Revision of Critical Habitat for Hawaiian monk seals

Draft Biological Report

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TABLE OF CONTENTS

LIST OF ACRONYMS **3**

EXECUTIVE SUMMARY **4**

BACKGROUND **6**

CRITICAL HABITAT UNDER THE ESA **7**

HAWAIIAN MONK SEAL NATURAL HISTORY AND STATUS **8**

NATURAL HISTORY 8
RANGE 10
POPULATION STATUS AND TRENDS 11
NORTHWESTERN HAWAIIAN ISLANDS (NWHI) VS. MAIN HAWAIIAN ISLANDS (MHI) 14
HABITAT 16

PHYSICAL OR BIOLOGICAL FEATURES ESSENTIAL FOR CONSERVATION **19**

GEOGRAPHICAL AREA OCCUPIED BY THE SPECIES AND SPECIFIC AREAS WITHIN THE GEOGRAPHICAL OCCUPIED AREA **23**

NORTHWESTERN HAWAIIAN ISLANDS (NWHI) 24
MAIN HAWAIIAN ISLANDS (MHI) 25

UNOCCUPIED AREAS **29**

SPECIAL MANAGEMENT CONSIDERATIONS OR PROTECTION **29**

IN-WATER & COASTAL CONSTRUCTION 30
DREDGING 31
ENERGY DEVELOPMENT 31
ACTIVITIES THAT GENERATE WATER POLLUTION 32
AQUACULTURE/MARICULTURE 33
FISHERIES 33
OIL-SPILL AND VESSEL GROUNDING RESPONSE ACTIVITIES 34
MILITARY ACTIVITIES 35
ADDITIONAL THREATS ADDRESSED IN THE PETITION 35

CRITICAL HABITAT REVIEW TEAM **37**

STEPS 2, 3, & 4 37
STEP 5 40

LIST OF FIGURES

Figure 1. Hawaiian monk seal critical habitat, designated in 1988. 6

LIST OF TABLES

Table 1. Essential features present in the specific areas 46
Table 2. Approximate Square Miles of Critical Habitat 47
Table 3. Threats identified in the Hawaiian monk seal Recovery Plan 48
Table 4. Reference for ESA listing factors associated with threats. 48
Table 5. Habitat related threats and impacted essential features 49
Table 6. Reference Table for Essential features. 49
Table 7. List of Anthropogenic Activities that may contribute to Identified Threats 50

Appendix 1. Maps Depicting Proposed Critical Habitat for the Hawaiian Monk Seal. 51

List of Acronyms

CHRT	Critical Habitat Review Team
DOD	Department of Defense
EPA	Environmental Protection Agency
ESA	Endangered Species Act
INRMP	Integrated Natural Resource Management Plan
MHI	Main Hawaiian Islands
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NWHI	Northwest Hawaiian Islands
OTEC	Ocean Thermal Energy Conversion
PCB	Polychlorinated Biphenyls
PIRO	Past Pacific Island Regional Office

EXECUTIVE SUMMARY

Section 4 of the Endangered Species Act (ESA) requires the designation of critical habitat of threatened and endangered species and provides for the revision of critical habitat based on the best scientific data available. This report contains a biological assessment in support of a proposed revision to critical habitat for the Hawaiian monk seal (*Monachus schauinslandi*). The revision was prompted by a 2008 petition requesting the National Marine Fisheries Service (NMFS) to revise the existing critical habitat designation by expanding the current critical habitat in the Northwestern Hawaiian Islands (NWHI), and by designating additional critical habitat in the main Hawaiian Islands (MHI). After reviewing the best available scientific information, NMFS announced, in the 12-month finding (74 FR 27988; June 12, 2009), the revision to critical habitat for the Hawaiian monk seal was warranted and acknowledged the intention to move forward with a proposed rule for critical habitat.

Following the announcement in the 12-month finding (74 FR 27988; June 12, 2009), a critical habitat review team (CHRT) consisting of seven NMFS biologists was convened to evaluate critical habitat for the species. Members of the team were tasked with using the best scientific data and knowledge available to; identify habitat features essential to the conservation of the species, delineate specific areas within the geographical area occupied which contain at least one essential habitat feature, and identify special management considerations or protections required within each area. The essential features identified by the team included: areas with characteristics preferred by monk seals for pupping and nursing; shallow, sheltered aquatic areas adjacent to coastal locations preferred by monk seals for pupping and nursing; marine areas from 0 to 500 m in depth preferred by juvenile and adult monk seals for foraging; areas with low levels of anthropogenic disturbance; marine areas with adequate prey quantity and quality; and significant areas used by monk seals for hauling out, resting or molting. As identified in the 12-month Finding (74 FR 27988; June 12, 2009), the geographical area occupied by the species consists of marine and terrestrial coastlines in the Hawaiian archipelago and Johnston Atoll. Within this occupied area, the CHRT identified 16 specific areas of terrestrial and adjacent marine areas within the Hawaiian Archipelago (including much of the petitioned areas) for consideration for critical habitat. Areas in the NWHI include 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 the 500-m depth contour around the following islands, atolls and reef: Kure Atoll, Midway Islands (not including Midway Harbor), Pearl and Hermes Reef, Lisianski Island, Maro Reef, Gardner Pinnacles, French Frigate Shoals, Necker Island, and Nihoa Island. Areas in the MHI includes marine habitat from the 500-m depth contour (relative to mean lower low water), through the water's edge into the terrestrial environment where the inland boundary extends 5 m inland from the shoreline described by, the upper reaches of the wash of the waves, other than storm or seismic waves, at high tide during the season in which the highest wash of the waves occurs, usually evidenced by the edge of vegetation growth or the upper limit of debris around the following areas (except those portions of the areas that have been identified as not included in the designation): Kaula Island, Niihau, Kauai, Oahu, Mai Nui (including Molokai, Lanai, Maui, and Kahoolawe), and Hawaii. Within these areas smaller areas have been identified as not included in the proposed designation due to the low quality or lack of essential features present.

