental disturbance of green sea turtles. Some of the activities would pose a potential risk of injury to Hawaiian monk seals, including sedation and handling activities, and some of the activities would result in intentional death from euthanasia, and potentially unintentional mortalities from sedation and/or handling. The effects on the individual target animals of disturbance, capture, restraint, and sampling proposed in the application [for the current program and permit] are known, as the activities proposed are commonly used and not new. A review of the literature on the effects of these research techniques on pinnipeds can be found in the EA on the Effects of NMFS Permitted Scientific Research Activities on Threatened and Endangered Sea Lions (NMFS 2002). In general, the available information (including that reviewed in the 2002 EA) indicates that, when performed correctly by experienced personnel, these types of research activities are not likely to pose a significant risk of adverse impacts on the animals. As previously described, the proposed action would have little to no impact on Hawaiian monk seals; therefore, no cumulative impacts on that species would result when considered with the Hawaiian Monk Seal research project.

The Marine Turtle Research Program (MTRP) (project number 6 on table 1) has conducted research and monitoring activities in the NWHI since 1972 and is planned to continue during the 2011 field season concurrent with the proposed action. The project contains activities including handling and tagging activities and some of the activities may result in intentional death from euthanasia and potentially unintentional mortalities from handling. The effects on the individual target animals of disturbance, capture, restrains, and sampling are known, as the activities are commonly used and not new. A review of the literature on the effects of green sea turtle research and monitoring methodology can be found in the PEA entitled, “Programmatic Environmental Assessment of the Marine Turtle Research Program at the Pacific Islands Fisheries Science Center (NMFS 2006),” and are incorporated by reference into this EA. In general, the available information (including that reviewed in the 2006 PEA) indicates that, when performed correctly by experienced personnel, these types of research and monitoring activities are not likely to pose a significant risk of adverse impacts on the animals. As previously described, the proposed action would have negligible impacts on green sea turtles; therefore, no cumulative impacts on that species would result when considered with the MTRP.

Hawaiian monk seal, green sea turtle, and lethal removal of Galapagos sharks have occurred in conjunction with each other at FFS in the past (2006, 2007, and 2010) with no observable negative impacts. Future actions may occur within FFS, specifically at Trig Island, Round Island and the Gins, as it is anticipated that future Monument permits may be issued annually for (1) Hawaiian monk seal research and monitoring; (2) Marine turtle research program and (3) Galapagos shark observation, monitoring and removal activities. There are currently no Monument applications pending which include activities proposed near any of the aforementioned islets within FFS; therefore, no cumulative effects, significant or otherwise, are anticipated.

6 Environmental Permits, Approvals, and Compliance

6.1 Permits

6.1.1 Papahānaumokuākea Marine National Monument Permit

NMFS has submitted an application for a Monument conservation and management permit to authorize shark observation, monitoring, and removal activities within the PMNM. This EA is being prepared to support a decision on that permit application.

6.1.2 Other Permits

No other permits are necessary for these activities, as the activities contained herein will not result in an incidental disturbance or take of Hawaiian monk seals or cetaceans.

6.2 Other Laws and Authorities Considered

6.2.1 Executive Order 13089: Coral Reef Protection

Executive Order (EO) 13089 requires all Federal agencies whose actions may affect U.S. coral reef ecosystems to (1) identify these actions; (2) utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and (3) ensure that any actions they authorize, fund, or carry out will not degrade the conditions of such ecosystems.

This assessment has considered EO 13089 and has determined that, while it may have a limited effect on U.S. coral reef ecosystems in the NWHI, the proposed action (Alternative 2.2) would not degrade the conditions of any U.S. coral reef ecosystem, including the coral reef ecosystems in the NWHI. The permits issued by the PMNM have several controls, conditions, and best management practices (anchoring of small boats on sandy substrate only and intensive monitoring of handlines and the surprise net, etc.) to ensure protection for natural coral reefs and the associated flora and fauna in the vicinity of the project site. In addition, the ecological monitoring related to this study would provide important information about the possible changes in the coral reef ecosystem. Such information would be very useful in making future management decisions concerning the mitigation of shark predation to enhance recovery of the endangered Hawaiian monk seal.

6.2.2 Magnuson-Stevens Fishery Conservation and Management Act

The site for the proposed action (Alternative 2.2) comprises coral reef and sand habitat and a portion of the surrounding water column, and no adverse direct impacts to the species present are expected. In addition, no commercial fishery occurs in this habitat because of its status as a Marine National Monument. The sand and coral bottom habitat surrounding the project site is inhabited by invertebrate infauna, burrowing fish, bottom-dwelling fish, and a wide variety of coral reef fish, and no adverse direct impacts to the habitat or the species present are expected. No adverse impacts to Essential Fish Habitat are expected. Also, cumulative or synergistic impacts are not expected as a result of the proposed action because a vast amount of similar habitat and species remain unaffected in the adjacent islands within FFS.

