UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

FEB 27 2014

Memorandum For: Tammy C. Adams, Ph.D.
Acting Chief, Permits and Conservation Division

From: Cathryn E. Tortorici CET
Chief, Endangered Species Act Interagency Cooperation Division

Subject: Biological and conference opinion on the proposal to implement the Hawaiian monk seal research and enhancement program and issue scientific research permit number 16632, pursuant to Section 10(a)(1)(A) of the Endangered Species Act of 1973

Enclosed is the NOAA National Marine Fisheries Service (NMFS) biological and conference opinion on the effects of the implementation of the Hawaiian monk seal research and enhancement program and issuance of scientific research permit number 16632, prepared pursuant to section 7(a)(2) of the Endangered Species Act of 1973, as amended (16 USC 1531 *et. seq*.).

In this biological opinion, NMFS concludes that the implementation of the program and issuance of the permit is not likely to jeopardize the continued existence of the Hawaiian monk seal or result in the adverse modification or destruction of its critical habitat. We also conclude that the action may affect, but is not likely to adversely affect, the following ESA-listed species: sperm whale, blue whale, fin whale, humpback whale, sei whale, false killer whale (Hawaiian insular) green sea turtle (all other areas), hawksbill sea turtle, leatherback sea turtle, loggerhead sea turtle (North Pacific), and olive ridley sea turtle (all other areas). In this conference opinion, NMFS concludes that the implementation of the program and issuance of the permit is not likely to jeopardize the continued existence of the following ESA-proposed species: *Acropora paniculata*, *Monitpora flabellate*, *M. dilatata*, *M. turgescens*, *M. patula*, and *M. verrilli*.

This concludes formal consultation and conference on this action. Consultation on this issue must be reinitiated if: (1) the amount or extent of allowable take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this biological opinion; (3) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action.

National Marine Fisheries Service
Endangered Species Act Section 7 Consultation
Biological and Conference Opinion
FPR-2012-0832

Agencies:	Pacific Islands Fisheries Science Center and Permits and Conservation Division of the Office of Protected Resources, National Marine Fisheries Service
Action Considered:	Implementation of the Hawaiian monk seal research and enhancement program and issuance of scientific research permit number 16632, pursuant to Section 10(a)(1)(A) of the Endangered Species Act of 1973
Consultation Conducted by:	Endangered Species Act Interagency Cooperation Division of the Office of Protected Resources, National Marine Fisheries Service
Approved by:	Donna S Wieting
Date:	FEB 27 2014

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1536(a)(2)), requires Federal agencies to insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat. When a Federal agency's action may affect listed species or critical habitat, formal consultation with National Marine Fisheries Service (NMFS) and/or the Fish and Wildlife Service is required (50 CFR 402.14(a)). Federal agencies may request a conference on a proposed action that may affect proposed species or proposed critical habitat.

Researchers at the NMFS Pacific Islands Fisheries Science Center (i.e., the researchers) propose to implement the Hawaiian monk seal research and enhancement program (the program), as described in the 2013 draft Final Programmatic Environmental Impact Statement (PEIS) for Hawaiian Monk Seal Recovery Actions, under the "preferred alternative." The NMFS Permits and Conservation Division (Permits Division) proposes to issue a 5-year permit (the permit, No. 16632), authorizing these activities pursuant to section 10(a)(1)(A) of the Endangered Species Act and section 104 of the Marine Mammal Protection Act (MMPA) of 1972. We, the ESA Interagency Cooperation Division of NMFS, consulted with the researchers and the Permits Division on their actions. This document transmits our biological and conference opinion (Opinion) on the proposed actions and their effects on the Hawaiian monk seal, its designated and proposed critical habitat, and other ESA-listed and proposed species that occur in the action area. We based our Opinion on information provided in the draft Final PEIS (May 30, 2013), the

2013 draft permit (September 13, 2013), consultation meetings, scientific publications, recovery plans, program reports, and other sources of information. We prepared our Opinion in accordance with section 7(a)(2) of the statute (16 U.S.C. 1536(a)(2)), associated implementing regulations (50 CFR 402), and agency policy and guidance (USFWS and NMFS 1998).

1.0 Consultation History

On August 19, 2011, NMFS published notice of availability (76 FR 51945) for public comment on the Draft Programmatic Environmental Impact Statement (PEIS) for Hawaiian Monk Seal Recovery Actions.

On March 13, 2012, the researchers and Permits Division requested initiation of section 7 consultation on the program as described in the Draft PEIS and draft permit application (File No. 16632), the draft permit No. 16632, and issuance of an amendment to their previous permit (No. 10137-07; PCTS #FPR-2012-3001).

On April, 3, 2012, the researchers and Permits Division requested separate consultation on the amendment to their previous permit (No. 10137-07; PCTS #FPR-2012-3001) because additional time was needed to complete their draft Programmatic Environmental Impact Statement. On May 17, 2012, we agreed to consult on the amendment separately and agreed to a 2-year extension on the program and permit consultation.

On July 11, 2012, we delivered a final biological opinion on the permit amendment (No. 10137-07; PCTS #FPR-2012-3001), concluding that the researchers and Permits Division had insured that the proposed activities (the use of remotely-controlled amphibious vehicles for monitoring, the collection of two whiskers via cutting or pulling for research purposes, and the annual translocation of six weaned pups between subpopulations within the NWHI for enhancement purposes) are not likely to jeopardize the continued existence of the Hawaiian monk seal or result in the destruction or adverse modification of the species' critical habitat.

On March 1, 2013, the Permits Division published notice of availability (78 FR 13863) for public comment on the application for a permit (File No. 16632) submitted by the researchers.

On May 30, 2013, NMFS completed their draft Final Programmatic Environmental Impact Statement (PEIS 2013), which describes their research and enhancement program.

On September 13, 2013, the Permits Division revised their draft Permit (No. 16632).

2.0 Description of the Proposed Action

The researchers propose to implement their research and enhancement program, as described in the PEIS, under the preferred alternative (Alternative 3; PEIS 2013); the Permits Division proposes to issue a 5-year permit, authorizing research and enhancement activities.

Comprehensive and detailed descriptions of the actions are provided in the PEIS and permit, respectively. Here, we provide a summary of that information, as required to understand and evaluate the proposed actions.

2.1 Research and Enhancement Program

The researchers propose to perform research and enhancement activities on Hawaiian monk seals in the main Hawaiian Islands (MHI), Northwestern Hawaiian Islands (NWHI), and Johnston Atoll. Research will also be conducted on monk seals in captive facilities. Their research is intended to identify impediments to recovery, inform the design of conservation measures, and execute and evaluate those measures. Their enhancement activities are designed to improve the survival and reproductive success of individual monk seals, with the intent to improve the status of the species. Specific monitoring, research, and enhancement activities are described below.

2.1.1 Monitoring/Survey/Observation

The researchers propose to observe, photograph, and monitor seals via aerial, vessel, and land (walking) surveys. They would conduct most surveys on foot, remaining out of sight, low to the ground, and as unobtrusive as possible to avoid disturbing seals. They would give a wide berth to nursing, molting, or other disturbance-sensitive seals. Researchers would also install remotely-operated, solar-powered cameras at seal haul-out areas and use autonomous, amphibious rover vehicles at distances as close as 10 ft to monitor seals in remote or crowded areas. The researchers would use small vessels to survey areas where they cannot access land; they would maintain a minimum distance of 33 ft. To perform aerial surveys, the researchers would use fixed-wing aircraft, unmanned aerial vehicles, or helicopters, maintaining minimum distances of 300 ft (vector combination of vertical and horizontal distance for fixed-wing manned aircraft), 250 ft (helicopters) and 10 ft (unmanned aerial vehicles).

2.1.2 Capture

The researchers propose to capture seals. Prior to capture, they would evaluate the area for environmental hazards (e.g., rocks or hard substrate) and avoid such areas, if necessary. They would approach and capture the seal by hand or net (stretcher, hoop, or throw). Once captured, they would either restrain the seal or guide it into a cage. The researchers would observe seals for a minimum of 5 minutes after being released to ensure the seal resumes normal behavior (either going into water or resuming normal respiration rates on land). They would observe seals entering the water, until they are out of sight.

2.1.3 Restraint

The researchers propose to physically restrain seals by hand or net. They would hold the seal in place by exerting pressure on the seal's neck and back and by holding the seal's pectoral and rear flippers. They would hold the seal securely but with as little pressure as required to temporarily restrain it. To minimize stress, the researchers would limit restraint time and use water to keep the seal cool. Restraint time would average 5 minutes and would generally not exceed 15 minutes, for activities not requiring sedation, and 1 hour, for activities requiring sedation.

If a seal has an adverse reaction to restraint, the researchers would initiate emergency procedures under the advice of an on-site veterinarian. Such procedures include, but are not limited to:

- If respiratory arrest occurs, manual stimulation to restore breathing, including, as necessary, stimulation to face, chest compressions, intubation, and administration of atropine and/or Dopram®. Dopram would be administered at dosage of 5 ml (pups/juveniles) and 10 ml (subadults/adults)

- If cardio-vascular arrest occurs, administration of epinephrine by the most effective means at a dosage of 1 ml/100-200 kg. Dexathasone or Solu-Delta Cortef may be administered after arrest to reduce shock
- If the emergency appears to result from diazepam overdose, Flumazenil may be administered to reverse the effects of diazepam. Flumazenil would be administered at a dosage of 2.5 ml (pups/juveniles) and 5.0 ml (subadults/adults) and repeated if necessary. At the discretion of the veterinarian other medications may be administered, including sodium bicarbonate, physiological saline, aqueous dextrose solution, and lactated ringer's solution.

2.1.4 Sedation

The researchers propose to sedate seals, if necessary. The researchers would sedate seals to reduce stress during more invasive procedures (e.g., instrumentation), weighing the stress of the activity against the risk and duration of sedation. A veterinarian would administer or oversee administration of the sedative, (e.g., intravenous diazepam at 0.1 – 0.20 mg/kg or intramuscular midazolam at 0.02 – 0.07 mg/kg).

2.1.5 Disentanglement

The researchers propose to disentangle seals caught in nets, line, and other marine debris. They would attempt to remove entangling items without restraint (e.g., by using a long-handled cutting implement), whenever possible. For badly entangled seals, the researchers would capture, restrain, and sedate the seal (as necessary), cooling the seal with water, prior to disentanglement.

2.1.6 Dehooking

The researchers propose to remove hooks from seals. They would restrain the animal in a hoop or stretcher net and remove the hook by hand. For deeply embedded hooks, the veterinarian would sedate the seal prior to dehooking.

2.1.7 Tagging/Retagging

The researchers propose to tag (or retag, if necessary) seals, using a variety of tags.

Flipper

The researchers propose to mark seals with external tags. They would apply two flipper tags (e.g., Temple Tags®) to the rear flippers of a seal. These tags measure approximately 4 x 2 cm^2 and are printed with unique identification numbers. To apply these tags, the researchers use a leather punch to create holes in the webbing between two digits of each rear flipper; they would insert the plastic tags through the holes. During retagging, old, broken, or unreadable tags would be removed. Tissue plugs would be removed from the leather punch and preserved in buffer for future analyses.

When standard capture and restraint is not possible or safe (e.g., pre-weaned pups), the researchers propose to apply alternative flipper tags (e.g., Monel steel or plastic tags such as All-Flex®, Dalton®, or Roto®). Such tags are fitted into purpose-designed pliers that pierce and attach or crimp in a single rapid motion (< 10 seconds). To tag pre-weaned pups, the researchers would sneak up to a pup sleeping relatively far from its sleeping mother; they would attach a single tag between two digits along the trailing edge of the flipper. The researchers would immediately vacate the area to minimize disturbance; they would observe the seal from a distance to confirm that the mother and pup remain together.

PIT
The researchers propose to tag seals with internal tags. Passive Integrated Transponder (PIT) tags are glass-enclosed, electromagnetic tags that are injected subcutaneously and read by a radio frequency scanner. The researchers would clean the injection area with Betadine and alcohol and inject the PIT tag(s) in the lateral lumbar area.

Sonic
The researchers propose to attach sonic tags to seals to monitor their activity relative to sonically tagged sharks. They would attach a sonic tag (2.4 cm, 3.6 g) to a rear flipper tag with two small zip ties and epoxy.

2.1.8 Mark

The researchers propose to mark seals with bleach for short-term identification. They would apply bleach to any seal captured for other activities (if not already marked). The researchers would also approach a sleeping seal and apply a unique identifier number to its pelage on the back or side. They would also apply a bleach “girdle” over the seal’s circumference in the vicinity of the tail. They would use cosmetic hair lightener in a squeeze applicator (similar to a condiment dispenser). The researchers would bleach captured or sleeping seals. They would avoid bleaching molting seals, seals in close proximity to other seals, and seals near environmental hazards (e.g., rocks). The researchers would observe seals for 5 minutes after the bleach application to monitor behavior and assess the efficacy of the mark.

2.1.9 Specimen Collection

The researchers propose to collect the following specimens from live animals:

Blood
The researchers would draw up to 105 ml of blood from the extradural vein using a standard syringe and external T-connector.

Skin
The researchers would collect and preserve the skin tissue plugs removed from the leather punch used during the flipper tagging procedure (see above).

Blubber
The researchers would collect two blubber core samples (through the full depth of the blubber layer) from the dorsal pelvic region using a sterile 6 mm biopsy punch.

Swabs
The researchers would collect microbial and/or viral swabs from the following sites: eyes, nares, mouth, anus, genital orifice, and external wounds.

Fecal Collection
The researchers would collect fecal samples using a fecal loop or digital extraction.

Whisker
The researchers would cut or pull up to two vibrissae for stable isotope and hormone analyses.

They would clip vibrissae at the base with small scissors for animals that are restrained without sedation. For sedated animals, the researchers would pull the vibrissae from the root by hand or using forceps.

The researchers propose to collect the following specimens from dead animals or samples shed or excreted:

Necropsy Samples, Import/Export of Samples, and Opportunistic Sample Collection

The researchers propose to conduct necropsies on dead seals (those found dead, are euthanized, or die incidental to research or enhancement activities) and collect tissues to determine the cause of death. Researchers would export/re-import samples for analysis, and may import samples from Mediterranean monk seals for conservation research. Researchers would opportunistically collect samples from the beach, such as placenta from pups which are stillborn, or which experienced perinatal death. Many of these placentae would still be attached to the carcasses of the pups (and would be therefore collected as part of necropsies), but some may be separated from the pup, particularly if the pup was alive for a short time after birth or if the pup carcass has been washed to sea. In addition, researchers would collect scat (feces), spew (vomitus), and molted fur from beaches.

2.1.10 Measurement

The researchers propose to measure the seal. They would measure length and girth using a flexible tape measure.

2.1.11 Weighing

The researchers propose to weigh the seal. After capturing the seal in a hoop or stretcher net, the researchers would suspend the net and seal from a hanging scale attached to a tripod. The process would take less than one minute.

2.1.12 Ultrasound

The researchers propose to use ultrasonography to non-invasively measure the depth of blubber in an effort to quantify body condition (i.e., fat stores) of a seal. They would use a portable veterinary ultrasound machine. They would apply light pressure to the skin along the sides and back of the animal.

2.1.13 Administration of Drugs and Supportive Fluids

The attending veterinarian or a trained researcher with veterinary approval would administer medication to seals, as deemed necessary. Prior to use, the veterinarian would assess possible adverse effects, including any observed in captive Hawaiian monk seals, and the pharmacokinetics of each drug (i.e., known information on how the drug is absorbed, distributed, the rate of action and duration of effect, chemical changes in the body, and effects and routes of excretion of metabolites). As needed, the attending veterinarian or a trained researcher would administer supportive fluids, such as electrolytes, dextrose, and sodium bicarbonate.

2.1.14 Treatment with anti-helmintics (Deworming)

The researchers propose to treat seals for internal parasites. They would approach and/or capture/restrain seals. They would administer an anti-helmintic as prescribed by the veterinarian. Prior to use in the field, the veterinarian would assess possible adverse effects, including any observed in Hawaiian monk seals, and the pharmacokinetics of each anti-helmintic. Prior to widespread anti-helmintic treatment, the researchers would conduct studies to establish efficacious deworming methods.

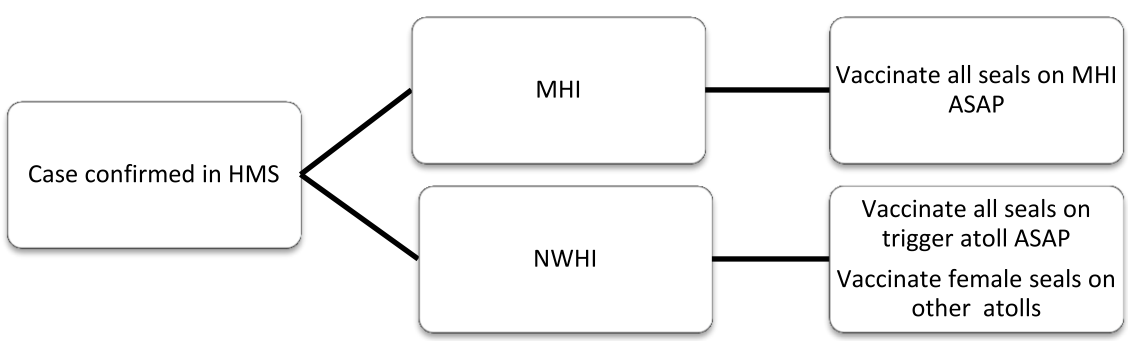
2.1.15 Vaccination

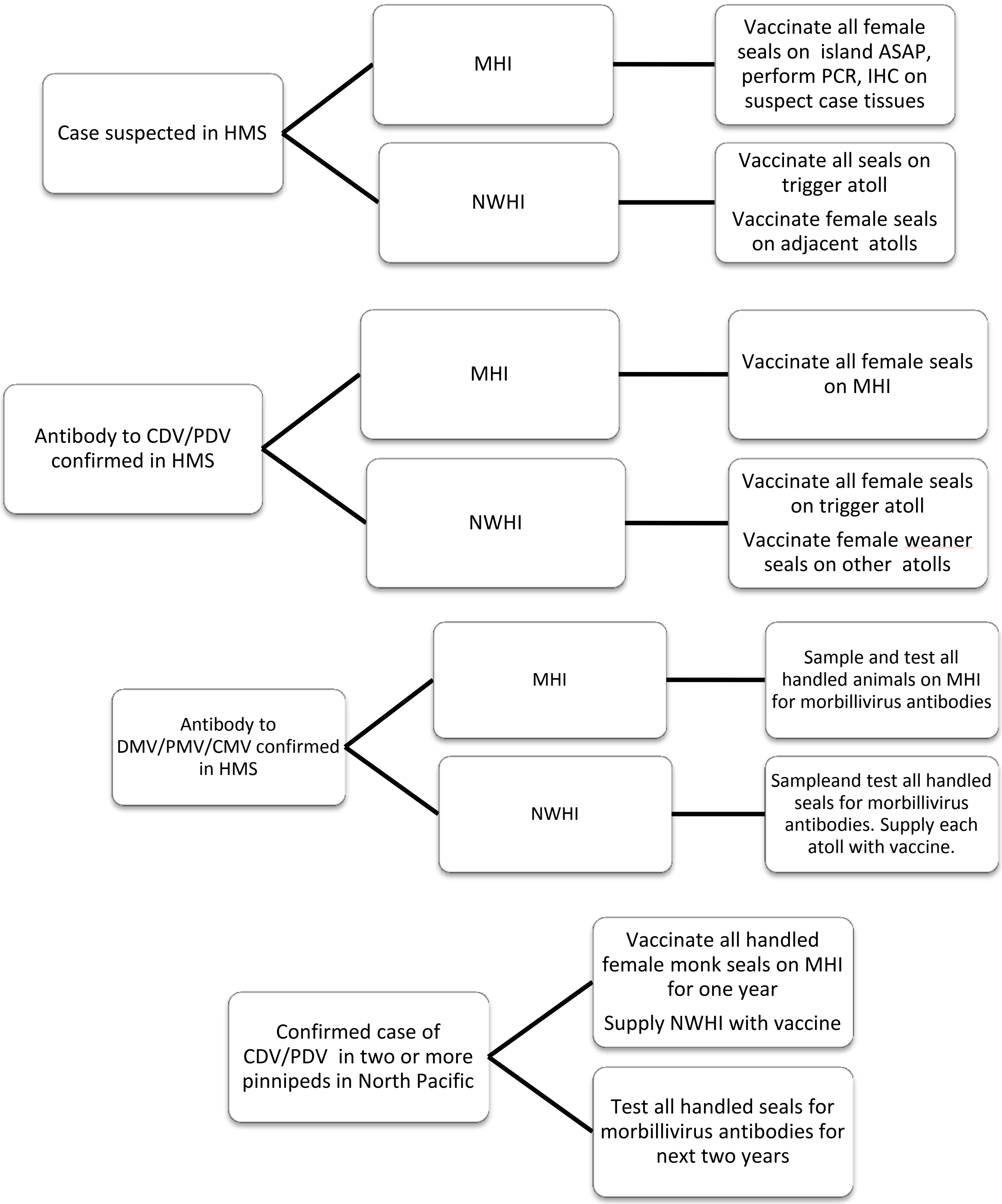
The researchers propose to conduct epidemiological research and to vaccinate Hawaiian monk seals to minimize the risk of infectious diseases. Vaccines are available for two viruses that have been identified as high risks to Hawaiian monk seals: morbillivirus and West Nile virus. Descriptions of the viruses, vaccines, and their impacts on other pinniped species are described in detail in Appendix D of the PEIS. Here we summarize the information required to evaluate potential responses of Hawaiian monk seals to vaccinations.