Critical habitat designations increase the protections for listed species by bringing awareness to the species' habitat needs and by insuring that federal agency activities do not destroy or adversely modify designated areas. Prohibitions against destruction and adverse modification of designated critical habitat are specific to federal agencies. The consultation process identified in section 7 of the ESA and outlined in joint NMFS and U.S. Fish and Wildlife regulations establishes a method for avoiding and mitigating impacts to critical habitat. In addition to these identified protections, critical habitat designations may allow for informed natural resource planning for all stakeholders utilizing these areas. A revision to Hawaiian monk seal critical habitat allows NMFS to employ the most current and best scientific and commercial information available for establishing the essential features and the areas for the designation with the intention of promoting the species' conservation (i.e., survival and recovery). Recovery goals for the Hawaiian monk seal were identified in the 2007 Hawaiian monk seal recovery plan and a population This report summarizes the available data on Hawaiian monk seal presence, distribution, and use of the identified areas and the CHRT's process for determining these areas as essential for conservation of the Hawaiian monk seal. The assessment and findings provided in this report are used in conjunction with other agency analyses (e.g. economic analyses) to support NMFS' proposal to revise the areas designated as critical habitat for the Hawaiian monk seal.

BACKGROUND

The Hawaiian monk seal (*Monachus schauinslandi*) was listed as endangered throughout its range under the ESA in 1976 (41 FR 51611; November 23, 1976). In 1986, critical habitat for the Hawaiian monk seal was designated at 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 10 fathoms (18.3 m) around Kure Atoll, Midway Islands (except Sand Island), Pearl & Hermes Reef, Lisianski Island, Laysan Island, Gardner Pinnacles, French Frigate Shoals, Necker Island, and Nihoa Island in the NWHI (51 FR 16047; April 30, 1986). In 1988, critical habitat was expanded to include waters around previously designated areas out to the 20 fathom (36.6 m) isobath and to include Maro Reef (53 FR 18988; May 26, 1988).