Although there is no fishery for the Galapagos shark, the population is considered a pelagic unit management species under the Western Pacific Fisheries Management Council's pelagic fisheries

management plan authorized under the Magnuson-Stevens Fishery Conservation and Management Act.

An ongoing coral reef monitoring program is being undertaken in conjunction with this project to ascertain possible changes in the ecosystem over time. This assessment has determined that the proposed action would not have a significant effect on Essential Fish Habitat.

6.2.3 Endangered Species Act

NMFS has determined that the proposed action would not adversely affect the Hawaiian monk seal or affect the green sea turtle occurring at Trig Island. The short-tailed albatross, an endangered species under FWS' purview, has been observed at FFS only six times during the last 68 years and only at Tern Island. Therefore, NMFS has determined that the proposed action would not affect the short-tailed albatross since it is highly unlikely that this seabird would occur at Trig Island during the shark deterrent experiment. All precautions would be taken not to disturb Hawaiian monk seals or green sea turtles, and the necessary PMNM permits will be in place before actions are taken to deter and monitor Galapagos shark predation on preweaned monk seal pups. The HMSRP staff involved in the project would coordinate all activities with staff from the FWS to ensure that no threatened or endangered species would be affected by the proposed action.

As previously stated, in 2007 the NMFS Pacific Islands Regional Office (PIRO) consulted on proposed shark fishing procedures at French Frigate Shoals—procedures which included monitoring seals and lethally removing sharks. In the analysis, NMFS PIRO determined that 1) disturbance from humans and equipment to protected species is temporary and insignificant and does not exceed those actions previously consulted on; 2) the likelihood of an entanglement or hooking with a protected species is discountable; 3) the likelihood of a vessel colliding with a monk seal or green turtle is discountable; and 4) a potential exists for beneficial effects from the project to monk seals. The PIRO concurred that the project was Not Likely to Adversely Affect ESA-listed Hawaiian monk seals and green turtles, and would have no effect on designated critical habitat.

On May 7, 2010 the PIFSC re-initiated consultation under the ESA to include use of the surprise net to lethally remove sharks at FFS. The PIRO concurred that use of the surprise net, along with the harpoon, spear gun and handline fishing techniques to mitigate the high predation rate by Galapagos sharks on Hawaiian monk seals is Not Likely to Adversely Affect ESA-listed Hawaiian monk seals and green turtles or their designated critical habitat.

6.2.4 National Historic Preservation Act (NHPA)

Under the provisions of Section 106 of the National Historic Preservation Act of 1966, the Secretary of the Interior has compiled a national register of sites and buildings of significant importance to America's history. The proposed action would not cause any negative impacts to registered sites or buildings on shore or any such submerged site, such as shipwrecks.

6.2.5 Marine Mammal Protection Act

The Marine Mammal Protection Act authorizes NMFS to take measures to protect marine mammals that may involve setting aside habitat required by various life stages, although the chief provision is the prohibition of "taking" marine mammals directly or indirectly. None of the activities proposed herein should directly or indirectly interact with monk seals or other marine mammals such as dolphins or whales.

6.2.6 Environmental Justice

Consistent with the President's Executive Order on Environmental Justice (February 11, 1994) and the Department of Commerce's Environmental Justice Strategy, the proposed action would not have any disproportionately high and adverse human health or environmental effects on minority or low income populations.

6.2.7 Executive Order 12866

Implementation of the activities herein described does not constitute a "significant regulatory action" as defined by Executive Order 12866 because (1) it would not have an annual effect on the economy of $100 million or more, or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities; (2) it would not create a serious inconsistency or otherwise interfere with an action taken or planned by another agency; (3) it would not materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; and (4) it would not raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

7 Appendix A – Codes for Galapagos Shark and Hawaiian Monk Seal Monitoring

A. Codes for Shark Behavior

Code 1: Cruising, no obvious signs of predatory behavior

Code 2: Patrolling, apparently hunting pups

Code 3: Making directed approach to a seal

Code 4: Charging Seal, clearly attempting to attack

Code 5: Injuring or killing pups

B. Codes for Hawaiian Monk Seal Age Classes

Definitions:

Pre-weaned or Nursing Pup: Pups sized as P1 through P-5 at last sighting, commonly still with mothers, and nursing.

Weaned Pup: Pups that have been weaned <30 days, when mothers are commonly absent and nursing behavior is not evident.

Codes:

P1: Pup that is nursing and has wrinkles, typically full term, as defined by full developed pelage, whiskers, nails, and oral cavity. If a perinatal death is evident and size is not given, pup is recorded as a P1, rather than as a fetus.

P2: Pup that is nursing, has no wrinkles and has black pelage.

P3: Pup that is nursing, has a blimps-shaped body and has black or reddish-brown pelage prior to molt.

P4: Pup that is nursing, has a blimp-shaped body and is molting.

P5: Pup that is nursing, has a blimp-shaped body and has molted (note: not all pups reach P5 before weaning).