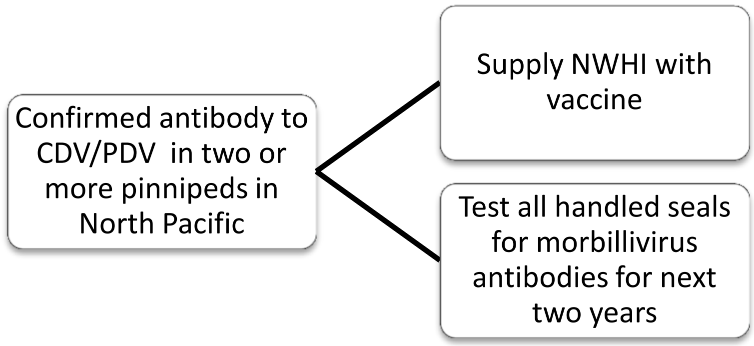
The researchers are currently testing vaccines for safety and efficacy on captive seals. A West Nile virus vaccine has been used regularly on captive Hawaiian monk seals, with no adverse reactions (Workshop to Evaluate the Potential for Use of Morbillivirus Vaccination in Hawaiian Monk Seals, Final Report 2005). A morbillivirus vaccine has been used on one captive Hawaiian monk seal with no adverse reactions. This vaccine is used extensively in zoological collections (Bronson et al. 2007), is recommended by the American Association of Zoological Veterinarians (http://www.aazv.org), and has been proven to be a safe and effective prophylactic treatment for captive southern sea otters (*Enhydra lutra nereis*) (Jessup et al. 2009). The researchers are continuing to test these vaccines on captive Hawaiian monk seals to establish safe and effective protocols for use in the wild (PEIS 2013).

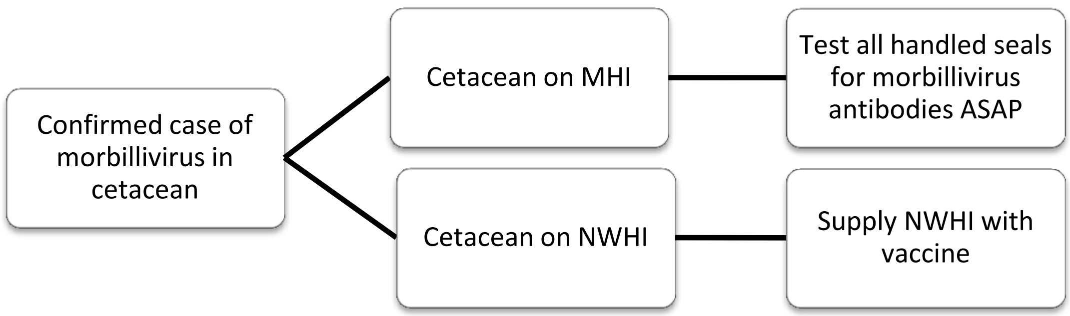
Once the vaccines have been determined to be safe and effective on captive seals, they will be tested on seals in the MHI. If no adverse effects are observed, the researchers may initiate prophylactic vaccination of all Hawaiian monk seals. Alternatively, the researchers may initiate vaccination in response to a trigger (i.e., activation of the State emergency response or detection of a virus in a seal, cetacean, or other animal within range of the species), as shown in Figure 1. To detect a trigger, the researchers would survey for morbillivirus or West Nile virus by testing monk seal blood, feces, or swabs for evidence of the viruses. After administering vaccinations, the researchers would continue to survey all vaccinated animals for a minimum of one year.

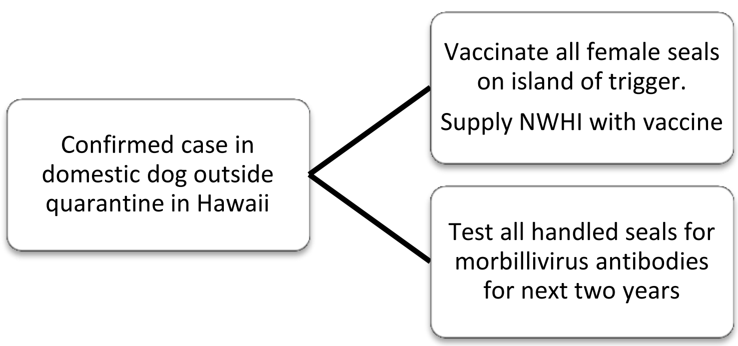
Figure 1. Vaccination triggers and administration plan (PEIS 2013).




Case suspected in HMS
MHI
Vaccinate all female seals on island ASAP, perform PCR, IHC on suspect case tissues
NWHI
Vaccinate all seals on trigger atoll
Vaccinate female seals on adjacent atolls
Antibody to CDV/PDV confirmed in HMS
MHI
Vaccinate all female seals on MHI
NWHI
Vaccinate all female seals on trigger atoll
Vaccinate female weaner seals on other atolls
Antibody to DMV/PMV/CMV confirmed in HMS
MHI
Sample and test all handled animals on MHI for morbillivirus antibodies
NWHI
Sampleand test all handled seals for morbillivirus antibodies. Supply each atoll with vaccine.
Confirmed case of CDV/PDV in two or more pinnipeds in North Pacific
Vaccinate all handled female monk seals on MHI for one year
Supply NWHI with vaccine
Test all handled seals for morbillivirus antibodies for next two years







2.1.16 Treatment of Wounds

The researchers propose to treat seals' wounds. They would lance abscesses with a scalpel and flush abscesses and other wounds with water, hydrogen peroxide, or a disinfectant. They would cut an umbilicus from a neonate pup that is being encumbered by a placenta. They would also administer a long-acting antibiotic.

2.1.17 Instrumentation

The researchers propose to attach instruments to seals to track seal movement, habitat use, and foraging behavior. Examples of instruments include: time-depth recorder, satellite tag, VHF radio tag, cell phone tag, and video camera (e.g., Crittercam). The total combined weight of the instruments would not exceed 1 kg. The researchers would capture and restrain the target seal. The veterinarian would sedate the seal. The researchers would clean the attachment site with acetone. They would glue the instrument to the dorsal pelage using epoxy adhesive (e.g., Devcon 10 Minute Epoxy Clear). The total restraint time would be approximately 25 minutes and would not exceed 60 minutes.

2.1.18 Translocation

The researchers propose to translocate seals for several different purposes, as described below. For all translocations, whenever possible, the researchers would not capture seals when other seals are in the immediate vicinity. Transported seals would be kept wet, as needed, to reduce overheating during daylight hours but would be otherwise undisturbed.

The researchers would conduct patrols of the area to resight animals that have been translocated. They would instrument at least a subset of translocated seals to monitor post-release assessment of location, behavior and survival.

Intra-island/atoll (mitigate pup separations)

The researchers propose to translocate seals within an island, i.e., move seals from one location on an island to another (i.e., no boat transfer necessary). In rare instances, intra-atoll transport via small boat may be necessary if the parturient female is located on a different islet from that on which the pup was abandoned. In such cases, the pup is secured by the net in the boat. They would capture and translocate nursing or pre-weaned pups separated from their mothers back to their natural mother or to a prospective foster mother, respectively. The researchers would observe the seals until it becomes clear whether the prospective foster mother has accepted or rejected the pup.

NWHI Intra-island/atoll and within MHI (risk alleviation)

The researchers propose to translocate seals between islands, within an atoll, i.e., move seals from one island to another within the same atoll or subpopulation. They would translocate weaned (or nearly weaned) pups from “high risk” locations, where there is a severely reduced chance of survival, to low risk locations within the same NWHI atoll (or to other beaches in the MHI). High-risk locations include areas of elevated shark predation (e.g., some islets at French Frigate Shoals), potential entrapment (e.g., behind a seawall), potential disease or contaminant exposure, or increased likelihood of human interaction (e.g., hooking, entanglement, socialization, or disturbance in the MHI). In the NWHI, the researchers would capture weaned pups in a net and transport them via small boat directly from weaning site to release site within the same atoll. In the MHI, the researchers would transport the seals in a cage on a vehicle (truck), boat, plane, or helicopter. The researchers would transport all pups immediately after capture without temporary holding, unless deemed necessary by an attending veterinarian (e.g., for health screening).

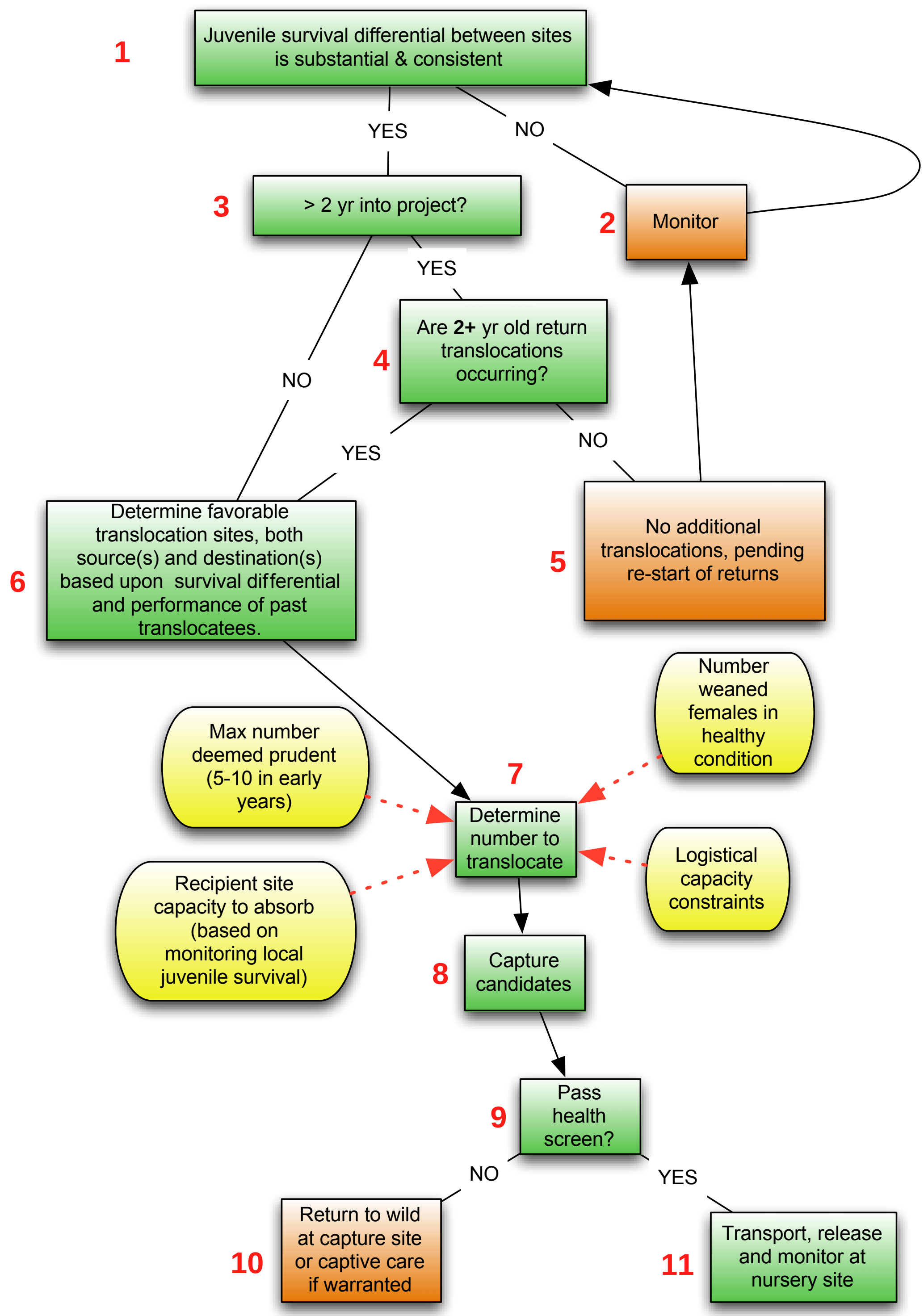
First stage of two-stage translocation (within NWHI or from MHI to the NWHI)

The researchers propose to translocate weaned pups and juvenile seals from subpopulations, where juvenile survival is low, to subpopulations with higher rates of juvenile survival. They provide a comprehensive, detailed description of this proposed activity in the PEIS, Appendices E and F (PEIS 2013). Here, we provide a summary of that information.

The researchers would capture, restrain, sedate, collect specimens (blood, swabs, blubber biopsy, fecal, and whisker), instrument, temporarily hold, and translocate seals from areas of low survival via boat, ship, vehicle, or aircraft (as described above and in Appendix F of the PEIS) to areas of higher survival. Upon release at the donor subpopulations, seals would be monitored by telemetry or during subsequent surveys.

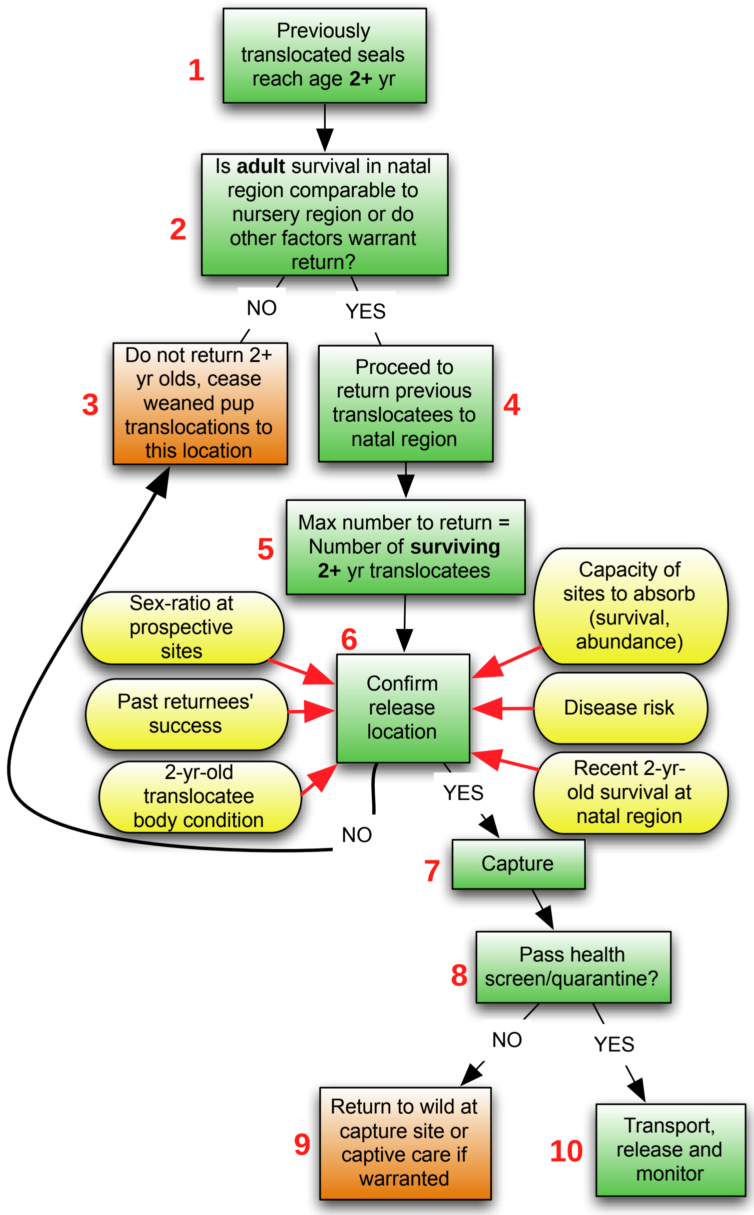
The researchers would use the decision framework (Fig. 2) to determine whether, where, and how many seals to translocate. To determine whether and where to translocate seals, they would compare juvenile survival rates, averaged over the past three years, to select donor and recipient subpopulations. To determine the maximum number of seals to translocate, they would select the smallest of the following: number of healthy weaned females at the donor subpopulation; capacity at the recipient subpopulation; logistical constraints; and experience (i.e., fewer seals would be translocated early on in the process).

Figure 2. Flow chart depicting decision framework for first stage of two-stage translocation (PEIS 2013)



Second stage of two-stage translocation (Seals returned to natal or other site)
The researchers propose to return translocated seals to their natal subpopulation (or another suitable site), at 2 - 3 years of age, when survival probability is universally high at all subpopulations. They would use the decision framework (Fig. 3) to determine whether and where to translocate seals. The researchers would capture, restrain, sedate, collect specimens (blood, swabs, blubber biopsy, fecal, whisker), instrument, temporarily hold, and translocate seals via boat, ship, vehicle, or aircraft (as described above and in Appendix F). Upon release at the donor subpopulations, seals would be monitored by telemetry or during subsequent surveys.

Figure 3. Flow chart depicting decision framework for second-stage of two-stage translocation (PEIS 2013).



Experimental translocation (within or between any subpopulation(s))
The researchers propose to translocate juvenile, sub-adult, or adult seals to formally evaluate the second stage of two-stage translocation (i.e., from areas of favorable conditions to potentially less favorable conditions). They would move seals of any age that have developed habitual patterns of human interaction from the MHI to the NWHI, where the seals could continue to live in a wild population, isolated from human contact. They would also have the option to move males of any age from any subpopulation or previously translocated seals (of either sex).

2.1.19 Temporary Captivity
The researchers propose to hold seals in temporary captivity prior to transport (during translocation or aggressive male removal) or under the behavioral modification program (i.e., taste aversion trials). Temporary captivity would occur in permanent marine mammal facilities or temporary shoreline pens. The permanent facilities include: Ford Island, Waikiki Aquarium, and The Marine Mammal Center. Temporary shoreline pens are made of plastic or metal; they measure up to approximately 24 ft x 80 ft. Approximately 30 percent of the surface area will include water at least 2 ft deep at lowest tide; the remainder of the pen would be intertidal and dry resting area above the high water line.

2.1.20 Supplemental Feeding
The researchers propose to provide supplemental feeding to wild seals in the NWHI, where human presence is minimal. This activity would not be conducted in the MHI, to avoid potentially harmful seal-human interactions. Supplemented seals would receive individually quick-frozen herring in quantities of up to 5% of body weight as frequently as once per day or at longer intervals for up to one year. In order to "wean" the animal while keeping it in good body shape, feeding would be reduced over time. Any uneaten herring would be collected and disposed of properly to keep any waste out of the natural environment.

2.1.21 Behavior Modification
The researchers propose to develop behavior modification tools to prevent or reduce human-seal interactions in the MHI and to encourage seals to avoid harmful situations (e.g., roads or boat ramps). Tools include: visual and aural disruptive stimuli (e.g., waving palm fronds); tactile harassment (prodding seals with blunt objects); acoustic harassment and deterrents; and chemical deterrents (i.e., to alter the taste of prey taken from fishermen). Taste aversion trials may involve placing the seal in temporary captivity. The researchers would apply behavioral modification techniques carefully and judiciously, for the protection of individual seals and the public. Potential aversive stimuli would be tested carefully prior to use to insure that they do not cause physical harm to seals, while providing the necessary discomfort or annoyance.

2.1.22 Mitigation of Adult Male Aggression
The researchers propose to haze aggressive males via noise, prodding, or throwing objects to distract them from conspecific victims (e.g., weaned pups or adult females that may be injured or killed). If this did not work, researchers would translocate these males, as described in the preceding sections. If hazing did not stop the aggressive behaviors and translocation is not feasible or advisable, the researchers would capture the males and place them in permanent captivity. During all restraint procedures, adult male seals will be sedated to reduce stress during handling. The researchers would euthanize males that cannot be hazed, translocated, or placed in permanent captivity. They would euthanize aggressive adult males by gun-shot, captive

penetrating bolt, or a lethal dose of Beuthanasia® (sodium pentobarbital) into the extradural vein at a dose of 1 ml/10 lb.

2.1.23 Euthanasia of Moribund Seals

The researchers propose to euthanize moribund seals. They would capture, sedate, and collect specimens from moribund seals. They would inject the seal with a lethal dose of Beuthanasia® (sodium pentobarbital) into the extradural vein at a dose of 1 ml/10 lb. They would conduct a complete necropsy immediately after the animal has died.

2.2 Issuance of Permit and Authorization of Take (Permits Division)

The Permits Division proposes to issue permit No. 16632, pursuant to Section 10(a)(1)(A) of the ESA and Section 104 of the Marine Mammal Protection Act (MMPA, 16 U.S.C. 1361). Their 5-year permit would authorize monitoring, research, and enhancement activities, as described above, and would authorize take as described in Table 1.

Table 1. Proposed authorized activities and maximum authorized annual takes.

Activities	Size (Age)	No. Takes /Year	No. Takes/ Seal/Year	Locations
Monitoring (visual observation and photo-identification) via beach surveys, vessel surveys, and aerial surveys; surveys may include unmanned vehicles and remote cameras	Any	250	5	MHI
		100	3	Nihoa
		75	3	Necker
		250	5	FFS
		10	1	Gardner
		400	5	Laysan
		275	5	Lisianski
		400	5	PHR
		150	5	Midway
		200	5	Kure
		5	3	Johnston Atoll
Tagging: restrain, tag (flipper,PIT, and sonic), collect specimens (tissue and whisker), measure	Any except lactating or pregnant females.	60	3	MHI
		25	3	Nihoa
		15	3	Necker
		100	3	FFS
		75	3	Laysan
		70	3	Lisianski
		70	3	PHR
		50	3	Midway
		50	3	Kure
		5	3	Johnston Atoll
Retagging: restrain, retag (flipper), collect specimens (tissue and whisker), measure	Any except lactating or pregnant females.	100	1	Hawaiian Archipelago and Johnston Atoll
Marking: mark with bleach	Any	150	3	MHI
		60	3	Nihoa
		30	3	Necker
		250	3	FFS
		250	3	Laysan

Activities	Size (Age)	No. Takes /Year	No. Takes/ Seal/Year	Locations
		250	3	Lisianski
		250	3	PHR
		100	3	Midway
		150	3	Kure
		5	3	Johnston Atoll
Health screening: restrain, sedate, tag (flipper and PIT), collect specimens (blood, tissue, blubber, swabs, and whisker), measure, weigh, ultrasound, attach instrument	Any healthy seal except lactating females with pups and nursing pups	100	2	Hawaiian Archipelago and Johnston Atoll
Health screening: restrain, sedate, tag (flipper and PIT), collect specimens (blood, tissue, blubber, swabs, and whisker), measure, weigh, treat (lance and cleanse abscesses, administer long-acting antibiotic), ultrasound, instrumentation, humane euthanasia or incidental mortality of 10 moribund animals	Any unhealthy seal except lactating females with pups and nursing pups	30	2	Hawaiian Archipelago and Johnston Atoll
Health treatment: restrain, treat (lance and cleanse abscesses, administer long-acting antibiotic), sedation, and instrumentation	Any unhealthy seal except lactating females with pups and nursing pups	As warranted	As directed by vet	Hawaiian Archipelago and Johnston Atoll
Intestinal parasite treatment and monitoring: restrain, sample, measure, weigh, ultrasound, up to 4 capture treatments with oral or injectable anti-helmintics; up to 4 capture monitoring takes	Pups $\geq$ 120 days post-weaning, juveniles < 3 years	300	8	Archipelago and Johnston Atoll
Intestinal parasite treatment without restraint: treat with topical anti-helmintics (up to 12 annually)	Pups $\geq$ 120 days post-weaning, juveniles < age 3	300	8	Hawaiian Archipelago
Intestinal parasite treatment with restraint: restrain, sample, measure, weigh, ultrasound, treat with topical anti-helmintics (up to 4), concurrent monitoring; if monthly treatments determined effective during research phase, captures for follow up monitoring would be discontinued and only topical treatments would be administered (12 annually)	Pups $\geq$ 120 days post-weaning, juveniles < 3 years	300	4	Archipelago and Johnston Atoll
Intra-island/atoll translocation: capture, restrain, and relocate to natural mother or prospective foster mother, sample (whisker)	Nursing pup	As warranted	6	Hawaiian Archipelago, Johnston Atoll
Intra-island/atoll or within MHI translocation: capture, restrain, sedate, collect specimens (blood, swabs, blubber biopsy, fecal, whisker), instrument, temporary holding, relocate from high risk areas via boat, ship, vehicle, or air craft	Any	As warranted	3	Hawaiian Archipelago, Johnston Atoll

Activities	Size (Age)	No. Takes /Year	No. Takes/ Seal/Year	Locations
1st stage of two-stage translocation: capture, restrain, sedate, collect specimens (blood, swabs, blubber biopsy, fecal, whisker), instrument, temporary holding, translocate from areas of low survival via boat, ship, vehicle, or aircraft	Weaned pup	20	3	Hawaiian Archipelago, Johnston Atoll
2nd stage of two-stage translocation: capture, restrain, sedate, collect specimens (blood, swabs, blubber biopsy, fecal, whisker), instrument, temporary holding, translocate via boat, ship, vehicle, or aircraft	Juvenile and sub-adult ("1st stage" seals)	30	3	Hawaiian Archipelago, Johnston Atoll
Experimental translocation: capture, restrain, sedate, collect specimens (blood, swabs, blubber biopsy, fecal, whisker), instrument, temporary holding, translocate via boat, ship, vehicle, or air craft	Juvenile, sub-adult, and adult	6	3	Hawaiian Archipelago, Johnston Atoll
Adult male removal: capture, restrain, sedate, collect specimens (blood, swabs, blubber biopsy, fecal, whisker), attach instrument; translocate, place in permanent captivity, or euthanize (only 10 lethal takes over 5 years)	Adult	20	2	Hawaiian Archipelago; Johnston Atoll
Adult male hazing: haze aggressive males away from conspecific victims in cases of immediate risk of injury or death to victims	Adult	As warranted	As warranted	Hawaiian Archipelago; Johnston Atoll
Disentanglement: capture, sedate, collect specimens (whisker), disentangle, dehook	Any	As warranted	As warranted	Hawaiian Archipelago; Johnston Atoll
Necropsy: any seal found dead, that died during restraint, or that was euthanized. Tissue may be used as bait for shark removals.	Any	As warranted	1	Hawaiian Archipelago; Johnston Atoll
Opportunistic retrieval of samples (placentae, scats, spews, and molted fur/skin)	Any	Unlimited samples	Unlimited samples	Hawaiian Archipelago; Johnston Atoll
Export (and re-import) Hawaiian monk seal samples collected under this permit. Import (and re-export) Mediterranean monk seal samples.	Any	Unlimited samples	Unlimited samples	World-wide
Supplemental Feeding: supplemental feeding of post-rehabilitated seals	Pup/juvenile	12	As warranted	NWHI
Behavioral Modification: Intentional harassment for behavior modification. Aversive conditioning and other methods including but not limited to: capture, restraint, sedation, sampling (blood, swabs, blubber biopsy, vibrissae), instrumentation, translocation, temporary holding; hazing using visual, audible and tactile means; impeding movement with barriers, etc.; Seals may be brought into temporary captivity for taste aversion research (chemical taste aversion with lithium chloride in captivity only).	Any	20	As warranted	MHI

Activities	Size (Age)	No. Takes /Year	No. Takes/ Seal/Year	Locations
Vaccinations: capture, restraint, sedation, sampling (blood, swabs, blubber biopsy, vibrissae), and administration of vaccine	Any	1,100	4	Hawaiian Archipelago
Incidental harassment to non-target animals during any activity	Any	400	3	Hawaiian Archipelago; Johnston Atoll
Unintentional mortality: during research	Any	2[1]	1	Hawaiian Archipelago; Johnston Atoll
Unintentional mortality: during enhancement	Weaned pup	2[2]	1	Hawaiian Archipelago; Johnston Atoll
Unintentional mortality: during enhancement	Juvenile/ Sub-adult	4[3]	1	Hawaiian Archipelago; Johnston Atoll
Unintentional mortality: during enhancement	Adult male	2[4]	1	Hawaiian Archipelago; Johnston Atoll
Euthanasia of moribund seals	Any	*	1	Hawaiian Archipelago; Johnston Atoll

[1]Two unintentional research-related mortalities annually not to exceed 4 over 5 years.
[2]Two unintentional enhancement-related mortalities annually not to exceed 4 over 5 years.
[3]Four unintentional enhancement-related mortalities annually not to exceed 8 over 5 years.
[4]Two unintentional enhancement-related mortalities annually not to exceed 4 over 5 years.
*10 over 5 years

2.2.1 Permit authorization authority

The Permits Division proposes to issue permit No. 16632, authorizing the take of Hawaiian monk seals for scientific research and to enhance the survival and recovery of the species, under section 10(a)(1)(A) of the ESA (50 CFR 222) and section 104 of the Marine Mammal Act (50 CFR 216).

Research and enhancement activities permitted under section 10 of the ESA must further the conservation of the species. Section 10(d) requires that, in order to issue such a permit, the Permits Division must find that the permit:

- Was applied for in good faith;
- If exercised will not operate to the disadvantage of the species; and
- Will be consistent with the purposes and policy in section 2 of the ESA.

Activities permitted under section 104 of the MMPA must qualify as *bona fide* scientific research or enhance the survival or recovery of a species. To authorize take, the Permits Division must find that the manner of taking is "humane." To authorize lethal takes, they must find that non-lethal methods are not feasible and that lethal take will directly benefit the species or otherwise fulfill a critically important research need. Under the MMPA, permits issued by the Permits Division must specify:

- The number and species of marine mammals authorized to be taken or imported;

- The manner (for example, methods, including but not limited to, capture, care, and transportation), location, and duration of the activities; and
- Any other terms or conditions deemed appropriate.

2.2.2 Permit terms and conditions

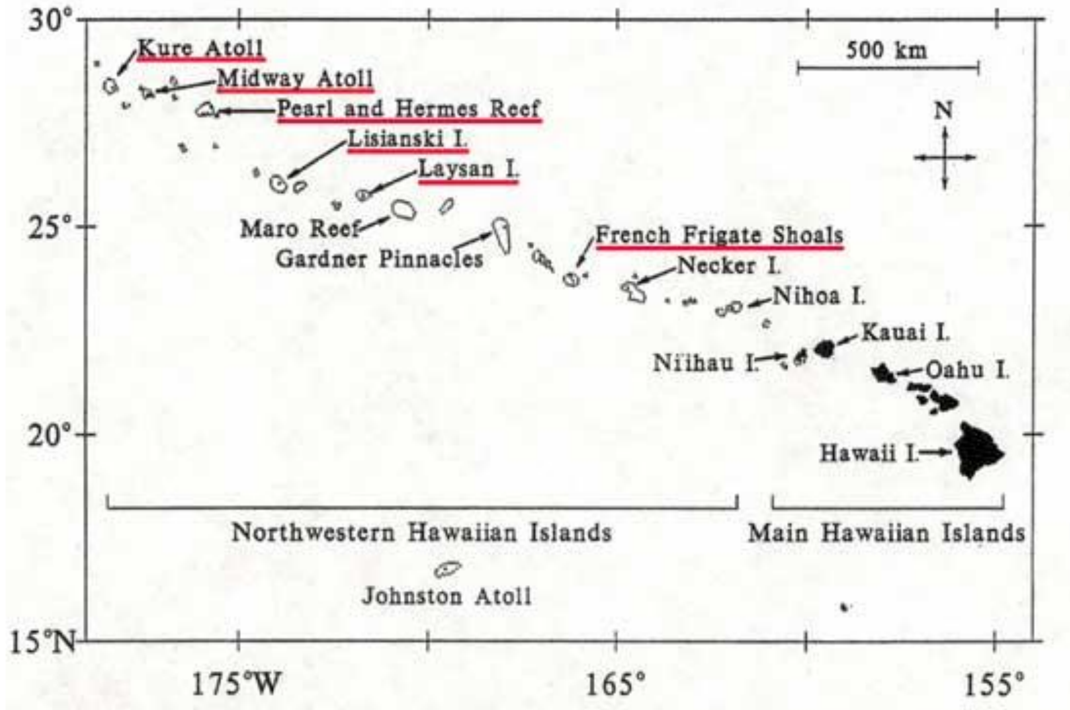
The Permits Division proposes to require the researchers to abide by general terms and conditions based on requirements of the statutes and regulations as well as special conditions for activities conducted on pinnipeds, and specifically on Hawaiian monk seals. The Permits Division would require the researchers to conduct activities by the means, in the areas, and for the purposes set forth in each permit application, and as limited by the terms and conditions specified in the permit. The Permits Division views permit noncompliance as a violation of the ESA and/or MMPA, requiring permit modification, suspension, or revocation, and possible enforcement actions. Permit No. 16632 lists all terms and conditions; the specific conditions are summarized as follows:

- Only experienced, well-trained personnel may perform intrusive procedures (including but not limited to blood and biopsy sampling and administering drugs). For activities involving sedation, an experienced marine mammal veterinarian must be present. An experienced veterinarian or highly qualified researcher under veterinary consultation must conduct euthanasia.
- The researchers must use sterile disposable needles, biopsy punches, and other sampling tools to the maximum extent practicable (they must always use disposable needles for blood sampling and injections of drugs or other approved substances). They must thoroughly clean and disinfect (with a bacteriocidal/virucidal agent, in accordance with product directions) all non-disposable equipment between animals and, as needed, immediately prior to each use.
- The researchers must monitor seals that have been captured, treated, or are recovering from immobilizing drugs to ensure they resume normal behavior and have an opportunity to recover without undue risk of drowning or injury from other animals.
- To the maximum extent feasible without causing further disturbance, researchers must monitor seals following any disturbance (e.g., sampling activities) to determine if any have adverse reactions or have been seriously injured or died as a result of the researchers' actions. In the event any seal is seriously injured, dies or is euthanized, a report must be submitted to the Chief of the Permits Division.
- Prior to initiating full-scale de-worming treatments or prophylactic vaccination treatments, the researchers/veterinarians must determine that the treatments have no significant adverse effects to seals.

3.0 Action Area

The action area consists of beaches and nearshore areas in the Hawaiian Archipelago, including the MHI and the NWHI, and Johnston Atoll (Fig. 4).

Figure 4. The action area and distribution of the Hawaiian monk seal (map courtesy of PIFSC).



4.0 Approach to the Assessment

Section 7(a)(2) requires every Federal agency, in consultation with and with the assistance of NMFS, to insure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any ESA-listed species or result in the destruction or adverse modification of critical habitat.

During the consultation and described in this Opinion, we first reviewed all relevant information provided by the researchers and the Permits Division to describe the action, including interrelated and interdependent actions. Interrelated actions are part of a larger action and depend on the larger action for their justification. Interdependent actions have no independent utility apart from the proposed action. We also described the action area, which includes all areas affected directly and indirectly by the action.

Second, we evaluated the current status of the Hawaiian monk seal and its critical habitat. We also evaluated the environmental baseline (i.e., past and present anthropogenic impacts within the action area).

Third, we evaluated the direct and indirect effects of the action on the species and its designated critical habitat. Indirect effects are caused by the proposed action and are later in time, but still are reasonably certain to occur. We assessed the exposure to physical, chemical, or biotic stressors produced by the proposed action, whether such exposure is likely to reduce the survival and reproduction of individuals, and whether fitness reductions would threaten the viability of populations and species. We assessed whether the action is likely to reduce the conservation value of critical habitat. We did not rely on the regulatory definition of "destruction or adverse modification of critical habitat (50 CFR 402.02); instead, we relied upon the statutory provisions of the ESA to complete our critical habitat analysis. We also searched for data on cumulative effects of non-Federal activities (i.e., State and private) that are reasonably certain to occur within the action area. For all analyses, we used the best available scientific and commercial data. For this consultation, we relied on information submitted by the action agencies, government reports, and the general scientific literature. To determine probable responses to the action, we used *Google Scholar* to search for information on the species, stressors, and possible effects. When the information presented contradictory results, we described all results, evaluated the merits or limitations of each study, and explained how each was similar or dissimilar to the proposed action to come to our own conclusion.

We used the above steps to help formulate our biological and conference opinion. Because we are consulting on the researchers' proposed research and enhancement program, which consists of many activities conducted over several geographic areas and long periods of time, there is substantial uncertainty about the number, location, timing, frequency, and intensity of individual activities. Therefore, we conducted a programmatic consultation to determine whether the researchers have insured that their program is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. Specifically, we asked the following questions:

1. Have the researchers structured the proposed programmatic action to identify, inform, encourage, and screen applicants (in this case, additional researchers or co-investigators) for potential eligibility under or participation in the programmatic action?

2. Have the researchers structured their program to know or be able to reliably estimate the probable number, location, and timing of activities?

3. Have the researchers structured their program to know or reliably estimate the physical, chemical, or biotic stressors that are likely to be produced as a direct or indirect result of activities?

4. Have the researchers structured their program to minimize likely adverse effects of such activities on ESA listed species and designated critical habitat?

5. Have the researchers structured their program to continuously monitor and evaluate likely adverse effects on listed species and critical habitat?

6. Have the researchers structured their program to encourage, monitor/evaluate, and enforce compliance (in this case, compliance of all researchers with their permits and program activities)?

7. Have the researchers structured their program to allow them to change their action, if deemed necessary, to minimize unanticipated impacts on listed species and critical habitat?

We used the answers to these questions to determine whether and to what extent the researchers have designed their program to minimize impacts to ESA-listed resources, monitor impacts of the action on listed resources, and modify their activities, if necessary, to avoid jeopardizing species and destroying or adversely modifying critical habitat.

5.0 Status of the Species

Table 2 describes the ESA-listed and proposed species and critical habitat that occur in the action area.

Table 2. Listed species and critical habitat (*) that may occur in the action area.

Common Name (DPS), *Critical Habitat	***Scientific Name***	***Status***
Cetaceans		
Sperm whale	*Physeter macrocephalus*	Endangered
Blue whale	*Balaenoptera musculus*	Endangered
Fin whale	*Balaenoptera physalus*	Endangered
Humpback whale	*Megaptera novaeangliae*	Endangered
Sei whale	*Balaenoptera borealis*	Endangered
False killer whale (Hawaiian insular)	*Pseudorca crassidens*	Endangered
Pinnipeds		
Hawaiian monk seal*	*Monachus schauinslandi*	Endangered
Marine Turtles		
Green sea turtle (All other areas)	*Chelonia mydas*	Threatened
Hawksbill sea turtle	*Eretmochelys imbricate*	Endangered
Leatherback sea turtle	*Dermochelys coriacea*	Endangered
Loggerhead sea turtle (North Pacific)	*Caretta caretta*	Endangered
Olive ridley sea turtle (All other areas)	*Lepidochelys olivacea*	Threatened
Corals		
Fuzzy table coral	*Acropora paniculata*	Proposed Threatened
Blue rice coral	*Montipora flabellate*	Proposed Threatened
Blue rice coral	*Montipora dilatata*	Proposed Threatened
Blue rice coral	*Montipora turgescens*	Proposed Threatened
Sandpaper rice coral	*Montipora patula*	Proposed Threatened
Sandpaper rice coral	*Montipora verrilli*	Proposed Threatened

5.1 Species and Critical Habitat Not Further Considered in the Opinion

The purpose of the proposed actions is to conduct and authorize research and enhancement activities that promote the survival and recovery of the Hawaiian monk seal, a species discussed in a later section. Proposed activities may affect other ESA-listed and proposed species in the action area; however, they are not likely to adversely affect these species because the effects would be insignificant or discountable. Insignificant effects relate to the size of impact and do not result in take; discountable effects are unlikely to occur. The following species are not considered further in this Opinion.

5.1.1 Cetaceans

The researchers propose to conduct aerial surveys over the action area, in which the following cetaceans may occur: sperm whale, blue whale, fin whale, humpback whale, sei whale, and Hawaiian insular false killer whale. If cetaceans were observed, the researchers would increase their minimum altitude to 1000 ft (PEIS 2013). The researchers would not hover or circle over cetaceans. Their flights may pass unknowingly over submerged cetaceans; however, any disturbance would be transient and minimal. We conclude that the distant sight and noise of the aircraft would have an insignificant impact on the behavior of ESA listed cetaceans and are not likely to adversely affect these species.

Similarly, the researchers would not intentionally approach non-target species during their proposed vessel surveys. They would avoid all cetaceans. The small boats and research vessel would operate at slow speeds and abide by safe boating guidelines. In addition to the captain or boat driver, there would be observers aboard to watch out for cetaceans. To date, there have been no documented incidents of collision with cetaceans. We conclude that the likelihood of vessel disturbance or collision is discountable, i.e., extremely unlikely to occur, and not likely to adversely affect listed cetaceans.

5.1.2 Sea turtles

The researchers propose to conduct beach surveys and may encounter sea turtles on land, where the U.S. Fish and Wildlife Service has jurisdiction over sea turtles on land and in near-shore waters over the species. Therefore, we do not analyze the action’s effects on sea turtles on land in this Opinion.

The researchers also propose to conduct aerial surveys. They would maintain minimum distances of 300 ft (fixed-wing manned aircraft) 250 ft (helicopters), or 10 ft (unmanned aircraft). They would not hover or circle over sea turtles. Their flights may pass unknowingly over submerged sea turtles; however, any disturbance would be transient and minimal. We conclude that the distant sight and noise of the aircraft would have an insignificant impact on the behavior of ESA-listed sea turtles and are not likely to adversely affect these species.

Similarly, the researchers would not intentionally approach non-target species during their proposed vessel surveys. They would avoid all sea turtles. The small boats and research vessel would operate at slow speeds and abide by safe boating guidelines. In addition to the captain or boat driver, there would be observers aboard to watch out for sea turtles. To date, no collisions with sea turtles during Hawaiian monk seal research and enhancement activities have been documented. We conclude that the likelihood of vessel disturbance or collision is discountable, i.e., extremely unlikely to occur, and not likely to adversely affect listed sea turtles.

5.1.3 Corals

Six proposed coral species occur in the action area: *Acropora paniculata*, *Monitpora flabellate*, *M. dilatata*, *M. turgescens*, *M. patula*, and *M. verrilli*. The researchers would avoid these corals while conducting beach surveys. Vessel operators would be trained to avoid corals. They would use mooring buoys and avoid anchoring on corals. They would regulate vessel discharges, insuring that their small boats, engines, and anchor lines are free of non-native species and meeting all EPA emission requirements for engines. These activities would have insignificant effects and are not likely to adversely affect corals.

The researchers may affect coral if marine debris entangling a seal was caught on the coral (an unlikely but possible occurrence). In such an instance, the researchers would use tools to remove the marine debris from the seal and coral. We conclude that the activity would have beneficial effect to the coral because it would remove the damaging effects of the marine debris and struggling seal.

5.2 Species and Critical Habitat Likely to Be Adversely Affected by the Action

5.2.1 Hawaiian monk seal

Species description

The Hawaiian monk seal is a large-bodied, warm-water phocid. It is endemic to the Hawaiian Archipelago, with individuals occasionally observed at Johnston Atoll. The species was listed as endangered under the ESA in 1976 (41 FR 51611) and is designated as depleted under the Marine Mammal Protection Act (41 FR 30120). The species is categorized as Critically Endangered by the IUCN Red List, as a result of its small population size, ongoing decline, and continued exposure to threats (Lowry et al. 2011).

Life history

Most monk seal pups are born between February and August (Johanos et al. 1994). They nurse for 5-6 weeks, during which time the mother does not forage. Upon weaning, the mothers return to sea, and the pups are left unattended on the beaches. Females spend approximately 8-10 weeks foraging at sea before returning to beaches to molt (Johanos et al. 1994). Females mature at 5 – 10 years of age. Males likely mature at the same age but may not gain access to females until they are older. Males compete in a dominance hierarchy to gain access to females (i.e., guarding them on shore). Mating occurs at sea, however, providing an opportunity for female mate choice. Though some females produce pups every year after first parturition, most do not. Overall reproductive rates are low, especially in the NWHI. Pup production in the NWHI declined dramatically in the 1990s, possibly reflecting unfavorable environmental conditions. Maternity is assigned when females are observed nursing pups. Observational bias is high (e.g., births occur outside of the annual field seasons and on unmonitored beaches), and it is not rare for maternity to go unrecorded. Fertility and reproduction rates are therefore minimum estimates. Monk seals are considered foraging generalists that feed primarily on benthic and demersal prey (Goodman-Lowe 1998, Longenecker 2010). They feed primarily in depths between 20 and 100 m (Littnan et al. 2006) though some foraging occurs in subphotic zones either because these areas host favorable prey items or because these areas are less accessible by competitors (Parrish 2009). For a variety of potential reasons (e.g., competition, foraging limitations, inexperience, and prey quality), juvenile seals in the NWHI are unable to attain sufficient food resources to survive may not have the experience, endurance, or diving capacity to make such deep dives, leaving them more susceptible to starvation.