C. Codes for Bite Severity Classes:

Severity 1: The total combined exposed area of all gaping injuries is <8 cm (approximately 50 cm^2), less than half of a flipper is missing, and/or head/eye results in a partially opaque eye (Hawaiian Monk Seal Field Manual, Chapter 9: Survival Factors).

Severity 2: The total combined exposed area of all gaping injuries is ≥ an 8 cm (approximately 50 cm^2) and a <20 cm diameter circle area (approximately 314 cm^2), ≥ half a flipper is missing and/or injury to head/eye results in a totally opaque/blinded eye (Hawaiian Monk Seal Field Manual, Chapter 9: Survival Factors).

Severity 3: The total combined exposed area of all gaping injuries ≥ a 20 cm diameter circle area (approximately 314 cm^2) and/or total loss of function critical for survival, such as both hind flippers are amputated (Hawaiian Monk Seal Field Manual, Chapter 9: Survival Factors).

D1. Criteria for and Categorization of Shark Predation of Monk Seal Pups

Category 1 - Shark Confirmed Predation

Category 2 - Shark Inferred Predation

Shark Confirmed Predation:

Injured by Shark: A pup of the year sustains an injury inflicted by a large shark or any severity and "survives" or does not fall into the dead or probably dead categories below. Here, large sharks are defined as all sharks other than the cookiecutter shark (*Isistius brasiliensis*). These injuries include shallow punctures or lacerations in the skin, deep lacerations, gaping wounds, and amputated limbs. The characteristic crescent shape of these wounds reflects the shape of the shark's jaw (Hiruki et al.1993).

Died due to Shark Injury: Confirmed deaths only (the death or body of the pup is observed). A pup of the year is observed being killed by sharks, or sustains moderate to severe shark injuries and subsequently dies. To be considered a cause of death an injury must, at minimum be of the following severity: the total combined exposed area of all gaping injuries to the body must be ≥ an 8 cm (approximately 50 cm^2), ≥ ½ flipper is amputated, and/or injury to the head/eye results in a totally opaque/blinded eye. Shark attack will be judged to be the primary cause of death if the seal is not otherwise compromised to a larger degree due to factors such as pre-existing emaciation or injury due to other causes (HMS Field Manual, Survival Factor Section).

Disappeared/Probable Death due to Shark Injury: A pup of the year sustains a moderate to severe shark injury, subsequently disappears, and is classified as a probable death. Shark attack will be judged to be the primary cause of the disappearance if the seal is not otherwise compromised to a larger degree due to factors such as pre-existing emaciation or injury due to other causes. To be classified as a probable death the minimum sustained injury must be of the severity level described above, and one of the following conditions must also be satisfied:

The pup is lethargic, has trouble moving, and/or floated listlessly in the water and disappears more than a week before the end of data collections, or

The pup is in deteriorating condition (loss of weight, enlargement of abscesses, sloughing skin) and disappears at least 10 surveys or a month before the end of data collection (whichever is longer).

Shark Inferred Predation:

Disappeared/Probable Death – Shark inferred: Young apparently healthy pups are also considered to have probably died if they disappear within 3 weeks of birth (>7 days old and ≤21 days old) and are not seen for at least 10 surveys or a month before the end of data collection. Unknown-age pups are also included in this category if they were unmolted at the time of disappearance. The cause of these probable deaths is unknown but considered shark inferred if the pup is over 7 days old, predatory shark behavior has targeted nursing/newly weaned pups in the current year and at that location, and there is no other probable cause. The pup's mother is typically observed to be in good condition, with a single pup, and parenting normally prior to disappearance and often searching for her pup at the time of disappearance. Other probable causes of disappearances that must be absent for a shark-inferred mortality to be concluded include: aggressive adult male monk seals, extreme environmental conditions and maternal abandonment. Adult male monk seals may injure weaned pups and inflict mounting injuries that are distinguished by their distinctive scars and lacerations (Hiruki et al. 1993). Adult female seals (mothers) vigorously defend their pups from adult males during the nursing period (Johanos et al. 1994). Thus, pre-weaned pups are typically not vulnerable to male aggression. Unless a flagrantly aggressive male is observed at a pupping site within the current year, pre-weaned pup disappearance in the historical data is safely attributed to shark predation unless other compromising factors are present, such as extreme environmental conditions. Extreme environmental conditions include high tides and/or strong currents. They are considered a factor in pup disappearance primarily for islets that would go awash at extreme high tides, e.g., Round, Mullet, Bare, Disappearing, and potentially Whaleskate & Shark.

Suspicious Disappearance/Likely Dead – Shark Inferred: Slightly older apparently healthy pups that disappear while still with their mothers or newly weaned are considered to have suspiciously disappeared, and to be likely dead if they are not seen for at least 10 surveys or a month before the end of data collection. Pups in this category are over 21 days old at the time of disappearance (or molting/molted if of unknown age), with a cut-off age of 2 weeks post-weaning. Pups over 2 weeks post-weaning are not included in any shark-inferred category. The cause of these suspicious disappearances is unknown but considered shark inferred if there is no other probable cause (see discussion above about probable cause above).

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