Population dynamics

To describe the population dynamics of the species, we used data from the 2011 annual report, because there was a dramatic reduction in field effort in 2012, as a result of reduced funding

(NMFS 2013). As of 2011, the best estimate of total abundance was 1,055 Hawaiian monk seals (HMSRP 2012). The majority of seals (N = 909) reside in the NWHI, where abundance has increased in each of the past three years but has decreased a total of 68% since 1958 (NMFS 2006, Carretta et al. 2009, HMSRP 2012). Monk seals are highly mobile and capable of long distance movements; however, seals move primarily among neighboring islands, especially among those in close proximity. Gene flow is sufficient to prevent genetic differentiation among subpopulations at both nuclear (microsatellite) and mitochondrial markers (Kretzmann et al. 1997, Schultz et al. 2011a).

Most seals haul out and give birth on beaches at six subpopulations: French Frigate Shoals, Laysan Island, Lisianski Island, Pearl and Hermes Reef, Midway Atoll, and Kure Atoll. Seals also haul-out and give birth at Necker and Nihoa Islands, where estimates of abundance are unreliable because field effort is low. Since the 1990s, there has been a rapid increase in the number of monk seal sightings and births in the MHI (Baker and Johanos 2004). As of 2011, a total of 146 seals were documented in the MHI, where the subpopulation is growing at a rate of seven percent annually (Baker and Johanos 2004, Baker et al. 2011b, HMSRP 2012). Because abundance trends differ among subpopulations, we provide additional details on each below.

French Frigate Shoals. In 2011, the minimum estimate of seals was 190 (i.e., 37 pups and 153 non-pups). During the early 1980s, this subpopulation hosted the largest subpopulation of monk seals, but abundance has steadily declined since 1989. An average of 22 percent of pups survive from weaning to 3 years of age (NMFS, unpublished data). Though this rate has increased in recent years, decades of poor juvenile survival have resulted in degraded age structure and diminished pup production, such that future decline is inevitable (Lowry et al. 2011). Food limitation, entanglement in marine debris, and shark predation contribute to a high rate of juvenile mortality, which is driving the population decline (Antonelis et al. 2006, Baker 2008).

Laysan Island. Laysan currently hosts the largest subpopulation of Hawaiian monk seals. In 2011, 226 seals were counted at Laysan (i.e., 40 pups and 186 non-pups). On average, 46 percent of pups survive from weaning to 3 years of age (NMFS, unpublished data). As a result, the age structure is not as degraded as observed at French Frigate Shoals. Though the subpopulation has declined in abundance since 2000, it has exhibited positive growth over the past 3 years (HMSRP 2012).

Lisianski Island. In 2011, 152 seals were counted at Lisianski (i.e., 15 pups and 137 non-pups). The population has slowly declined in abundance since 2000. On average, 44 percent of pups survive from weaning to 3 years of age (NMFS, unpublished data). As a result, the age structure is not as degraded as observed at French Frigate Shoals (HMSRP 2012). Lisianski continues to decline but at a slow rate.

Pearl and Hermes Reef. In 2011, 181 seals were counted at Pearl and Hermes (i.e., 21 pups and 160 non-pups). The population has declined in abundance since 1995, but there has been positive growth over the past 3 years (HMSRP 2012). On average, 68 percent of pups survive from weaning to 3 years of age (NMFS, unpublished data); this juvenile survival rate is higher than any other subpopulation in the NWHI. As a result, the age structure is not as degraded as observed at French Frigate Shoals (HMSRP 2012). After many years of decline, the subpopulation may be showing signs of recovery.

Midway Island. In 2011, 50 seals were counted at Midway (i.e., 10 pups and 40 non-pups). Population abundance has declined since 2000. This subpopulation has never been large; and it has been extirpated in the recent past, likely as a result of human disturbance (Kenyon 1972). On average, nine percent of pups survive from weaning to 3 years of age (NMFS, unpublished data). Variable juvenile survival has led to a fractured age structure. Pup production is low but relatively steady (HMSRP 2012).

Kure Atoll. In 2011, 110 seals were counted at Kure (i.e., 18 pups and 110 non-pups). The population has declined in abundance since 2000, but there has been positive growth over the past 3 years (HMSRP 2012). On average, 37 percent of pups survive from weaning to 3 years of age (NMFS, unpublished data). As a result, the age structure is not as degraded as observed at French Frigate Shoals (HMSRP 2012).

Necker and Nihoa Islands. Population abundances at Necker and Nihoa Islands are not well characterized because field efforts at these sites are low. A single beach count has been conducted at these islands in most recent years (HMSRP 2012). Necker is highly variable; we assume that its status is stable. Nihoa seems to be increasing in abundance (HMSRP 2012).

Main Hawaiian Islands. A minimum of 146 monk seals reside in the MHI (i.e., 23 pups and 123 non-pups). The MHI exhibit the highest growth rates of all subpopulations (HMSRP 2012). Though this subpopulation continues to grow at a rate of seven percent per year, there is concern over intentional killings in recent years. Three deaths are currently under investigation (McAvoy 2012).

Population viability

In the past, Hawaiian monk seals were harvested for their meat, oil and skins, leading to extirpation in the MHI by the 19th century (Baker and Johanos 2004, Schultz et al. 2010, Watson 2011) and near-extinction of the species by the 20th century (Hiruki and Ragen 1992, Ragen 1999). Though no longer harvested for commercial or subsistence purposes, several seals have been recently killed in the MHI, possibly reflecting conflict over actual and perceived fisheries interactions (Watson 2011, McAvoy 2012). The species faces other anthropogenic threats including: entanglement in marine debris; fishery competition for prey; disturbance on MHI beaches; and global climate change. Declines in NWHI subpopulations, however, are mainly attributed to natural threats, including: starvation; predation by sharks; competition with sharks and large carnivorous fish; male aggression; beach erosion; and environmental changes that reduce prey availability. Each of these threats is further discussed in the *Environmental Baseline* section.

Status summary

The Hawaiian monk seal is a critically endangered species that continues to decline in abundance, presumably as a result of changes to their foraging base. With only ~1,000 individuals remaining, the species' resilience to further perturbation is low. Other species in the same genus have gone extinct (Caribbean monk seal) or have been extirpated from the majority of their previous range (Mediterranean monk seal). We conclude that the Hawaiian monk seal's resilience to further perturbation is low, and its status is precarious.

5.2.2 Hawaiian monk seal critical habitat

Critical habitat was originally designated on April 30, 1986 (51 FR 16047) and was extended on May 26, 1988 (53 FR 18988; CFR 226.201). Monk seal critical habitat includes all beach areas, sand spits and islets, including all beach crest vegetation to its deepest extent inland, lagoon waters, inner reef waters, and ocean waters out to a depth of 20 fathoms (37 m) around the NWHI breeding atolls and islands. These include the following: Kure Atoll (28°24′ N, 178°20′ W), Midway Islands, except Sand Island and its harbor (28°14′ N, 177°22′ W), Pearl and Hermes Reef (27°55′ N, 175° W), Lisianski Island (26°46′ N, 173°58′ W), Laysan Island (25°46′ N, 171°44′ W), Maro Reef (25°25′ N, 170°35′ W), Gardner Pinnacles (25°00′ N, 168°00′ W), French Frigate Shoals (23°45′ N, 166°00′ W), Necker Island (23°34′ N, 164°42′ W), Nihoa Island (23°03.5′ N, 161°55.5′ W).

The marine component of this habitat was designated primarily as feeding areas for Hawaiian monk seals, while terrestrial habitat serves as resting habitat for all seals as well as pupping and nursing habitat for mothers and pups. Both components are currently under significant degradation pressure.

On June 2, 2011, NMFS published a proposed rule to revise critical habitat for Hawaiian monk seals (76 FR 32026). They proposed to extend the current designation in the NWHI out to the 500 m depth contour, include Sand Island at Midway Atoll, and designate six new areas in the MHI. These areas in the MHI include: terrestrial and marine habitat from 5 m inland from the shoreline extending seaward to the 500 m depth contour around Kaula Island, Niihau, Kauai, Oahu, Maui Nui (including Kahoolawe, Lanai, Maui, and Molokai), and Hawaii (except those areas that have been identified as not included in the designation). Some areas would be excluded from designation because the national security benefits of exclusion outweigh the benefits of inclusion. Exclusion of these areas would not result in extinction of the species. These areas include: Kingfisher Underwater Training area in marine areas off the northeast coast of Niihau; Pacific Missile Range Facility Main Base at Barking Sands, Kauai; Pacific Missile Range Facility Offshore Areas in marine areas off the western coast of Kauai; the Naval Defensive Sea Area and Puuloa Underwater Training Range in marine areas outside Pearl Harbor, Oahu; and the Shallow Water Minefield Sonar Training Range off the western coast of Kahoolawe in the Maui Nui area. A final rule has not yet been published as of the date of this Opinion.

6.0 Environmental Baseline

The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions, which are contemporaneous with the consultation in process (50 CFR 402.02). Because it would be difficult to list all such past and present impacts in the Hawaiian Archipelago and Johnston Atoll, we describe the natural and anthropogenic impacts that have shaped the status and trends of the Hawaiian monk seal and its critical habitat.

6.1 Prey limitation

Prey limitation is considered to be one of the primary reasons for the decline of monk seals in the NWHI (Craig and Ragen 1999, Antonelis et al. 2006, NMFS 2006, Baker 2008, Parrish et al. 2011). It may result in decreased pup girth at weaning, high juvenile mortality, delayed age at first parturition, low birth rate, and emaciated animals (Lowry et al. 2011). Young seals, in particular, may be inexperienced foragers and more susceptible to starvation. Additional stress and smaller size place these seals at further risk of disease, shark predation, and kleptoparasitism from interspecific competitors (Craig and Ragen 1999, Baker 2008). Furthermore, juveniles may not have the experience or metabolic reserves of adults, which forage at subphotic depths and target bottomfish assemblages (Parrish 2009).

6.2 Environmental variability

Reduced prey availability may be the result of an overall decline in ecosystem productivity as a result of environmental variability (Craig and Ragen 1999, Parrish et al. 2011). The Pacific Decadal Oscillation (PDO) is a well-documented, long-term pattern in which sea surface temperatures shift between positive and negative phases. In the Hawaiian Archipelago, the positive phase is associated with higher productivity, caused in part by southward migration of the nutrient-rich transition zone chlorophyll front. Numerous authors have documented the correlation between monk seal survival and variable oceanic productivity in parts of the NWHI (Polovina 1994, Polovina et al. 2001, Polovina 2005, Antonelis et al. 2006, Baker et al. 2007, Lowry et al. 2011, Parrish et al. 2011, Schultz et al. 2011b, Baker et al. 2012). The correlation extends to other NWHI species as well, including: lobsters, reef fish, sea birds, and bottomfish. Reduction in the prey base due to reduced primary productivity likely results in lower weaning weight in pups, emaciation in juveniles, increased competition, and increased predation (Baker et al. 2007). For example, just as the PDO was transitioning to the negative phase in 1998, monk seal abundance began to decline (Polovina 2005). Parrish et al. (2011) found that in a trophic model, PDO, along with fishery removal of bottomfish, provide the best explanations for recent monk seal declines at FFS. The most recent analyses of monk seal abundance trends and PDO, however, indicate a strong relationship at the northernmost atolls, but not at Laysan and French Frigate Shoals (Baker et al. in review).

Other oceanographic processes may influence monk seal survival. Antonelis et al. (2003) describe increased girths at French Frigate Shoals and Laysan during El Nino years. Weaned pups born at French Frigate Shoals were more likely to survive to age two, but this effect was not seen at Laysan. The mechanism for increased survival likely includes greater vertical mixing, increased prey abundance, and increased concentration of prey at shallower depths (Antonelis et al. 2003).

6.3 Predation

Tiger and Galapagos sharks are known to prey upon seals and are abundant in the NWHI (Dale et al. 2011a, Dale et al. 2011b). At French Frigate Shoals, Galapagos sharks also prey on preweaned pups. Between 1993 and 2010, an estimated 173 monk seal pups were killed by Galapagos sharks at French Frigate Shoals (Lowry et al. 2011). Shark culling from 2000 to 2007 removed 12 sharks, reducing annual pup predation from a high of 21 pups in 1999 to 6 – 11 pups in subsequent years (Gobush 2010). Given the decline in pup production (from 91 in 1993 to 37 in 2010), current predation rates are unsustainable (Lowry et al. 2011).

6.4 Male aggression

Multiple-male aggression, or mobbing, was at times the primary cause of adult female mortality at Laysan Island, and single male aggression is episodically a significant cause of pup mortality. Multiple-male aggression is thought to result when males significantly outnumber females (Johanos et al. 2010). To mitigate these threats, a total of 40 adult male seals were either translocated (N = 32), placed in permanent captivity (N =5), died during translocation (N =2), or were euthanized (N = 1). These individuals were removed from the gene pool; however, the loss of these males has had little effect on the species as a whole, as Hawaiian monk seals are polygynous and exhibit low genetic diversity. As a result of the removals, multiple male aggression related deaths have declined dramatically (Johanos et al. 2010).

6.5 Habitat loss

The majority of monk seals reside in the NWHI, which are protected as the Papahanaumokuakea Marine National Monument, one of the largest no-take marine reserves in the world. These low-lying islands are threatened by sea level rise and natural erosion. From 1985 to 1996, approximately 35 percent of French Frigate Shoals pups were born at Whaleskate, a 6.8 hectacre island. In the late 1990s, the island disappeared due to natural erosion. It is possible that loss of this important pupping beach led to crowding at Trig Island, which exposed pups to increased shark predation and ultimately contributed to the decline. Climate change, and sea level rise in particular, may contribute to future habitat loss (Baker et al. 2006).

6.6 Disease

Disease is a concern for the species, given its low genetic diversity and presumably depressed capacity for an effective immune response (Schultz et al. 2009, Schultz et al. 2010); however relatively few monk seals have been observed to have contracted or died of infectious diseases. As reviewed by Littnan et al. (2006) and Aguirre et al. (2007), infectious diseases that pose a risk to the species, include: chlamydia, toxoplasmosis, leptospirosis, morbillivirus, herpes, and heartworm. In 1978, the death of at least 50 Laysan seals was hypothesized to be associated with ciguatoxin poisoning, based on positive bioassay results and elephant seal feeding trials (DeLong and Gilmartin 1979). Ciguatoxin activity has since been detected in the tissues of dead stranded monk seals from the NWHI; however, ciguatoxin was also detected in 19% of healthy seals that were still alive several years later (Bottein et al. 2011). The researchers continue to sample and monitor the species for ciguatoxin outbreaks.

6.7 Over-exploitation

Little is known regarding early human-seal interactions in the Hawaiian Archipelago. Monk seals likely inhabited the entire Hawaiian Archipelago prior to human colonization. The species was extirpated from the MHI prior to Western colonization in 1778, and likely much earlier, given the lack of Hawaiian words, stories, and artifacts referencing monk seals (Watson 2011). Two midden deposits (on Maui and Hawai'i Islands) containing monk seal remains support the latter hypothesis. Given their lack of natural land predators, monk seals would have been easy prey and provide a large source of protein to early Hawaiians. Though the majority of seals now reside in the NWHI, the large islands of the MHI have the potential to provide more resting/nursing beaches; they also support a larger prey base. Therefore, it is possible that the MHI may have once served as primary habitat for the species, with the smaller islands of the NWHI providing peripheral or refugial habitat.

Western exploration of the NWHI led to the first description of the Hawaiian monk seal in 1805. Early explorers described the abundance of seals as “numerous,” “many,” and “considerable” (Hiruki and Ragen 1992, Ragen 1999, Schultz et al. 2011b). Over the next 80 years, hundreds to thousands of seals were hunted for their meat, skins and oil by sealers, shipwrecked sailors, and shark fishermen requiring bait (Ragen 1999). By 1900, at least two subpopulations (Laysan and Midway) appear to have been extirpated; the others were severely depleted (Ragen 1999). At its nadir, population abundance may have been as low as 23 individuals (Schultz et al. 2009). By the turn of the century, commercial hunting had ceased, and the subpopulations began to grow. By 1958, 916 non-pup seals were counted on the beach, representing a total population size of 1,350 – 2,962 individuals (Rice 1960, Gilmartin et al. 1991, Schultz et al. 2011b). The long-term effects of over-exploitation may have altered the species’ distribution (with the majority of seals now residing in the NWHI) and depleted its genetic diversity (Schultz et al. 2011b).

Between 2009 and 2012, six monk seals were killed in the MHI (Baker et al. 2011b, McAvoy 2012). The reason behind these killings is not certain but may reflect growing resentment toward a species that is considered by some to be a competitor to fishermen, a nuisance to beach goers, and/or an invasive species that was introduced to the MHI by NMFS (Watson 2011).

6.8 Fisheries interactions

Fisheries interactions comprise one of the greatest threats to monk seal survival. Monk seals often become entangled or hooked in active and discarded fishing gear. Between 1982 and 2006, 48 hookings were recorded throughout the archipelago. Over the same time period, entanglement in discarded fishing gear led to at least seven deaths and 32 serious injuries in the NWHI (Lowry et al. 2011). In the MHI, at least six seals have drowned in gill nets since 1976; three of those were since 2006 (Leone 2010). In the MHI, hooks often become imbedded in the mouth or in internal organs, killing the seal or preventing future foraging. Fishing may have indirectly helped the species as well: the large recreational fishery in the MHI may have reduced the number of large carnivorous fish in the area, inadvertently reducing inter-specific competition for monk seals (Baker and Johanos 2004).

Fishing no longer occurs in the NWHI; however the effects of distant fisheries linger. Each year, numerous seals are entangled in discarded fishing gear. Entanglements can lead to drowning or prevent the seal from foraging.

Reduced prey availability, as described above, may be the result of overfishing (Craig and Ragen 1999, Parrish et al. 2011). The monk seal decline coincided with the crash of the NWHI lobster fishery in 1999. Though the decline of both species could have been caused by environmental variability, the loss of a member of its prey base and the loss of bait and discards from the lobster fishery would certainly have contributed (Schultz et al. 2011b).

From 1930 to 2010, the bottomfish fishery targeted an important component of the monk seal diet (Goodman-Lowe 1998, Longenecker 2010, Parrish et al. 2011, Schultz et al. 2011b). Trophic model simulations indicate that fishery removal of benthic bottomfish, along with environmental variability (described above), may explain declining trends in monk seal abundance at French Frigate Shoals (Parrish et al. 2011).

Historically, numerous fisheries targeted shark and jack populations in the NWHI. These populations have likely grown in size since the NWHI became protected as the Papahanaumokuakea Marine National Monument and fishing is no longer allowed. It is also possible that unlike monk seal populations, these fish populations have remained large in size, despite fishing pressure, and occupied the niche of the monk seal when it was hunted to near extinction. Such competitive displacement would result in a lower carrying capacity for monk seals in the NWHI as compared to historic levels.

6.9 Human disturbance

Human disturbance of nursing and resting seals is a major concern in the MHI, where seals share the beaches with recreational beach-goers, fishermen, and pets. Volunteer groups and stranding network members try to monitor such activities and educate the public on proper viewing distances; however interactions still occur. Few people reside in the NWHI; however, there has been a history of disturbance at these islands. After the establishment of a LORAN station at Kure in 1960, pregnant seals abandoned the human-occupied beaches and instead pupped on ephemeral sand islets, possibly contributing to a 70% decrease in abundance over 20 years (Johnson et al. 1982). Military activities at Midway may have led to the extirpation of that subpopulation in the 1960s (Kenyon 1972). These activities have since ceased, and human disturbance is no longer a major threat in the NWHI.

6.10 Anthropogenic climate change

Anthropogenic climate change will undoubtedly influence the future abundance of monk seals. Warming sea surface temperatures and ocean acidification is likely to reduce the availability of prey (Polovina et al. 2008). Sea level rise would reduce available beach habitat. The result may be long-term, steady decline of monk seal carrying capacity in the NWHI (Schultz et al. 2011b).

6.11 Scientific research

Several active research permits authorize takes on Hawaiian monk seals. This Opinion describes the activities and permit that would replace the current permit No. 10137 and its amendments (01-07). Permit No. 932-1905/MA-009526, issued to the NMFS Marine Mammal Health and Stranding Response Program, authorizes takes of Hawaiian monk seals for response and rescue activities carried out under section 109(h) of the MMPA. Permits Nos. 13583 and 14301 authorize the import, export, and archival of monk seal specimens. Permit Nos. 13602, 15453, and 16124 authorize research on captive monk seals, and Permit No. 17429 authorizes permanent holding of captive monk seals. Permit Nos. 13846, 15240, 15330, and 16163 allow the incidental take (disturbance) of monk seals during cetacean studies in the Hawaiian Archipelago. Permit Nos. 17268, 17860, 18072, 18073, 18074, and 18075 allow the incidental take (harassment) of monk seals during offshore pile driving (17268) and military operations (all others).

6.12 Conservation, management, and recovery activities

The PIFSC has implemented numerous initiatives to mitigate declining abundance of the Hawaiian monk seal, including: removal of aggressive males from the population, translocation, rehabilitation, disentanglement, medical treatment, and population monitoring. These activities have met with a variety of success or failure but have definitively slowed, but not reversed, the species' decline (Harting et al. in prep.).

To mitigate the 70% decline in abundance at Kure, PIFSC researchers instituted a head start program from 1981-1991. They fed weaned female pups in shoreside enclosures for 23-188 days. Both treated and untreated pups exhibited increased survival rates over this time period, possibly indicating that the researcher's presence altered the disruptive behavior of the LORAN operators (Gilmartin 2011).

Between 1984 and 1995, PIFSC began a captive care and translocation program to salvage the reproductive potential of underweight or ill seals that were unlikely to survive if left untreated at French Frigate Shoals. They collected a total of 104 young female seals for captive care. Most of the seals (N = 74) were released at Kure; however, 17 died in captivity, and 13 were placed in permanent captivity due to the development of health (i.e., blindness) and behavioral problems. The initiative resulted in an estimated net gain of 10 – 28 seals (Gilmartin et al. 2011)

Systematic beach counts of seals have provided the framework for assessing long-term trends since 1982, and represent the most consistent data series during the past 26 years by which a long-term population trend can be assessed (NMFS 2009d). Systematic and extensive tagging has resulted in the individual identification of the majority of monk seals. These activities have few negative consequences and provide important data on abundance and population trends (Henderson and Johanos 1988, Baker and Johanos 2002). Such monitoring activities are key to assessing the current status and predicting future trends of the species.

In recent years, the researchers have introduced new enhancement initiatives. These include shark mitigation, anti-helmintic treatment, and inter-atoll translocation. It is too early to determine whether these initiatives have increased the fitness of individuals, slowed population declines, or increased the recovery potential of the species.

6.13 Summary

The Hawaiian monk seal continues to decline in abundance, primarily as a result of low prey availability, unfavorable environmental conditions, shark predation, and fisheries interactions. Other major stressors include habitat loss, male aggression, and harmful human interactions in the MHI. The decline is likely to continue without mitigation of these stressors. Therefore, we conclude that the Hawaiian monk seal's resilience to further perturbation is low, and its status is precarious.

7.0 Effects of the Action

Pursuant to Section 7(a)(2) of the ESA, Federal agencies are required to ensure that their actions are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. Using the best available scientific and commercial information, we describe: the potential physical, chemical, or biotic stressors associated with the proposed actions; the probability of individuals of listed species being exposed to these stressors; and the probable responses of those individuals (given exposure). If responses are likely to reduce an individual's fitness (i.e., growth, survival, annual reproductive success, and lifetime reproductive success), we evaluate the risk posed to the viability of the listed population. The ultimate purpose of this assessment is to determine whether the proposed action is expected to reduce the species' likelihood of surviving and recovering in the wild.

Our "destruction or adverse modification" determinations must be based on an action's effects on the conservation value of habitat that has been designated as critical to threatened or endangered species. If an area encompassed in a critical habitat designation is likely to be exposed to the direct or indirect consequences of the proposed action on the natural environment, we ask if primary constituent elements included in the designation (if there are any) or physical, chemical or biotic phenomena that give the designated area conservation value are likely to respond to that exposure.

For this consultation, we are particularly concerned about responses that are likely to result in a reduction of fitness of an individual. This includes behavioral disruptions that may result in an individual's failure to survive or breed successfully.

7.1 Stressors

The researchers propose to implement their research and enhancement program in an effort to promote recovery of the Hawaiian monk seal. While the purpose of each activity is to either study or enhance the survival of the species, several activities are likely to produce stressors to individual seals. We list these here and evaluate the potential responses to such stressors in the *Response* section. We also identify activities that are not likely to cause stressors; we do not consider these activities further.

- Monitoring/Survey/Observation: disturbance
- Capture/restraint: stress response, potential for injury or mortality
- Sedation: potential for overdose
- Disentanglement/Dehooking: pain, potential for injury
- Tagging/retagging: pain, potential for injury, potential for infection
- Mark with bleach: disturbance
- Specimen collection: pain, potential for injury, potential for infection
- Measurement/Weighing/Ultrasound: discomfort
- Administration of drugs and supportive fluids: potential for chemical reaction
- Deworming: potential for chemical reaction
- Vaccination: potential for chemical reaction
- Treatment of wounds: pain
- Instrumentation: increased drag, potential for entanglement
- Translocation: stress response, exposure to an unfamiliar environment, potential for injury, possible group effects
- Temporary captivity: stress response; potential for injury, potential for disease transmissioninfection
- Supplemental feeding: potential for developing behavioral issues
- Behavior modification: stress response, pain, displacement
- Mitigation of adult male aggression: loss of reproductive potential
- Euthanasia of moribund seals: mortality
- Unintentional mortality: mortality
- Issue permit and authorization of take: elevated take authorization
- Necropsy: no stressors identified; no further consideration
- Opportunistic retrieval of samples: no stressors identified; no further consideration

- Export/import of samples: no stressors identified; no further consideration

7.2 Exposure

The researchers propose to implement their research and enhancement program in an effort to promote recovery of the Hawaiian monk seal. Monk seals would potentially be exposed to all activities, as described in the *Description of the Action*. The researchers have been conducting similar research and enhancement activities for several decades and collecting data on these activities. We use their data from the past 10 years (2003 – 2012) to provide an estimate of the numbers of seals that are likely to be exposed to similar activities in the future. We provide two estimates: the mean (and 95% confidence interval) number of seals exposed to each activity between 2003 and 2012, which we use to describe the range of values for past events; and the mean plus four standard deviations of the mean, which we use to describe the maximum number of seals that are likely to be exposed to such activities in the future (Table 3). The following activities overlap with the activities described in Table 3 (i.e., they occur while conducting other activities and are not recorded separately): monitor/survey/observe, capture/restrain, sedate, collect specimens, measure, weigh, ultrasound, administration of drugs and supportive fluids, and treat wounds. The following activities are not included in Table 3 (see Table 1 for proposed takes): treatment with anti-helmintics, vaccination, second-stage and experimental translocation, temporary captivity, supplemental feeding, behavior modification, and mitigation of adult male aggression.

Table 3. Summary statistics of seals exposed to research and enhancement activities, annually from 2003 to 2012, and proposed annual maximum take for permit no. 16632. Mean, 95% confidence interval, and mean plus four standard deviations rounded up to the nearest whole number.

Activity	**Sex**	**Age**	**Mean (95% CI)**	**Mean + 4 SD**	**16632 proposed**
Tagging	Any	Any	156 (141, 171)	254	520
Retagging	Any	Any	15 (4, 25)	83	100
Bleaching	Any	Any	518 (442, 593)	1005	1495
Health screening	Any	Any	13 (8, 18)	43	100
Translocation[1]	Any	Pre-weaned	4 (2, 6)	17	As warranted
Translocation[2]	Any	Weaned	18 (14, 21)	38	As warranted
Translocation[3]	Any	Weaned	5 (3,8)*	14*	20
Removal	Male	Adult	1 (0, 1)	2	20
Disentanglement	Any	Any	11 (8, 14)	28	As warranted
Mortality (research)	Any	Any	1 (0, 1)	2	2

[1]Intra-island/atoll (mitigate pup separations)
[2]NWHI Intra-island/atoll and within MHI (risk alleviation)
[3]First stage of two-stage translocation (within NWHI or from MHI to the NWHI)
*Based on only three years of data (2008, 2009, and 2012)

In accordance with Section 10(a)(1)(A) of the ESA and section 104 of the MMPA, the Permits Division proposes to issue permit no. 16632. The permit describes the maximum number of exempted annual takes that would be allowed (Table 1), should the permit be issued. It is important to emphasize that the Table 1 defines the maximum level of take that would be permitted; it does not necessarily reflect the number of seals that *have been* exposed to such activities, or the number of seals that *are likely* to be exposed to such activities. We summarize the maximum take numbers (from Table 1) and include them in Table 3, for comparison. We use all numbers in our effects analyses below.

To estimate the number of seals that are likely to be exposed to each of the proposed research and enhancement activities, we use the mean plus four standard deviations of the mean (Table 3), for activities that have been conducted in the past. We define likelihood broadly as 99.99 percent of the “population” in a normal distribution (equivalent to a probability of greater than 1 in 10,000). This provides the benefit of the doubt to the species, and prevents us from underestimating the number of seals that may be exposed to an activity. We also consider the possibility that the researchers would use all of the proposed permitted “takes,” even though this is highly unlikely, given previous data (i.e., all proposed permitted take limits exceed our estimates, such that there is less than a 1 in 10,000 chance that such take would occur). Seals are likely to be exposed to many activities repeatedly, simultaneously, or throughout the year. Therefore, we also analyze the likely responses of seals to multiple exposures to several activities in our cumulative impacts section.

7.3 Response

In this section, we evaluate likely responses of Hawaiian monk seals to the proposed actions. For each activity, we review potential stressors and estimate the extent of exposure. We describe likely responses of an individual. Specifically, we determine whether an individual’s fitness is likely to be reduced as a result of the action. If so, we determine whether fitness reductions are likely to diminish population viability. If so, we determine whether diminished population viability is likely to jeopardize the species. We also determine whether the action will adversely affect critical habitat. If so, we determine whether the adverse effects are likely to reduce the conservation value of critical habitat.

7.3.1 Monitoring/Survey/Observation

The researchers’ monitoring program has been conducted for decades and constitutes the foundation upon which all other activities are built and evaluated. The researchers have established several preventative measures to minimize impact as a result of these activities; however, disturbance is likely to occur. This stressor ranges in severity from a simple head raise (little cost to an animal) to entering the water (energy costs and interruption of resting behavior). Monitoring may result in the disturbance of any seal (male or female, of any age).

In response to 2012 monitoring activities, seals responded in the following manner: 1.4 percent raised their head, 0.15 percent moved away (a distance of < 2 body lengths), and 0.36 percent entered the water (NMFS 2013). Between 2003 and 2007, there were 126,912 sightings of seals in the NWHI (NMFS, unpublished data). Of these, only 3,746 (2.95 percent) resulted in disturbances. Only 690 sightings (0.54 percent) resulted in movement into the water. Seals did not respond to the vast majority of sightings (123,166 or 97.05 percent). These findings are consistent over longer time frames (1997-2007), in which the overall rate of response approaches is also 2.95 percent, with less than one percent entering the water (NMFS 2008). Therefore, it is likely that less than three percent of all future monitoring activities are likely to result in disturbance and less than one percent is likely to result in the most severe response (movement into the water).

Hawaiian monk seals that enter the water upon approach are believed to do so as a stress response. However, in response to monitoring, Hawaiian monk seals have not been observed to exhibit the behavioral characteristics of a strong fight-or-flight response (e.g., massive cortisol release, extreme and persistent escape or attack behavior, cardiomyopathy, frequent death during invasive human interaction) (Reif and Bachand 2004). Abandonment of a beach or island/atoll subsequent to the researchers' actions has not been documented, and individuals are regularly resighted (NMFS 2009c). We do not expect death or stress pathology (such as myopathic injury) to result from monitoring activities. In the rare event (less than one percent) that seals move to the water following approach, we expect that individuals will experience a low-level stress response, without any fitness consequence.

Monitoring/surveys/observation results in disturbance in less than three percent of exposures. As described above, such disturbances are short-lived and cause at most minor physiological changes. As described in the PEIS, a seal would experience such disturbances five times per year, at most (PEIS 2013). Therefore, we do not expect such activities to result in fitness reductions for any individual.

7.3.2 Capture and Restraint

The researchers propose to capture and restrain seals for a variety of research and enhancement activities, including: tagging/measuring, medical treatment, disentanglement/de-hooking, biomedical sampling, de-worming, vaccinations, translocation, and instrumentation. They have captured and restrained seals for decades and have established effective protocols to minimize impact on seals; however, such activities are likely to result in a "fight or flight" response. The severity of such a response ranges from disturbance or alarm to possible injury or mortality. Responses are likely to occur in all seals (male or female, of any age), though the responses of recently weaned pups are likely to be less severe than older seals.

Seals respond to capture and restraint by vocalizing, biting, or trying to escape. Vocalizations or defense behavior is not likely to adversely affect seals. Attempts to escape could lead to injuries (such as contusions, lacerations, abrasions, hematomas, concussions, and fractures) or death. Stress responses could also lead to hyperthermia (excessively high body temperature which could lead to muscle rigidity, brain damage, or death) and myopathy from increased muscle activity. Capture myopathy is associated with prolonged or repeated stress responses in many mammals (though whether it occurs in pinnipeds is uncertain) and is characterized by degeneration and necrosis of striated and cardiac muscles (Fowler 1986). It may be fatal and may not develop until many days after capture and handling. After release, most seals enter the water and return to the beach within hours (Amy Sloan and Thea Johanos, pers. comm.). Recently weaned pups, however, often remain on land after capture.

To determine the effects of capture and restraint ("handling") on Hawaiian monk seals, Baker and Johanos (2002) compared the survival, migration, and condition of handled seals (N = 549) and non-handled "control" seals (N = 549) between 1983 and 1998. There were no significant differences in survival (i.e., resighting rates of 80 – 100 percent), observed migration, and body condition between handled seals and controls. Similarly, Henderson and Johanos (1988) determined that capture, brief restraint without sedation, and flipper tagging had no effect on subsequent behavior of weaned pups.

Between 1982 and 1999, 5 of 4,800 handled seals (0.1 percent) died as a result of capture and/or restraint (Baker and Johanos 2002). One of these seals died as a result of male aggression, after release (therefore, restraint may have been a contributing factor but was not the ultimate cause of death). Two seals died as a result of capture stress, and the cause of death was undetermined for the other two seals. In recent years (1999 – 2013), only two seals have died as a result of capture and/or restraint. An old, adult male died while under restraint and sedation; the subsequent necropsy identified a heart abnormality (J. Baker pers. comm.) The other seal exhibited a defense behavior, rearing up its head defensively, upon approach. In the process, it hit a nearby rock, resulting in a catastrophic head injury. This appears to have been a rare incident because seals often perform similar displays in response to other seals and are commonly found in rocky environments; however, researchers since have modified their protocols to avoid such risks. Their protocols now require the following: "Prior to any animal capture the site would be evaluated for presence of environmental hazards that could present a risk of injury to the animal or the handlers. For example, seals would not be restrained or tagged if they are in proximity to rock ledges or dangerous substrate." Therefore, we do not expect similar incidents in the future. Combining all data (1982 to 2013), 7 of 8,644 handled seals (0.08 percent) died as a result of capture and restraint.

The researchers are likely to handle approximately 300 seals annually and are permitted to handle approximately 600 seals annually. Given the data above, we would expect 0.2 to 0.4 (i.e., one seal) unintentional mortalities annually, as a result of capture and restraint.

As a result of capture and restraint, seals are likely to experience a "fight or flight" response, which does not significantly change body condition or migration behavior. Less than one in a thousand handled seals, however, die from related complications. Therefore, capture and restraint results in the mortality of at most one individual of either sex and of any age, annually. We will assess the impact of such loss in a later section, when we consider the effect of the action on population viability.

7.3.3 Sedation

The researchers propose to sedate seals when they need to restrain them for longer periods of time (> 10 minutes) or when they need to perform more invasive procedures (e.g., remove an imbedded hook). To sedate a seal, an experienced veterinarian uses (or directs the use of) diazepam (valium) or midazolam (drugs and dosages are explained in Appendix C of the PEIS). The researchers have sedated seals for decades, and these past experiences have informed current protocols and dosages. As described in the PEIS, administration of the drugs could cause pain, stress, and damage to the vein or surrounding tissue. Possible side effects include bradycardia (slowed heart rate), respiratory depression, tremor, confusion, blurred vision, nausea, vomiting, depressed gag reflex, lethargy, and ataxia (inability to coordinate muscle activity during voluntary movement). Miscalculation of dosage could lead to overdose and consequently death.

In a previous biological opinion (NMFS 2009a), we described the effects of diazepam in detail. Here we provide a summary of that information. Diazepam is routinely used to sedate marine mammals; recommended dosages have a high safety margin (Gales 1989). The counteractive drug flumazenil would be administered except in cases of diazepam overdose. Diazepam has been used as a sedative for Hawaiian monk seals in approximately 300 animals. Effects appear in Hawaiian monk seals within 20-40 seconds of administration by injection to the extradural vein and is similar to times reported in harbor seals (Lapierre et al. 2007; Bob Braun, pers. comm.). Respiratory and heart rate depression are observed in Hawaiian monk seals and neonatal harbor seals (likely a result of sympathetic nervous system depression), but return to normal (precapture) levels shortly thereafter in Hawaiian monks seals (Lapierre et al. 2007; Bob Braun, pers. comm.). Seals frequently enter a sleeping state (apparent by snoring; Thea Johanos and Amy Sloan, pers. comm.). None of the 300 seals treated with diazepam have died or experienced injury as a result of sedation (Bob Braun, pers. comm.). Administration of diazepam to Hawaiian monk seals has resulted in predictable sedation and has not been implicated in any individual pathology.

In pregnant humans, side effects of diazepam can include congenital abnormalities, if administered in the first trimester (Plumb 2005); however, use of diazepam is widespread in pinnipeds, and observed birth defects have not been observed (Frances Gulland, pers. comm.). Metabolites may be found in milk that can cause effects in the central nervous system of pups; however, nursing mothers will not be exposed to diazepam, and therefore no such response is expected.

Overall, sedation is expected to reduce the stress response caused by capture and restraint (Champagne et al. 2012). Additionally, individuals may experience a temporary loss of memory (i.e., forgetting the incident), resulting in the reduction of the severity of the stress response, during future captures. As no individual is known to have died as a result of sedation (Bob Braun, NMFS, pers. comm.), mortality is not an expected response. We do not expect a reduction in fitness of any individual, as a result of sedation.

7.3.4 Disentanglement/Dehooking

The researchers propose to disentangle seals from marine debris and remove hooks, as necessary. Such activities are proposed to improve the overall condition of the seal, though they may result in immediate pain or injury.

In some cases, debris is cut away from seals while they are asleep, and no disturbance occurs. In other cases, seals must be captured to disentangle them or remove an embedded fishing hook. As described above, seals are likely to experience a stress response as a result of capture. Further injury is possible, but not likely, because the researchers would use caution to avoid causing any further injuries than those resulting from the entanglement.

As described in the PEIS, entanglement in marine debris and hookings are known sources of serious injury and mortality. As such, the risks associated with disentanglement/dehooking are weighed against the risks of leaving the debris or hooks in place (PEIS 2013). Nearly 300 Hawaiian monk seals have been observed entangled in marine debris and over 60 have been observed with embedded hooks (Carretta et al. 2010). None of these individuals have experienced additional injury or died as a result of disentanglement or dehooking.

Overall, disentanglement and dehooking is expected to remove impediments to a seal’s survival. No individual has been injured or died as a result of such activities. Therefore, disentanglement or dehooking is likely to increase the fitness of individuals and not likely to reduce the fitness of any individuals.

7.3.5 Tagging/Retagging

The researchers propose to tag or retag seals for identification and resighting purposes. Such activities are common to wildlife research. Possible stressors include: pain, potential for injury, and potential for infection.

Since the early 1980s, nearly all Hawaiian monk seals have been captured, restrained and tagged with plastic flipper tags as soon as possible after weaning. To ensure that this practice did not have negative effects, Henderson and Johanos (1988) conducted a study at Lisianski Island to compare the early survival, behavior, and movements of tagged and untagged weaned pups. They found no differences in any of these metrics between tagged and untagged pups. For most Hawaiian monk seals, initial tagging at weaning is the only time in their lives they are handled by humans. However, some seals may be captured, restrained and retagged at an older age if their flipper tags become lost, worn or broken. Baker and Johanos (2002) compared the survival, migration, and condition of 437 seals during the year subsequent to retagging to an equal number of matched controls with pre-existing tags. It was important to choose control seals that were already tagged, so that probability of resighting would not be biased between the two groups. They found no differences in survival, migration, or condition between the retagged and control groups.

Tagging is likely to cause temporary pain to seals. Despite the potential for injury or infection, tagging does not reduce the survival rate, migration patterns, or body condition of seals. Therefore, tagging is not likely to result in fitness reductions for any individuals.

7.3.6 Mark

The researchers propose to mark seals with bleach for easy identification and monitoring. Disturbance is a possible stressor that may result from this activity.

During the bleaching process, most seals do not awaken, but some do. In these cases, disturbance may occur as described above, in the monitoring section. Field staff is instructed not to place bleach to a part of the pelage that the seal could reach with a fore flipper, to ensure that the animal cannot rub any bleach on its face or in its eyes.

The researchers have applied many thousands of bleach markings on monk seals and have observed no negative effects other than the occasional minor disturbance (NMFS 2013). Bleach marking reduces other adverse effects to seals because it aids in detection of a seal's identity from a greater distance than would be possible with flipper tags alone, thereby reducing the necessary approach distance and consequently the chance of disturbance.

Bleach marking is likely to occasionally result in the disturbance of Hawaiian monk seals. As described above, such disturbances are expected to be short-lived and cause at most minor behavioral changes. Therefore, we do not expect such activities to result in fitness reductions for any individual.

7.3.7 Specimen Collection

The researchers propose to collect biological specimens from the seal. Such collections would cause discomfort and pain to the seal; there is also the potential for injury or infection. The researchers have been collecting specimens for decades and have modified their protocols to minimize discomfort and the risk of injury or infection. As described below, specimen collections are not expected to reduce the fitness of any seal.

Blood

The researchers would draw up to 105 ml of blood from the extradural vein using a standard syringe and external T-connector. The insertion of a needle is likely to cause pain and discomfort to the seal; however, it is not expected to cause injury or infection, as the entry point is minuscule. Blood removal would cause increased blood cell production, resulting in a metabolic cost to the seal. In studies done on human hospital patients, phlebotomy is associated with a decrease in hemoglobin and hematocrit, and can contribute to anemia (Thavendiranathan et al. 2005). Such responses, however, are expected to be temporary and minor. Therefore, we do not expect the collection of blood samples to reduce the fitness of any seal.

Skin

The researchers would collect and preserve the tissue plugs removed from the leather punch used during the flipper tagging procedure. As described above, this procedure does not reduce the survival rate, migration patterns, or body condition of seals. The researchers would also collect shed molt samples opportunistically, which would have no effect on the seals. Therefore, tissue collection is not likely to result in fitness reductions of any seal.

Blubber

The researchers would collect two blubber core samples (through the full depth of the blubber layer) from the dorsal pelvic region using a sterile 6 mm biopsy punch. Samples would only be collected from sedated seals, which would minimize any pain or discomfort. During the procedures, the researchers have observed a minor twitch at the insertion of the punch or when the punch reaches full depth, but the seal's heart rate and respiration are not affected, or they return to normal after the procedure is complete (Charles Littnan, NMFS, pers. comm.). This is consistent with the behavioral responses observed in cetaceans as a result of biopsy samples, which are not performed under sedation. Responses for whales include tail flicks and submerging, and animals typically resume normal behavior within a few minutes of the stressor (Weinrich et al. 1991, Weinrich et al. 1992, Gauthier and Sears 1999). Scarring is likely to happen at the site of the blubber plug; however, injury or infection has not been observed. Therefore, blubber collection is not likely to result in fitness reductions of any seal.

Swabs

The researchers would collect microbial and/or viral swabs from the following sites: eyes, nares, mouth, anus, genital orifice, and external wounds. We expect that some seals may experience minor discomfort; however, swab collections are not likely to result in fitness reductions of any seal.

Fecal Collection

The researchers would collect fecal samples using a fecal loop or digital extraction. We expect seals to experience minor discomfort; however, fecal collections are not likely to result in fitness reductions of any seal.

Whisker

The researchers would cut or pull up to two vibrissae for stable isotope and hormone analyses.

Whiskers (vibrissae) are keratinous, hair-like structures that are highly innervated, have large blood sinuses, and are controlled by voluntary muscles (Hirons et al. 2001). The removal of two whiskers, whether by cutting or pulling (if under sedation), would result in temporary pain for the seal. The pulling of two whiskers may provide an entry point for infectious diseases. Whiskers are used as tactile sensors to navigate in water, detect prey, and follow the hydrodynamic trails of fish (Dehnhardt et al. 2001). Two experiments demonstrate the importance of whiskers to seals. In one study, a mask that was placed over the muzzle of a harbor seal (*Phoca vitulina*) prevented it from detecting a hydrodynamic trail (Dehnhardt et al. 2001). In another study, the removal of all whiskers temporarily impaired two juvenile harbor seals' ability to capture fish (Renouf 1979). Monk seals likely use their whiskers to identify benthic prey (Hirons et al. 2001). The removal of all whiskers would likely interfere with a monk seal's foraging behavior; however, the researchers would only remove a maximum of two annually. Seals shed their whiskers periodically; they also damage or lose whiskers during normal foraging activities (Hirons et al. 2001). These losses do not appear to affect their ability to forage, survive, or reproduce. Therefore, it is unlikely that the cutting or pulling of whiskers would affect a seal's ability to forage, survive, or reproduce. We conclude whisker collection would result in temporary pain to a seal, but it would not reduce the fitness of any individual.

Necropsy and Opportunistic Sample Collection

No direct effects would occur from researchers collecting samples from dead animals or opportunistically collecting samples found on the beach. Seals in proximity to the sampling could be incidentally disturbed, discussed in a previous section.

7.3.8 Measurement/Weighing/Ultrasound

The researchers would measure, weigh, and ultrasound seals. Measuring and ultrasound involve the use of light pressure onto the skin of a seal and are not expected to result in any additional discomfort, beyond that of restraint. To weigh seals, the researchers would suspend the seal in a net. The process requires less than one minute and is expected to cause the seal minor discomfort. These procedures are not likely to result in injury. Therefore, the activities are not likely to reduce the fitness of any seal.

7.3.9 Administration of Drugs and Supportive Fluids

The researchers propose to administer drugs and supportive fluids to seals, as necessary. The PEIS (Appendix C) lists all drugs proposed for use, as well as possible adverse effects, and the pharmacokinetics of each drug (*i.e.*, how the drug is absorbed, distributed, the rate of action and duration of effect, chemical changes in the body, and effects and routes of excretion of metabolites). In addition, supportive fluids such as electrolytes, dextrose, and sodium bicarbonate may be administered at the discretion of the attending veterinarian in response to adverse reactions to capture, handling, and drug administrations.

The proposed drugs and supportive fluids have been used, or have been approved, by veterinarians with substantial pinniped experience. No severe adverse reactions have been observed that would preclude future use. Drugs and supportive fluids are administered, at the discretion of the attending veterinarian, for the benefit of the seal. For example, sedatives are given to reduce stress during certain handling events, and emergency drugs are administered if a seal has an adverse reaction during handling.

As new drugs may become available, they may be used if approved by the attending veterinarian, based on his/her experience or the experience of other veterinarians in treating pinnipeds (e.g., from The Marine Mammal Center). Information on such new drugs would be provided by PIFSC to the Permits Division. Possible adverse effects of any new drugs would be weighed against the benefits of using the drugs for each case. Also, if any severe adverse reactions are reported in Hawaiian monk seals, the drugs would be discontinued or dosages modified per recommendation by the attending veterinarian.

Drugs and supportive fluids would be administered only if deemed necessary by an attending veterinarian and for the sole purpose of improving the condition of a seal. They are likely to cause discomfort or pain upon injection. Though there is the possibility of adverse drug reactions, the risk is minimized by previous testing on monk seals (in the wild or in captivity) and other pinnipeds. For Hawaiian monk seals, we are not aware of adverse drug reactions, injury, or mortality as a result of these activities. Therefore, we conclude that the administration of drugs and supportive fluids is likely to help an individual and not likely to reduce the fitness of any seal.

7.3.10 Deworming

The researchers propose to treat seals with anti-helmintics to reduce their parasite load (i.e., deworming) through injection, oral, or topical delivery of anti-helmetics. Injected and oral treatments have been reviewed in great detail in prior biological opinions on the Hawaiian Monk Seal Research Program (NMFS 2009a), (NMFS 2009b), (NMFS 2010), all of which found that the deworming procedures were not likely to reduce the fitness of seals. Since then, the researchers have modified and improved their procedures to include topical treatments. Here, we summarize these findings and review the likely responses of seals to topical deworming.

Gastrointestinal parasites have negative fitness consequences for Hawaiian monk seals, and deworming has been shown to have positive fitness effects on other pinnipeds (DeLong 2007). To test the efficacy of deworming procedures, Gobush et al. (2011) conducted a pilot study of 43 juvenile seals to evaluate the effects of an injected dewormer on seal survivorship, weight gain, and the presence of eggs. There was no difference in survival or egg presence of the treatment seals, as compared to control seals; however, treated seals experienced higher growth rates during a portion of the study. Complications related to the injection of the dewormer (i.e., one seal developed an abscess at the injection site) led the researchers to alter their deworming protocols and to try a topical dewormer.

The topical dewormer is similar to commercial dewormers used on pets (e.g., Profender®). The researchers approach sleeping seals and administer the treatment without waking the seal. In 2011 and 2012, they used the topical dewormer on 70 seals, all of which remained sleeping throughout the process (i.e., no response or disturbance). There were no observed adverse reactions to the drug, indicating that its widespread use on monk seals is safe.

The application of the topical dewormer does not cause any discomfort or pain to the seal. It may result in weight gain for some seals (by reducing their parasite load). Therefore, deworming is likely to increase the fitness of individuals and not reduce the fitness of any seal.

7.3.11 Vaccination

The researchers propose to administer vaccinations to seals. Though infectious diseases do not currently limit species abundance, the small population size and low genetic diversity of the species increase its susceptibility to devastating epizootic outbreaks. For example, canine distemper dramatically reduced black-footed ferret (*Mustela nigripes*) populations in Wyoming, bringing them to extinction in the wild (Thorne and Williams 1988); and, avian malaria reduced native Hawaiian honeycreeper (*Hemignathus parvus*) populations to such small numbers that many were finally eliminated by predation or habitat loss (Warner 1968).

Vaccines are available for two viruses that have been identified as high risks to Hawaiian monk seals: morbillivirus and West Nile virus. Morbillivirus may have caused an unusual mortality event in Mediterranean monk seals, resulting in the death of more than half of the population (Harwood 1998). West Nile virus caused the death of a captive Hawaiian monk seal.

Prior to use, the researchers would perform/collaborate/assess studies to determine the safety and efficacy of vaccines against potentially devastating viruses (e.g., morbillivirus and West Nile Virus). Studies would first include surrogate species and captive monk seals, followed by trials of free-ranging Hawaiian monk seals. If the research indicates that such vaccines are safe and effective, the researchers would administer them preventatively or in response to an outbreak (see Figure 1).

The purpose of vaccination is to increase the fitness of seals by immunizing them against novel infectious diseases; however, all vaccines carry some risk. To reduce this risk, the researchers are proposing to use recombinant and inactivated vaccines. No adverse reactions have been reported following use of the recombinant morbillivirus vaccine in marine mammals (i.e., Steller sea lions, sea otters, harbor seals, and one Hawaiian monk seal). The West Nile virus vaccine has been used on several captive Hawaiian monk seals. None have had adverse reactions, and all seals have sero-converted following vaccination (Workshop to Evaluate the Potential for Use of Morbillivirus Vaccination in Hawaiian Monk Seals, Final Report 2005). As with humans, vaccination may result in an immune response, which may cause fever or swelling at the site of injection that resolves in 5-7 days. All vaccinated seals would be closely monitored for such responses after vaccination and would receive additional treatment (as described above), if deemed necessary.

The researchers would proceed cautiously with their proposed vaccination. As described above, they are conducting safety and efficacy trials in captive seals. If these studies are successful, they will conduct trial vaccinations on MHI seals, which are observed year-round (and are the seals most likely to come into contact with novel viruses). They would monitor all vaccinated seals to detect and treat any adverse effects.

Seals are likely to experience discomfort due to the injection, and they may experience a temporary immune response; more severe adverse effects are unlikely. Given their ability to protect individuals from infectious diseases, the vaccinations are likely to improve the fitness of Hawaiian monk seals and are not likely to reduce the fitness of any seal.

7.3.12 Treatment of wounds

The researchers propose to treat wounds. They would lance, drain, and clean shallow abscesses (e.g., injuries inflicted by adult males). Treatments would be done by or under the direction of a veterinarian. They would be followed by the administration of a long-acting antibiotic to prevent or treat infection.

Seals would likely experience temporary discomfort and pain during the procedure; however, treatment of the wound and administration of long-acting antibiotics are expected to relieve long-term pain and prevent possible infections. Lancing also allows for the drainage of pockets harboring pathogenic bacteria that can cause systemic infection and death in pinnipeds (Petrauskas et al. 2008). Therefore, the treatment of wounds is likely to improve the fitness of individuals and is not likely to reduce the fitness of any seal.

7.3.13 Instrumentation

The researchers propose to attach instruments to seals for tracking (e.g., after relocation) and research purposes. Instruments may include: cell phone tags, VHF tags, time-depth-recorders, Crittercam® or other similarly sized instruments. The attachment of an instrument would require additional handling of the seal, while under restraint and sedation.

The attachment of an instrument involves use of an epoxy adhesive on a seal's pelage. There have been no adverse reactions to the epoxy, and the epoxy and instrument are shed during the seal's annual molt.

An instrumented seal is likely to experience increased drag, as described in detail in a previous biological opinion (NMFS 2009a). Here, we summarize the best information available. It is expected that the larger the instrument to body-size ratio, the greater the drag (Wilson et al. 1986; African penguin); however, Walker and Boveng (1995) found that while foraging trip length was related to body size for Antarctic fur seals, a time-depth-recorder did not have a greater effect on smaller seals.

Littnan et al. (2004) assessed the effects of Crittercam® on the foraging behavior of immature Hawaiian monk seals. Crittercams®, time-depth-recorders, and VHF radio transmitters were affixed to seals, and after 3-10 days (mean duration 5.7 days) the Crittercams® were removed (TDR and VHF remained until 4-48 days later). Descent and ascent on dives was slower with the Crittercam®, possibly indicating energetic costs to individuals, but the results were not statistically significant. Seals did not appear to significantly modify their dive behavior when fitted with Crittercam®; however, the sample size of the study was small (7 seals). Crittercams® have been deployed on Hawaiian monk seals for longer periods (1-12 days; Parrish et al. 2005), but the effects of instrumentation were not assessed. Abernathy and Siniff (1998) found that monk seals fitted with TDRs dove to the same range of depths as seals equipped with cameras.

Based on the best information available, there is a risk that instrumentation, especially larger equipment such as Crittercams®, could cause hydrodynamic drag, reducing foraging abilities and/or increasing the energy cost to the animals. However, the greater effect of the Crittercam® would be mitigated by the shorter duration of its attachment: Crittercams® would be deployed for at least three days; within two weeks after attachment, researchers would recapture the seal and remove the camera, leaving other instruments in place. Because of their smaller size, we would expect weaners and juveniles to be more affected by instrumentation than adults. However, Littnan et al. (2004) did not observe a significant difference in foraging behavior of immature monk seals equipped with Crittercams® compared to those without and instruments currently used are significantly smaller than those used in the study, suggesting that even for younger seals, there would not be a fitness consequence of instrumentation.

Another potential stressor associated with instrumentation is the increased potential for entanglement. Seals often forage or investigate marine debris, including fishing nets. Attached instruments may become snagged, trapping the seal. While the researchers have disentangled more than 300 seals, none of the entanglements were associated with attached instruments. Furthermore, the instruments are detached or shed, limiting the time during which a seal could become entangled.

Instrumentation is likely to result in a small, temporary increase in drag and may increase the risk of entanglement. Because of the limited duration, and based on previous experience, we do not expect this increase to cause significant problems in foraging, diving, or the avoidance of predators. Therefore, instrumentation is not likely to reduce the fitness of any individual.

7.3.14 Translocation

The researchers propose to translocate seals, which we define as moving a seal from one location to another, for enhancement purposes (or to test enhancement hypotheses). The researchers would translocate seals for a variety of different reasons, including: reuniting pups with nursing females, risk alleviation, and survival enhancement. The goal of survival enhancement is to increase the fitness of individuals, with the hope of slowing or reversing the overall downward trend in population abundance; however, removing individuals from a subpopulation could reduce the viability of that subpopulation. Therefore, the researchers propose a "two-stage translocation" in which they would move a weaned pup to a location where it is more likely to survive. Once it has reached an age where survival rates are similar between the donor and recipient population, the seal would be translocated again, back to its natal or other suitable population. Because the second-stage translocation has not been previously implemented, the researchers propose to perform studies on this activity (i.e., experimental translocation). Below we assess the likely effects and responses of the proposed translocation activities.

Intra-island/atoll (mitigate pup separations)

The researchers propose to reunite pre-weaned pups with their mothers or a foster mother, a process that involves capturing a separated pre-weaned pup and transporting it to the mother's (or a foster mother's) location. As a result of the separation, mothers and pups are likely to be in a state of stress.

Pups are likely to experience an additional stress response upon capture/restraint and transport. This stress response is described under the Capture/Restraint section. It should be noted that the stress response of young, naïve individuals is much less severe than that of older seals. Approaching the mother with the pup is likely to result in temporary disturbance of the mother. We expect the long-term result of the activity (reunion and reestablished nursing) to alleviate the stress of both individuals, and increase the fitness of both mother and pup.

Since 2003, the researchers translocated an average of five pre-weaned pups per year (95% CI = 3 – 8). They have not observed any adverse effects, other than the mild and transitory stress responses and disturbance, as described above. Without the translocation, these pre-weaned pups would likely have died. As a result of this translocation, mothers and pups are likely to experience increased fitness; we do not expect the fitness of any individual to be reduced.

NWHI Intra-island/atoll and within MHI (risk alleviation)
The researchers propose to translocate weaned pups from areas of high risk to areas of lower risk, within the same subpopulation. High risk areas may include areas with elevated shark predation, dangerous physical features (e.g., decaying seawalls), or the potential for infection (e.g., near a freshwater stream carrying vectors for leptospirosis). Stressors include disturbance, stress response, and potential for injury.

The researchers would capture, restrain, and transport weaned seals from one atoll/island location to a nearby location within the same subpopulation. Seals are likely to exhibit a temporary stress response, as described under the Capture/Restraint section. As described above, the stress response of young, naïve individuals is much less severe than that of older seals.

From 2003-2013, the researchers translocated an average of 18 weaned pups annually (95% CI = 14 – 21), for the purpose of risk alleviation. For example, weaned pups were translocated to minimize the risk of shark predation at one site in French Frigate Shoals. Weaned pups in the Main Hawaiian Islands were translocated to move them away from beaches with high levels of human activity. Beyond a temporary stress response, the researchers have not observed adverse effects related directly to the translocation of at-risk seals. No seals were injured. These translocations do not remove all risks to seals: in French Frigate Shoals, shark predation is still a major threat to weaned pups; and a translocated pup in the Main Hawaiian Islands later drowned in a gill net. However, translocation reduces the likelihood of such risks. As a result of this translocation, we expect weaned pups to experience increased fitness; we do not expect the fitness of any individual to be reduced.

First stage of two-stage translocation (Within NWHI or from MHI to the NWHI)
The researchers propose to translocate weaned pups from one subpopulation with low juvenile survival rates to another with higher juvenile survival rates, either within the NWHI or from the MHI to the NWHI. They would use the decision tree (Fig. 2) to identify donor and recipient subpopulations and whether translocations should proceed (their decision making process is further evaluated in the Programmatic Analysis section).

The activity is likely to cause the following stressors: disturbance, stress-response, potential for injury, potential for group effects, and exposure to unfamiliar environment. We described the disturbance, stress response, and potential for injury in the previous section, and the responses are expected to be the same for this translocation activity. Here we describe exposure to unfamiliar environment and the potential for group effects.

Upon translocation to the recipient subpopulation, the seal would be released to an unfamiliar environment. The seal may respond to this stressor by acclimating to its new environment, surviving, and reproducing. Alternatively, the seal may struggle in its new environment, die, or fail to reproduce. Only recently weaned pups would be considered for this activity. Pups are not "taught" to forage; at weaning, they are simply left alone on the beach. Pups often remain on the beach for days before attempting to forage on their own. Therefore, we expect that a recently weaned pup is likely to become acclimated to whatever underwater environment it encounters.

To evaluate this hypothesis, we evaluate four datasets involving the translocation of seals without extensive captive care (Table 4): 2 seals translocated from FFS to Laysan (unpubished data); 12 seals translocated from FFS to Nihoa (Norris and Gulland 2010); six seals translocated from FFS to Kure (Baker et al. 2011a, Gilmartin et al. 2011); and one seal translocated from MHI to Kure (Baker et al. 2011a). We did not consider a dataset that included extensive captive care (Gilmartin et al. 2011) because it is a significantly different scenario than the one under consideration (i.e., no captive care). To provide a more robust sample size, we would like to combine all datasets; however that would require certain assumptions. The primary assumption is that no external factors, unique to the donor subpopulation (such as limited prey availability), are responsible for low juvenile survival rates; another assumption is that seals from different donor subpopulations do not have inherently different constitutional endowments. Because we do not have adequate data to accept these assumptions, we consider each dataset separately.

Table 4. Summary of past translocations of weaned pups, number in parentheses; survival is the proportion of translocated seals or seals from the donor subpopulation that survived to age one or 1 year post-release; reproduction is the proportion of seals that survived to age one that were observed nursing at least one pup over their lifespan; we calculated fitness by multiplying survival by reproduction.

Dataset (N), Year	Prop. Survival to Age 1*		Prop. Reproduction		Fitness (%)	
	Translocated	Donor	Translocated	Donor	Translocated	Donor
FFS-Lay (2), 2012	0.50	0.25-0.40	NA	NA	NA	NA
FFS-Nih (12), 2008-09	0.50*	0.27	NA	NA	NA	NA
FFS-Kur (6), 1990-91	0.83	0.60	0.20	0.11	0.16	0.07
MHI-Kur (1), 1991	1.00	0.50	1.00	0.00	1.00	0.00

* Minimum survival based on limited resight effort

The data indicate that seals translocated from a subpopulation with low survival rates are more likely to survive than seals that remained in the subpopulation with low survival rates. One of the two seals translocated to Laysan survived to at least one year post-release (unpublished data). Ten of the 12 seals translocated to Nihoa survived and were tracked via satellite for at least two months post-release; and eight of the 12 were tracked for at least four months. These seals foraged in the shallow depths (<40 m) for short durations (<4 minutes), similar to eight resident weaned pups (Norris and Gulland 2010). Both resident and translocated weaned pups progressively used more of the submerged terraces and eventually dove to similar depths and durations as the nine resident adults that were also tracked (Norris and Gulland 2010). Six of the 12 translocated seals survived to 1 year of age, and at least three of six seals (those translocated in 2008) survived to 2 years of age (Norris and Gulland 2010). A healthy, weaned pup that was translocated from MHI to Kure in 1991 survived and reproduced (Baker et al. 2011a). Six healthy seals (N = 6) were translocated from FFS to Kure; five survived 1 year after release and at least one seal reproduced in the recipient subpopulation (Gilmartin et al. 2011). The fact that more seals survived in the recipient subpopulation (relative to the donor subpopulation) suggests that a recently weaned pup is likely to acclimate to its environment upon release.

Inter-island translocation is intended to increase the fitness of weaned pups, relative to the donor site, but it has the potential to lower their fitness if they do not survive and reproduce. To evaluate the effect of translocation on individual fitness, we would ideally compare the survival and reproduction of a translocation seal to its survival and reproduction in its native subpopulation. Of course, it is not possible to translocate a seal and simultaneously leave it at its native subpopulation. Instead, we compare the fitness (here defined as the survival and at least one instance of recorded reproduction) of seals that have been translocated to the fitness of cohort seals that were not translocated. We acknowledge that this is not a perfect approximation because seals likely have different constitutional endowments, i.e., from birth, seals have different likelihoods of survival and reproduction as a result of genetics, development, and maternal care. Furthermore, sample sizes are small, such that fitness differences (positive or negative) may result from chance, rather than the translocation. Finally, survival and reproduction are both subject to observational bias, i.e., a seal must be observed (survival) and observed giving birth to or nursing at least one pup over its lifespan (reproduction). Therefore, our data represent minimum estimates of survival and reproduction. Even with these caveats, this method provides a metric to compare the fitness consequences of translocated and non-translocated individuals.

As summarized in Table 4, a minimum of 50 percent (1 of 2) of the seals translocated to Laysan survived to 1 year of age, compared to 25 – 40 percent of those that remained at FFS; none have reached maturity, therefore reproduction cannot be assessed (unpublished data). Similarly, a minimum of 50 percent (6 of 12) of the seals translocated to Nihoa survived to 1 year of age, compared to 27 percent of those that remained at FFS (Norris and Gulland 2010). Furthermore, three of the six seals that were translocated to Nihoa in 2008 survived to 2 years of age (50 percent), compared to 26 percent of FFS weaners (NMFS, unpublished data). None of these seals has reached maturity; therefore, reproduction cannot be assessed. In 1990 and 1991, six weaned females were translocated from FFS to Kure; five survived 1 year post-release (83 percent), two survived to maturity (11 and 21+ years of age), and at least one (20 percent) of these seals reproduced (Gilmartin et al. 2011; NMFS, unpublished data). For comparison, only 60 percent of non-translocated seals (N = 30) survived to age 1 at FFS, and 11 percent (N = 2) survived to reproduce (Baker et al. 2011a). A healthy, weaned pup that was translocated from MHI to Kure in 1991, survived and reproduced (Baker et al. 2011a; NMFS, unpublished data). Two other seals were born in the MHI in 1991; one survived to age three and did not reproduce (NMFS, unpublished data). In summary, translocated seals were more likely to survive and reproduce than cohort seals that remained at the donor subpopulation, in all instances.

We apply these data to estimate the likely fitness of translocated versus non-translocated weaned pups. Using the most conservative estimates of survival (0.50) and reproduction (0.20) for translocated pups (i.e., the *worst* case scenario), we would expect ten percent of translocated seals to survive and reproduce. Though low, the expected fitness of translocated seals is higher than the *best* case scenario for pups left at their natal subpopulation; using a survival rate of 60 percent and a reproduction "rate" (i.e., percent with observed reproduction) of 14 percent, we would expect eight percent of non-translocated seals to survive and reproduce. Stated another way, translocation provides each individual seal with a greater chance of surviving and reproducing than if it had been left at its natal subpopulation. In addition, no "group effects" were noted in any of the previous translocations described above. Group effects (such as disease outbreak or a capsized ship) would be disastrous to all translocated seals; however, because it has not occurred over numerous translocation events, we conclude that it is an unlikely risk. Therefore, we expect the activity to increase the fitness of translocated weaned pups.

We also must consider whether translocation results in fitness costs for the non-translocated individuals remaining in the donor subpopulation. In our previous consultations, we concluded that the distribution of longevity and reproductive success of non-translocated seals at the donor subpopulation was likely to remain the same following translocation of weaned pups (NMFS 2009b). We also concluded that the viability of the subpopulation was likely to remain the same (NMFS 2009b). Since the translocation of 12 female pups in 2008 and 2009, the survival rate of juveniles (age 1-4 years) at FFS has increased from 0.33 to 0.44 (NMFS, unpublished data). The removal of these pups may have reduced intra-specific competition. Alternatively, environmental conditions may have become more favorable, such as return of the PDO positive phase (Parrish et al. 2011 but see Baker et al. 2011). These hypotheses require further investigation. Regardless, the removal of 12 weaned female pups did not reduce the fitness of non-translocated seals in the donor subpopulation, and translocation is unlikely to reduce the fitness of non-translocated seals at other subpopulations in the future.

Finally, we consider the benefits and costs for the recipient subpopulations. In our previous consultations, we concluded that the distribution of longevity and reproductive success of the seals in the recipient subpopulation was likely to remain the same following the addition of translocated animals (NMFS 2009b). We also concluded that the viability of the recipient subpopulation was likely to remain the same (NMFS 2009b). At Nihoa, monitoring effort is low, and there were only single counts of seals in 2010 and 2011. Though the data are noisy and may only be used to evaluate gross trends, the subpopulation appears to be increasing in abundance (HMSRP 2012). The highest mean beach count was reported in 2009. The 2010 mean beach count was the second highest on record. Only a single beach count was conducted in 2011, such that the probability of not observing seals was high. Though this count was lower than those of 2009 and 2010, it was within the distribution of previous counts (2003 through 2008). In addition, weaning girths at Nihoa continue to be the highest in the NWHI (NMFS, unpublished data). High weaning girths indicate good maternal foraging conditions and are a good predictor of juvenile survival (Baker 2008). Though the data are limited, they do not indicate a positive shift in the distribution of survival. The addition of 12 translocated pups did not appear to reduce the fitness of seals native to the recipient subpopulation, and therefore, translocation is unlikely to reduce the fitness of native seals at other subpopulations in the future.

In conclusion, we do not expect the first stage of translocation to reduce the fitness of any seal; we expect the first stage of translocation to increase the fitness of most seals.

Second stage of two-stage translocation (Seals returned to natal or other site)

The goal of the first-stage translocation is to increase the fitness of individuals, with the hope of slowing or reversing the downward trend in abundance; however, removing individuals from a subpopulation could reduce the viability of that subpopulation. Therefore, the researchers propose a "two-stage translocation." During the first stage of the translocation, they would move a weaned pup to a location where it is more likely to survive, as described above. Once it has reached an age where survival rates are similar between the donor and recipient population, the seal would be translocated again (i.e., second stage), back to its natal population, or if necessary, to another population.

The stressors involved in the second stage translocation are similar to those in the first stage, but involve juvenile seals. Therefore, we expect the stress-response, potential for injury, and exposure to unfamiliar environment to be more severe. Here, we also consider the possibility for reduction of individual fitness, group effects, and the reduction in fitness for other individuals in the donor or recipient subpopulation.

As this is a newly proposed activity, there are no data on seal responses; however, there are data on the capture and translocation of older seals. Baker et al. (2011) analyzed data on 247 translocation events. Most of these involved the translocation of weaned pups, which we've reviewed in the discussion of first stage translocation. Because no juveniles have been translocated, we use a dataset describing the translocation of 34 adult males to evaluate stress response and injury potential of older seals. We use a subset of this data to assess post-release survival rates in older seals (we excluded seals translocated to Johnston Atoll because we consider such a translocation to be equivalent to removing a seal from the wild population).

Of the 34 adult males translocated to alleviate male aggression, two (six percent) died prior to translocation. One male died while being restrained and the other died during temporary captivity; the cause of the deaths could not be determined but may have been linked with capture stress and/or a pre-existing condition. As noted above, the stress response of weaned seals (zero percent mortality) is less severe than that of older seals (six percent mortality). Therefore, giving the benefit of the doubt to the species, we conclude that the stress response linked with the second stage of translocation is likely to reduce the fitness in six percent of individuals. Second stage translocation is a newly proposed activity, but we predict that the number of seals likely to be translocated will be similar to the number of seals involved in the first stage of translocation. If we expect an average of five but as many as 14 seals (based on first stage translocation data; Table 3) to be translocated, it is likely that one seal would die as a result of an elevated stress response. If the researchers translocate 30 juvenile seals (as authorized by the proposed permit), it is likely that two seals would die as a result of an elevated stress response. It should be noted here that these are maximum estimates, based on data for adult male seals. We expect mortality rates of juvenile seals to be lower. Furthermore, the researchers will likely improve the efficiency of their capture techniques as they handle juvenile seals more frequently and as they learn more about the process through experimental translocation (described below).

We also must consider the stressors of injury and exposure to an unfamiliar environment. In the adult dataset, no seals were injured as a result of translocation. Exposure to an unfamiliar environment does not appear to be problematic, either. Monk seals are large, highly mobile marine organisms. Tracking and tagging results indicate that individuals move and migrate hundreds to thousands of kilometers away from their natal subpopulation (Schultz et al. 2011a) (Johanos et al. in review). Therefore, they are likely to encounter novel environments throughout their life, even without translocation. The adult male translocation dataset indicates that older seals are equally likely to survive in donor and recipient subpopulations. Baker et al. (2011a) estimated annual survival for the translocated males to be 92.3 percent (95% CI 87.4–95.5%), which is comparable to annual survival rates in the donor subpopulation (90.4% to 97.4%) and recipient subpopulation (94.3%; 95% CI 87.8– 97.4%; Baker et al. 2011; Baker and Thompson 2007). The slightly lower survival rate in translocated seals is an artifact of lost tags and low resighting effort. For example, the survival estimate does not include two adult males, translocated from Laysan and later observed in the MHI, because due to damaged tags, they could not be individually identified. Therefore, we conclude that injury and exposure to an unfamiliar environment are not likely to reduce the fitness of any seal during two-stage translocation.

Group effects are another concern when translocation multiple individuals at once. Catastrophic events (e.g., storms, vessel incidents, or disease outbreaks) occurring during translocation could result in the loss of fitness of all individuals. Such events, by their nature, are rare, but if they occur, they could have devastating effects on the population. To minimize the likelihood of disease transmission, the researchers would translocate few individuals (e.g., 2 – 5 seals) at the start of the program. They would screen and quarantine all individuals for diseases prior to preparation for translocation. They would vaccinate disease-free seals prior to translocation. Seals would not be translocated from subpopulations with known disease occurrence. To minimize the likelihood of other catastrophic events, the researchers would exercise caution while translocating seals. They would not translocate seals during hurricanes or other extreme weather events. They always use an experienced ship and crew to perform the translocations. No group effects have occurred in over 250 translocations; however, one group effect (disease) occurred during captive care (an activity that is no longer conducted but is discussed in the *Temporary captivity* section, below). With the added precautions to prevent disease transmission, no group effects are expected in the future. Therefore, we conclude that group effects are not likely to reduce the fitness of any individuals.

Finally, we consider the effect on other individuals in the donor and recipient subpopulations. Hawaiian monk seals do not exhibit strong social bonds and often haul out away from other seals. The removal of juvenile seals from one subpopulation is not likely to adversely affect other seals in that subpopulation; if anything, it would remove intra-specific competitors. On the other hand, translocation of seals to the recipient subpopulation would introduce intra-specific competitors. Hawaiian monk seals have a polygynous mating system, so it is unlikely that competition for mates would reduce the fitness of any individual. Competition over prey resources may be a concern because food limitation is thought to be the primary cause of low juvenile survival (here defined as less than 2 years of age). We do not expect translocated seals to reduce the fitness of 2+ year-old seals in the recipient population because “adult survival rates” are uniformly high in all subpopulations (0.9 or higher; Table 3, Appendix E, PEIS), and there is no evidence that those rates have historically fluctuated with changing population sizes, in accordance with density dependent regulation. Returned seals (second stage of two-stage translocation) would constitute only a small portion of the total abundance at their natal site, so that their presence would have a minimal, if any, influence on density dependent population regulation. Nevertheless, the proposed translocation project includes provisions to cease translocations to any recipient site where an unexplained decline in pup/juvenile survival, of sufficient magnitude to warrant concern, has occurred. Therefore, we do not expect the translocation of seals to reduce the fitness of other seals in the donor or recipient subpopulations.

In summary, we expect the second stage of translocation to reduce the fitness of two seals annually, maximum, as a result of an elevated stress response leading to mortality.

Experimental translocation

As described above, second-stage translocation has not been previously implemented. The researchers propose to test scenarios similar to second-stage translocation (i.e., experimental translocation) to ascertain and mitigate potential adverse effects.

The researchers would select up to six seals annually for this study. The seals would be 2 or 3 years of age or older. They would be translocated from their natal subpopulation to a recipient subpopulation. Their survival and fitness will be monitored to address the concerns described in the previous section. The seals chosen for such studies will include MHI seals that have interacted with humans and need to be translocated to the NWHI. They may also include male seals, which are less valuable to the population than female seals.

As described in the previous section, an elevated stress response, as observed in response to capture of older seals, is likely to result in the death of six percent of the seals. Six percent of six seals equals 0.36, therefore, at most, we would expect the death of one seal per year, at most, as a result of experimental translocation. We do not expect this activity to reduce the fitness of any other seals.

Translocation Summary
Translocation of seals usually involves many other activities, including: capture, restraint, sedation, temporary captivity, deworming, sampling, and instrumentation. Risks of these activities are described above and below; however, we include the effects of capture (i.e., elevated stress response) because it led to the death of two adult male seals, prior to translocation (Baker et al. 2011). Given the potential for elevated stress response in older individuals, we conclude that a maximum of three seals (two during the two-stage translocation and one during experimental translocation) are likely to experience reduced fitness (i.e., mortality) as a result of translocation. We will consider the impact of the loss of three seals on the population and species, in the sections below. We do not expect any other reductions in fitness as a result of translocation, and in fact, we expect most seals to experience an increase in fitness, as a result of translocation.

7.3.15 Temporary captivity

Several of the proposed activities require placing a seal in temporary captivity (e.g., a few hours to a few weeks). For example, a seal may be placed in temporary captivity before it is translocated, while it is being tested for infectious diseases, or while the researchers are capturing other seals for translocation. The researchers are not proposing to place seals in longer-term captivity for captive care. Temporary captivity may involve isolating a seal in a pen on its natal beach or temporarily placing a seal in a permanent captive facility. We identified three potential stressors associated with temporary captivity: captive stress, potential for injury, and potential for disease transmission.

Over 302 seals have been placed in temporary captivity before translocation; of these two died during temporary captivity (0.7 percent). As described above (under second stage translocation), one adult male seal died in temporary captivity. In addition, a pup died while held in temporary captivity (Baker et al. 2011).

We are not aware of any injuries or illnesses as a result of temporary captivity; however seals held for longer periods (e.g., several months), for the purposes of captive care, have experienced problems. A group of females, receiving captive care, and a lone pup, also receiving captive care, developed cataracts, which led to functional blindness. For the females, the cataracts may have been a result of an infectious disease (i.e., a group effect, as described under translocation). Such group effects are more likely to occur in prolonged captivity, as opposed to temporary captivity. Alternatively, the cataracts were thought to have developed in response to prolonged exposure to UV light in the captive facilities (C. Littnan, pers. comm.); since then, all captive facilities minimized possible contributing factors by reducing artificial light exposure, providing shade, and repainting pools. In addition, the researchers now screen, quarantine, and vaccinate all individuals before placing them in temporary captivity. These measures should reduce risks to all seals, including those held temporarily. We do not expect any such problems to arise during temporary captivity because 300 of 302 seals held prior to translocation did not develop cataracts or experience any other adverse effects.

We expect a maximum of 105 seals to be held in temporary captivity each year (all translocated seals, not including adult male removal). Given the data above, we expect one seal (0.7 percent of these individuals) to die as a result of temporary captivity. We do not expect any other reductions to fitness. We will consider the impact of the loss of one seal, in the sections below.

7.3.16 Supplemental feeding

The researchers propose to provide supplemental feeding to seals in the NWHI. Generally, researchers will supplementally feed seals that have been previously fed, for example, in captivity. Such feeding would only occur in the NWHI, where human presence is minimal. The purpose of supplemental feeding is to increase the body condition of seals until they are able to successfully forage on their own.

Stressors associated with this activity potentially include disturbance and the possibility of developing behavioral issues (such as fisheries interactions or approaching humans). We discussed disturbance above, under monitoring activities, and concluded that responses are short lived and include, at most, minor physiological changes. The possibility of developing behavioral issues is a greater concern because seals that approach humans for food must be removed for the safety of both species. The NWHI are protected as the Papahānaumokuākea Marine National Monument. As such, they are uninhabited by humans, except for a small group of researchers and cultural practitioners, who are allowed access to the islands and surrounding waters. These people receive extensive training on environmental awareness and know to give seals a wide berth. Therefore, dangerous human-seal interactions are unlikely to occur in the NWHI, even if a seal has developed behavioral issues. For example, seals that develop behavioral issues in the MHI are often translocated to the NWHI, where the behaviors are no longer a threat to the seal or humans. It is highly unlikely that a seal from the NWHI will migrate to the MHI. In over 5,174 seals that have been tagged in recent decades, only four seals (0.07 percent) migrated without assistance (i.e., translocation) from the NWHI (where supplemental feeding could occur) to the MHI (Johanos et al. in review). Therefore, it is unlikely that supplementally fed seals will develop behavioral problems that may endanger the seal or humans. We conclude that supplemental feeding is not likely to reduce the fitness of any seal, and it is likely to increase the fitness of recipients (through improved body condition).

7.3.17 Behavior modification

The researchers propose to conduct studies to determine the safest and most effective methods for modifying undesirable behavior in seals. Such methods may include "hazing" seals by visual, audible and tactile methods or guiding/impeding movements with temporary barriers. Such methods may include activities described above, including: capture, restraint, sedation, biomedical sampling, instrumentation, translocation, and temporary holding. Responses to these activities have already been described and would entail the same risks identified above. As described in the PEIS, stressors unique to behavioral modification include:

- Stress response, as a result of hazing and the use of barriers to alter movement
- Minor pain or discomfort, though the techniques would not intentionally inflict injury
- Displacement from foraging or resting areas, if seals must be moved seals away from a specific area, due to human interaction

To date, only a small number of seals in the MHI have been hazed or subjected to temporary barriers to movement. There have been no injuries or mortalities as a result (PEIS 2013). Future efforts will be conducted as research studies to maximize efficacy and minimize adverse effects. Though there is potential for injury or even mortality, it has not been realized, and the alternative (inappropriate human interaction) is highly likely to result in the death or removal of the seals. Therefore, we conclude that behavioral modification is not likely to result in the reduction of fitness for any seal relative to its condition prior to the activity.

7.3.18 Mitigation of adult male aggression

Adult male aggression is one of the most commonly documented causes of monk seal mortality (the others being emaciation, shark attack, and entanglement). The researchers propose to mitigate adult male aggression to increase the fitness of juveniles and females within a population. They propose to mitigate adult male aggression through removal or chemical behavioral modification of males.

The researchers would remove aggressive adult male Hawaiian monk seals from their subpopulation via translocation to Johnston Atoll, permanent captivity, or by euthanasia. These removals are demographically equivalent in that they would eliminate the male's reproductive contribution to the wild population. As explained in the PEIS, mobbing or aggressive males tend to be non-dominant individuals, with low or no reproductive success; however, they could become more successful in time, if allowed to remain as a member of their subpopulation. Alternatively, the removal of aggressive adult males would prevent serious injury or death to the subjects of the attacks (juveniles and adult females), increasing the reproductive success of other seals (PEIS 2013). Because female reproductive success has a much greater impact on population viability than male reproductive success, the removal of aggressive males is likely to provide an overall benefit to the species.

To avoid removal, the researchers also propose to research chemical behavior modification. Gonadotropin-releasing hormone (GnRH) agonists (*e.g.*, decapeptyl or deslorelin) would be used to lower testosterone levels and, ideally, aggressive behavior (PEIS 2013). Decapeptyl has been used safely on Hawaiian monk seals with no adverse effects (Atkinson et al. 1993, Atkinson et al. 1998). The effects of deslorelin have proven safe in other mammals (Bertschinger et al. 2001, Trigg et al. 2006). As described in the PEIS, potential risks include:

- An initial relatively brief rise in testosterone levels prior to their suppression (as shown in other mammals injected with GnRH agonists). During this period there is a risk that male seals could exhibit elevated levels of aggression, posing a risk of harm to other seals;
- Treatment might cause the subjects to be attacked or harmed by other males;
- If effective in reducing testosterone, subject males would be temporarily "chemically castrated," such that they potentially have lower reproductive success; and
- GnRH agonists may have unknown side effects.

Testosterone reducing drugs would be tested on seals in captivity prior to use in wild seals. Study subjects in the future would be closely monitored so that any resulting adverse reactions or mortalities could be detected and quantified (PEIS 2013). While the efficacy of this approach to mitigate aggressive male behavior is undetermined, there have been no deaths associated with the administration procedures or from effects of the drug itself (Atkinson et al. 1993, Atkinson et al. 1998).

Until it has been determined that GnRH agonists are a safe and effective way to mitigate adult male aggression, the fitness of aggressive males will be reduced (i.e., reproductive potential will be eliminated) to preserve the fitness of juvenile and adult female seals. On average, the researchers have removed one male seal annually (95% CI = 0,1) in the past. We estimate that the researchers may remove as many as two aggressive males annually in the future (see Table 3). The proposed permit would authorize up to 20 removals annually. We discuss the population-level effects of the loss of 2 – 20 males below.

7.3.19 Euthanasia of moribund seals

The researchers propose to euthanize moribund seals, which are seals that are about to die as a result of unrelated causes (i.e., not a result of research or enhancement). Because this activity has not been permitted in the past, the researchers have not previously euthanized moribund seals. They are proposing this activity in response to veterinarians' requests for samples from moribund seals, during unusual mortality events. Such samples could be used to identify the cause and prevent additional seal mortalities. In addition, the euthanasia of moribund seals is humane because it reduces the duration of a seal's pain and suffering. The proposed permit would authorize euthanasia of 10 seals over a 5-year period. We discuss the population-level effects of the loss of moribund seals below.

7.3.20 Research on permanently captive seals

Researchers may perform the same activities described above on monk seals in permanent captivity. While the stressors, responses, and mitigation would be the same, these seals would never be released to the wild and are no longer considered part of the wild population (i.e., any reduction of fitness occurred when the seal was removed from the wild). Thus, there will be no effects to the population from conducting research on seals in permanent captivity.

7.4 Cumulative Impacts

In the sections above, we have described each proposed activity and the likely responses of seals to the stressors caused by that activity. We then asked whether that activity would reduce the fitness of any seal, and if so, how many seals would likely experience a reduction in fitness.

In reality, most activities would not occur in isolation, but rather, would occur during or in addition to other activities. In some cases, a seal would be exposed to all activities during a single capture. In other cases, a seal would be exposed to numerous activities throughout a year or over its lifespan.

Here we ask whether and how seals would respond to the cumulative impacts of multiple activities, either conducted during a single capture event, or spread out throughout the year. Seals are likely to respond to multiple activities through a general stress response, as described above. The severity of such a stress response is likely to be directly related to the duration and reoccurrence of the activities. While the first tagging of a weaned pup may elicit a minor stress response, the tagging, instrumentation, etc. of a previously tagged seal is likely to elicit a more severe response. For lengthy procedures, the researchers generally sedate a seal, to minimize the stress response. In addition, the researchers use excellent records to determine whether a seal has been previously handled; these seals, along with larger (and thus older) seals are generally sedated prior to handling.

In our discussions of individual activities, we described the response of seals associated with capture and restraint. Though we used these statistics to describe the likely effect of handling, it should be noted that in many cases, the seals within the study were exposed to multiple activities, including capture/restraint, tagging, specimen collection, instrumentation, etc. In essence, the experience of the seals in those studies is typical. Therefore, we recite those examples here, to describe the response of seals to multiple activities.

Henderson and Johanos (1988) determined that capture, brief restraint without sedation, and flipper tagging had no effect on subsequent behavior of weaned pups. There were no significant differences in survival (i.e., resighting rates of 80 – 100 percent), observed migration, and body condition between handled seals (N = 549) and control seals (N = 549; Baker and Johanos 2002). Between 1982 and 2013, 8,644 handling events exposed seals to multiple research and enhancement activities; only 7 seals (0.08 percent) died as a result of these activities (we attribute all deaths to stress response as a result of capture and restraint). Baker et al. (2011) described the results of 247 translocation events, which generally included many additional activities such as tagging and instrumentation. With the exception of the capture/captivity-related mortalities described above, no adverse effects were noted, and translocated seals exhibited the same or greater survival rates, as compared to non-translocated seals.

The cumulative impacts of all proposed activities are likely to increase the duration and intensity of seal stress responses; however, the researchers would mitigate such responses with sedation for long procedures, for larger seals, or for seals that have been handled multiple times. All responses are likely to be temporary and infrequent. Therefore, we do not expect cumulative impacts of the proposed activities to further reduce the fitness of any seal.

7.5 Issuance of Permit and Authorization of Take (Permits Division)

The Permits Division proposed to authorize the above listed activities under the ESA and MMPA. They propose to authorize the directed take of individuals for research and enhancement purposes, as described in Table 1. The proposed permit lists general and special conditions to be followed as part of the proposed research activities. These conditions are intended to minimize the potential adverse effects of the research activities on targeted Hawaiian monk seals.

The Permit Division's proposed action would not result in any additional activities, other than those described above. In this manner, it is not likely to result in any additional adverse affects. However, as described in Table 3, the Permit Division proposes to authorize far more takes and unintentional mortalities than are expected, based on previous effort and data. Because many of these takes (and all unintentional mortalities) result in reduced fitness of individuals, we must consider the implications of the Permit Division's maximum authorize take (Tables 1 and 3), in the following section.

7.6 Population and Species-level Impacts

In this section, we describe whether the reduced fitness of individuals (as identified above) is likely to reduce the viability of populations. In this case, the species includes a single, panmictic population (Schultz et al. 2011a). Though the subpopulations experience differential levels of growth, they are inextricably linked through migration and reproduction. Therefore, the reduction of one subpopulation is likely to impact all subpopulations and the viability of the entire species. In addition, all activities are likely to occur at all subpopulations, exposing all individuals in the species to the proposed actions. For these reasons, we ask how the reduction of fitness of individuals, as identified above, is likely to affect the population and species.

Above, we described the stressors generated by the proposed activities under two actions: the Hawaiian monk seal program (PEIS Preferred Alternative) and the Permits Division's take authorization. As previously noted, we used past data from the well-established and well-monitored research and enhancement program to estimate the exposure and responses of Hawaiian monk seals. Acknowledging that additional activities or increased effort may result in greater exposure and potential for adverse effects, we estimated the maximum number of responses to the program's activities (Table 3: mean plus four standard deviations). These estimates are much lower than the Permit Division's proposed take numbers (Table 1). We have more confidence in our estimates because they were derived from actual data, based on previous effort; whereas, the Permit Division's proposed take numbers were not. While our estimates provide the likely number of seals that *would* be affected, the Permit Division's take numbers provide the maximum number of seals that *could* be affected. Therefore, we analyze these two sets of data separately, in this section.

Permits Division

The Permits Division proposes to authorize the removal (i.e., unintentional mortality or the equivalent) of a total of 40 seals from the population over a 5-year period: 24 males (20 removals and 4 unintentional mortality), and 16 additional unintentional mortalities of either sex (including 4 weaned pups, 8 juveniles, and 4 seals of any age/sex). As described in the PEIS, the researchers simulated the loss of these individuals, as compared to a baseline of no authorized unintentional mortality (PEIS 2013). To test the worst-case scenario, they assumed all mortalities "of either sex" to be females. They found that the loss of 40 individuals resulted in the reduction of the realized growth rate from 0.985 (95% CI = 0.971 – 0.998) to 0.981 (95% CI = 0.968 – 0.994). This difference is not statistically significant (P = 0.67) and the confidence intervals overlap considerably. Therefore, though the proposed permit is likely to reduce the fitness of some individuals, it is not likely to have population or species-level impacts.

Hawaiian Monk Seal Research and Enhancement Program
We have determined that the researchers' proposed activities are likely to reduce the fitness of nine individuals annually: one seal of any age and either sex as a result of capture and restraint; three juveniles (two likely females and one unknown) during translocation (second stage and experimental, respectively); one seal of any age and sex during temporary captivity; two adult males to mitigate aggression; and on average 2 moribund seals (10 over 5 years) of any age and either sex. We conclude that the removal of males and moribund seals is not likely to have a significant impact on the viability of the population; in addition, due to the constraints of the proposed permit, the researchers' proposed activities are likely to significantly reduce the population by a maximum of 16 seals over 5 years, as follows: four seals of any age and either sex as a result of capture and restraint during research; eight juveniles of either sex during translocation (second stage or experimental); and four weaned pups of either sex during temporary captivity prior to captivity. As described above, the loss of 16 individuals does not result in a statistically significant reduction in the realized growth rate of the population. Therefore, though the proposed research and enhancement program is likely to reduce the fitness of some individuals, it is not likely to have population or species-level impacts.

Summary
Neither scenario (the likely reduction in fitness of 16 or 40 individuals over a 5-year period) is likely to reduce the viability of the panmictic Hawaiian monk seal population. In fact, many of the activities are likely to result in the increased fitness of individuals, which would increase population viability and enhance the recovery potential of the species.

7.7 Critical Habitat

The proposed activities are not likely to adversely affect the designated critical habitat of the Hawaiian monk seal in any way. The vessels, vehicles, and observers would move over beach habitat and through near shore waters. Though they may leave tracks in the sand, they would not permanently alter any component of monk seal critical habitat. Any effects on critical habitat would be insignificant. Therefore, monitoring of seals is not likely to affect monk seal critical habitat. The capture of seals involves handling seals on shore. Translocation involves the use of small boats to transfer the seals to a larger research vessel, located offshore from the subpopulation. Temporary captivity would involve the construction, and later removal, or shore-side pens. Researchers would be careful not to permanently alter any beach habitat, including beach crest vegetation, during capture, translocation, and temporary captivity. They would not anchor their small boats on coral habitat. Any disturbance to sand on the beaches or near-shore would be transient and insignificant. Therefore, capture, translocation, and temporary captivity are not likely to affect monk seal critical habitat. In summary, none of the proposed activities are likely to affect Hawaiian monk seal critical habitat.

7.8 Programmatic Analysis

Here, we evaluate whether and how the researchers have insured that their program is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat.

1. *Has the agency structured the proposed programmatic action to identify, inform,*

encourage, and screen applicants (in this case, additional researchers or co-investigators) for potential eligibility under or participation in the programmatic action?

The researchers are the only ones who are permitted to conduct research on Hawaiian monk seals. Other interested parties must work with the researchers or apply for a research permit, through the Permits Division. The researchers screen the eligibility of interested parties by reviewing a resume and research proposal and by asking how the proposed research would benefit monk seal conservation. In this manner, research is always consistent with the recovery plan, never duplicated, and meets all permit and program requirements.

Enhancement activities are conducted by the researchers, but also by the NMFS Marine Mammal Health and Stranding Response Program, who perform such activities under a different permit (also issued by the Permits Division and the subject of a separate section 7 consultation). Enhancement activities in the MHI are coordinated between the researchers and the responders. The researchers perform all enhancement activities in the NWHI. Close coordination and collaboration between the two programs insures that efforts are not duplicated and that lessons learned are shared.

2. Have the researchers structured their program to know or be able to reliably estimate the probable number, location, and timing of activities?

The researchers have been conducting the research activities for several decades and are able to accurately estimate the probable number and location of most activities. The timing is often dependent on the seals; however, the researchers generally know when seals nurse, molt, etc. As shown in Table 3, the researchers' effort is fairly consistent across years, and the 95% confidence intervals are relatively narrow.

Many of the enhancement activities are new or have only been performed a few times, previously. When starting a new activity (whether enhancement or research), the researchers are very conservative. For example, when the researchers resumed translocating weaners between islands (i.e., first stage) in 2008, they only translocated six seals. Newly proposed activities, such as vaccination and second stage translocation, would be first tested on a small number of seals.

The researchers are also very careful when planning where and when to implement activities. For example, the researchers assess the environment before capturing any seal (to avoid injury to the seal), and they would limit human interactions with seals in the MHI. They avoid capturing females that may be pregnant. In this manner, the researchers not only know the probable number, location, and timing of their proposed activities, they also control these factors for the benefit of the seals.

3. Have the researchers structured their program to know or reliably estimate the physical, chemical, or biotic stressors that are likely to be produced as a direct or indirect result of activities?

The researchers have structured their program to reliably estimate likely stressors of, and responses to, their proposed activities. Throughout the past several decades, the researchers have observed and monitored thousands of seals. During and after each activity, they observe and monitor seal responses. As described above, when a new activity is introduced, they test it on a subset of seals and record their responses. As a result, there are extensive data on stressors and responses. These data are summarized in annual reports and peer-reviewed publications, as cited throughout this Opinion.

The researchers use these data to estimate their impact on the species. As described above, the researchers take a conservative approach, estimating the worst-case scenario, as a result of their action. For example, in the PEIS, the researchers calculated the impact of 40 unintentional mortalities over 5 years. It is unlikely that their activities would result in 40 unintentional mortalities. Our calculations, which estimate the maximum number of mortalities that are likely to occur based on the mean plus four standard deviations of the mean of previous years' data, indicate 36 unintentional mortalities, and only 16 that are likely to have negative impacts on population viability. We consider our estimate to be extremely conservative estimate (i.e., we expect far fewer unintentional mortalities), yet the researchers use an even more conservative worst-case scenario to assess whether there is any possibility that their activities would adversely affect the population growth rate (there is not).

In addition, the researchers design studies to reliably estimate stressors and responses for newly proposed activities. For example, all vaccines and drugs are first tested on captive Hawaiian monk seals and/or other pinniped species. Each behavior modification activity will be conducted in a manner to systematically test its safety and efficacy. The researchers would conduct experimental translocations on seals that either must be moved (due to human interactions) or those that are less important to the population growth rates (i.e., males) to be able to predict stressors and responses when performing second stage translocations. In this manner, the researchers have or are able to reliably estimate stressors and responses associated with their proposed activities.

4. Have the researchers structured their program to minimize likely adverse effects of such activities on ESA listed species and designated critical habitat?

The researchers have structured their program to minimize likely adverse effects on the Hawaiian monk seals in several ways. Many of the proposed activities are conducted to minimize adverse impacts of other activities. For example, bleach marking is used to reduce the need for repetitive approaches. Sedation and the administration of drugs and supportive fluids may reduce the adverse impacts of invasive activity. And supplemental feeding would be used to transition a seal from temporary captivity back into the wild.

The researchers are continually refining their protocols to minimize impact to seals. For example, they switched the delivery of their deworming treatment from an injection (that required capture and restraint) to a topical form that is applied to seals' pelage while they sleep. They now avoid capturing seals near rocky ledges, after a seal died during a capture event. They minimize handling duration, and animals are sedated if the researchers anticipate a long or complicated restraint. For invasive techniques, they use sterile or new equipment to prevent infection. For translocation, they perform disease screening and quarantine to prevent the spread of infectious diseases. To minimize the risk of "group effects," for example, during translocation, the researchers have established disease screening and emergency protocols, including placing seals in temporary captivity at a number of different facilities (to isolate seals, if necessary). We conclude that the researchers design, and continue to improve, their activities to minimize adverse effects to seals.

5. Have the researchers structured their program to continuously monitor and evaluate likely adverse effects on listed species and critical habitat?

As previously described, the researchers monitor the effects of each activity on every seal. They have tagged and individually identified nearly every seal in the population (and species), so that they are able to track a seal's condition from year to year. They record, evaluate, and report on all data in their annual reports and peer-reviewed publications. As a result of their efforts, the Hawaiian monk seal is one of the most thoroughly monitored species under NMFS jurisdiction.

6. Have the researchers structured their program to encourage, monitor/evaluate, and enforce compliance (in this case, compliance of all researchers with their permits and program activities)?

The researchers control all research on Hawaiian monk seals and all enhancement activities in the NWHI. In the MHI, they work together with the NMFS Marine Mammal Health and Stranding Response Program on enhancement activities. They provide extensive training to all personnel who handle or approach monk seals. The personnel work in teams, generally led by an experienced researcher. While in the field, the teams are able to correspond with the research program staff and veterinarians via email and/or phone. Written protocols are available at all times. More invasive and life-threatening procedures require the involvement of senior staff and a veterinarian. In this manner, the researchers have structured their program to enforce compliance with all permit requirements and protocols.

7. Have the researchers structured their program to allow them to change their action or requirements, if deemed necessary, to minimize unanticipated impacts on listed species and critical habitat?

The researchers incorporate adaptive management into their decision making processes, which allows them to change their action, if necessary, to minimize unanticipated impacts. For example, the researchers developed decision trees for both stages of the two-stage translocation (Figs. 1 and 2). The researchers would use the decision trees to determine whether, where, and how many seals to translocate. To determine whether and where to translocate seals, they would compare survival rates, averaged over the past three years, of select donor and recipient subpopulations. To determine the maximum number of seals to translocate, they would select the smallest of the following: number of healthy weaned females at the donor subpopulation; capacity at the recipient subpopulation; logistical constraints; and experience (i.e., fewer seals would be translocated early on in the process).

These decision trees involve feedback mechanisms, such that seals would not continue to be translocated if previous translocations have been unsuccessful, either due to the activity itself or due to uncontrollable environmental problems. As described in the PEIS, the fundamental concept underlying application of translocation is to address mismatches between local environmental conditions and distribution of seals among subpopulations. The decision trees allow the researchers to customize the activities in accordance with prevailing monk seal demographics and environmental conditions. The PEIS presents possible scenarios and analyzes the possible effects of such scenarios using simulations. In all simulations, the sample subpopulation exhibits continued decline; however, the best-case scenario moderates this decline and reinforces the population. Such resilience would allow the subpopulation to capitalize on improved conditions and to initiate a slow natural recovery, which might be bolstered by additional interventions. Even the worst-case scenario results in increased survival for the translocated individuals (it has little effect on the decline of the subpopulation).

Once the translocations are underway, the researchers would use incoming data to modify the simulations and the decision framework and to change the plan, if needed. Such adaptive management is integral to all of the researchers' proposed activities. Widespread vaccination of seals is another example that involves adaptive management and the use of current data to guide enhancement activities.

The researchers also use data, collected throughout all research and enhancement activities to the general benefit of the species. As described above, they analyze data to redesign and improve the efficacy and safety of all activities. They analyze data to address important issues raised in the recovery plan, including: foraging success (e.g., instrumentation), population connectivity (e.g., tagging and specimen collection), and health (e.g., specimen collection and monitoring). They frequently synthesize and review all data to develop new or refined research and enhancement activities to advance the survival and recovery of the species. In this manner, the researchers have structured their program to change their action if unanticipated impacts occur or to improve their action for the benefit of the species.

8.0 Cumulative Effects

Cumulative effects include the effects of future state, tribal, local or private actions that are reasonably certain to occur in the action area considered by this Opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

During this consultation, NMFS searched for information on future state, tribal, local, or private actions reasonable certain to occur in the action area. We did not find any information other than what has already been described in the *Environmental Baseline,* which we expect will continue into the future. Anthropogenic effects include commercial fishing, vessel traffic, ocean noise, and those from habitat degradation due to pollution, discharged contaminants, and coastal development. An increase in these activities could result in an increased effect on ESA-listed species; however, the magnitude and significance of any anticipated effects remain unknown at this time.

9.0 Integration and Synthesis of Effects

Researchers at the NMFS Pacific Islands Fisheries Science Center (i.e., the researchers) propose to implement the Hawaiian monk seal research and enhancement program, as described in the "preferred alternative" of their 2013 draft Final Programmatic Environmental Impact Statement (PEIS). The NMFS Permits and Conservation Division (Permits Division) proposes to issue a 5-year permit (the permit, No. 16632), authorizing these activities pursuant to section 10(a)(1)(A) of the Endangered Species Act and section 104 of the Marine Mammal Protection Act (MMPA) of 1972. All proposed activities are described in detail in the draft Final PEIS, and the proposed take numbers are described in detail in the draft permit. The majority of proposed activities have been previously implemented by the researchers and permitted by the Permits Division; such activities include: monitoring, capture/restraint, tagging, marking, specimen collection, instrumentation, administration of drugs and fluids, deworming, translocation, aggressive male removal, and temporary captivity. Newly proposed activities include: vaccination, the second stage of a two-stage translocation, and euthanasia of moribund seals. Though the purpose of all research and enhancement activities is to promote the survival and recovery of the species, some activities are likely to adversely affect Hawaiian monk seals. No activities are likely to adversely effect any other listed or proposed species or designated critical habitat (including that of the Hawaiian monk seal), under NMFS jurisdiction.

The Hawaiian monk seal is a critically endangered species that continues to decline in abundance, primarily as a result of low prey availability, unfavorable environmental conditions, shark predation, and fisheries interactions. Other major stressors include habitat loss, male aggression, and harmful human interactions in the MHI. The decline is likely to continue without mitigation of these stressors. With approximately 1,000 individuals remaining in the wild, we conclude that the species' resilience to further perturbation is low, and its status is precarious.

We used the best available information to evaluate the effects of the proposed actions on Hawaiian monk seals. This information included the draft PEIS, draft permit, peer-reviewed scientific research papers, government reports, unpublished data, personal communications with scientists and veterinarians, and newspaper articles. We critically evaluated all data to describe the likely stressors of, exposure to, and responses to the proposed activities.

We found that many activities were likely to increase the fitness of individual seals, relative to their likely fitness without intervention. These "enhancement" activities include: disentanglement, deworming, vaccination, treatment of wounds, translocation, behavior modification, and mitigation of aggressive males. Some activities are designed to reduce the adverse impacts of the action; such activities include: sedation, bleach marking, administration of drugs or supporting fluids, and supplemental feeding. The other activities are proposed to address questions important to the survival and recovery of the species (e.g., monitoring, tagging, specimen collection, etc.) or to alleviate the suffering of seals (i.e., euthanasia of moribund seals). In fact, all activities are proposed to benefit the species; however, there is potential for adverse effects as a result of some activities.

During our analyses, we identified six activities that are likely to reduce the fitness of at least one seal as a result of unintentional mortality. Such activities include (with maximum annual mortality in parentheses): capture/restraint (N = 1), second-stage translocation (N = 2), experimental translocation (N = 1), temporary captivity (N = 1), aggressive male mitigation (N = 2), and euthanasia of moribund seals (N = 2). Over a five-year period, we expect the loss of 36 seals, maximum, as a result of the proposed activities (this number is less than expected over 4 years due to the constraints of the permit). The Permits Division proposes to authorize a total of 40 unintentional mortalities over 5 years. The inconsistency is attributed to the difference between the *likely* maximum number of unintentional mortalities (based on our analyses of previous data) and the *authorized* maximum number of unintentional mortalities (based on the Permits Division's proposed permit), but we use the greater of the two numbers (N = 40) to provide the benefit of the doubt to the species.

Because the status of the species is precarious and its resilience to further perturbation is low, we must consider how these unintentional mortalities would affect the viability of the population. The loss of 40 individuals over a 5-year period does not significantly reduce the population growth rate (0.981), as compared to a "no action" scenario (0.985). Part of the reason is because the loss of males and moribund seals (the majority of authorized mortalities) are minimally important to population viability. Though we must calculate the worst-case scenario, it should be noted that most activities are likely to provide a positive fitness benefit to affected individuals and a net gain to the population, through increased survival and reproduction of numerous individuals. Therefore, we expect a net gain for the species, which is comprised of a single, panmictic population.

The researchers have conducted research and enhancement activities on the Hawaiian monk seal for decades. They run the only research program on the species and collaborate with another NMFS program to conduct enhancement activities. Therefore, they are able to effectively train and monitor the implementation of all activities. Because of an extensive monitoring and response dataset, the researchers are able to reliably estimate the number, timing, and location of all activities and the likely effects of those activities. The researchers use their extensive dataset to analyze seal exposure and responses and to improve or modify their activities. They have a long history of using adaptive management to change their action to minimize adverse effects to individuals, and they continually evaluate their program to implement activities most likely to enhance the survival and recovery of the species. Though future private and State activities are beyond their control, we are not aware of any cumulative effects that are likely to result in adverse effects to the species or its critical habitat.

10.0 Conclusion

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the researchers and the Permits Division have insured that their action, as proposed, is not likely to jeopardize the continued existence of the following ESA-listed species: Hawaiian monk seal; the action may affect, but is not likely to adversely affect, the following ESA-listed species: False killer whale (insular Hawaiian), sperm whale, blue whale, fin whale, humpback whale, sei whale, green sea turtle (all other areas), hawksbill sea turtle, leatherback sea turtle, loggerhead sea turtle (North Pacific), and olive ridley sea turtle (all other areas).

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the researchers and the Permits Division have insured that their action, as proposed, is not likely to destroy or adversely modify designated critical habitat of the Hawaiian monk seal.

After reviewing all relevant information, it is our conference opinion that the researchers and the Permits Division have insured that their action, as proposed, is not likely to jeopardize the continued existence of the following ESA-proposed species: *Acropora paniculata*, *Monitpora flabellate*, *M. dilatata*, *M. turgescens*, *M. patula*, and *M. verrilli*.

11.0 Incidental Take Statement

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the "take" of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the U.S. Fish and Wildlife Service as an act which actually kills or injures wildlife, which may include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the U.S. Fish and Wildlife Service as actions that create the likelihood of injury to listed species by annoying them to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Sections 7(b)(4) and 7(o)(2), taking that is incidental and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement. We do not anticipate that the proposed action will incidentally take any ESA-listed or proposed species.

12.0 Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The researchers have developed a strong research and enhancement program that addresses nearly every aspect of the species' recovery plan. Their monitoring efforts are extensive, and they make every effort to minimize impact to the species. Therefore, we do not have any conservation recommendations for the researchers or the Permits Division at this time.

13.0 Reinitiation Notice

This concludes formal consultation and conference on the actions. As described in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where incidental take occurs, any operations causing such take must cease pending reinitiation.

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