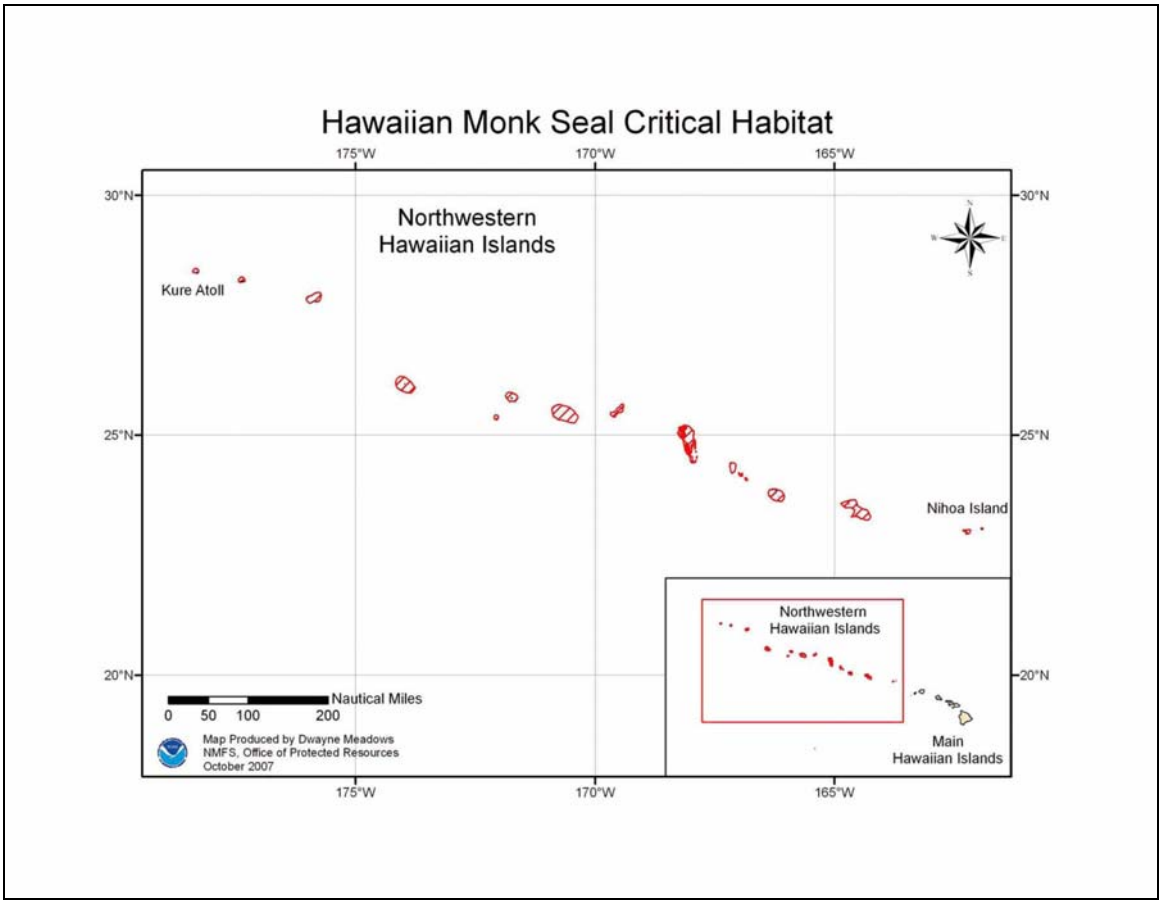

Figure 1. Hawaiian monk seal critical habitat, designated in 1988.

On July 9, 2008, NMFS received a petition dated July 2, 2008, from the Center for Biological Diversity, Kahea, and the Ocean Conservancy (Petitioners) to revise the Hawaiian monk seal critical habitat designation (Center for Biological Diversity 2008) under the ESA. The Petitioners sought to revise critical habitat by adding the following areas in the MHI: key 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 200 meters (m). In addition, the Petitioners requested that designated critical habitat in the NWHI be extended to include

Sand Island at Midway, as well as ocean waters out to a depth of 500 m (Center for Biological Diversity 2008).

On October 3, 2008, NMFS announced in its 90-day finding that the petition presented substantial scientific information indicating that a revision to the current critical habitat designation may be warranted (73 FR 57583; October 3, 2008). Having reviewed current scientific information available, NMFS announced its intention to move forward with the revision to critical habitat on June 12, 2009 in its 12-month finding (74 FR 27988; June 12, 2009). The decision to revise was based on new information available on Hawaiian monk seal use of foraging habitat and the apparent re-colonization of the MHI by seals since the 1988 designation. NMFS identified 5 steps to move forward with the designation of critical habitat in the 12-month finding, including: (1) Determine the geographical area occupied by the species at the time of listing; (2) Identify the physical or biological features essential to the conservation of the species; (3) Delineate area within the geographical area occupied by the species that contain these features, and that may require special management considerations or protections; (4) Delineate any areas outside of the geographical area occupied by the species that are essential for the conservation of the species; and (5) Conduct economic, national security, and other analyses to determine if any areas identified in steps 3 and 4 could be excluded from critical habitat consideration under section 4(b)(2) of the ESA. To complete these steps and determine the appropriate areas for consideration for the revision, NMFS convened a Critical Habitat Review Team (CHRT) consisting of seven biologists with experience working on issues related to Hawaiian monk seal research and management. The team employed the use of the best available scientific data, the current status of the species, and the recovery goals from the 2007 recovery plan ((NMFS) 2007a) to evaluate and identify critical habitat for the Hawaiian monk seal. This report contains a biological assessment of the life history, movements, and habitat use of the Hawaiian monk seal to support the proposed critical habitat designation for the Hawaiian monk seal.

CRITICAL HABITAT UNDER THE ESA

Critical habitat is defined in section 3(5)A of the ESA (16 U.S.C. 1532 (5)(A)) as :

> "(i) the specific areas within the geographical area occupied by the species at the time it is listed…, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and
>
> (ii) specific areas outside the geographical area occupied by the species at the time it is listed… upon a determination by the Secretary that such areas are essential for the conservation of the species."

Section 3 of the ESA (16 U.S.C. 1532(3)) defines the terms "conserve," "conserving," and "conservation" to mean: "to use, and the use of, all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this chapter are no longer necessary."

Section 4(a)(3)(A)of the ESA (16 U.S.C. 1533(a)(3)(A)) requires that to the maximum extent prudent and determinable, that critical habitat be designated concurrently with the listing of a species, and 4(a)(3)(B) allows for as appropriate the revision of such designation.

Such designations of critical habitat must be based on the best scientific data available and are further guided by provisions of the Act. One provision includes section 4(a)(3)(B)(i) (16 U.S.C. 1533) which precludes from designation any lands owned by, controlled by, or designated for the use of the Department of Defense (DOD) that are covered by an integrated natural resources management plan (INRMP) that the Secretary has found in writing will benefit the listed species. A second provision in section 4(b)(2) (16 U.S.C. 1533(4(b)(2)) of the Act requires the agency to consider the economic, national security, and other relevant impacts of specifying any particular area as critical habitat. Under this provision of the Act the Secretary may exclude any area from critical habitat if the benefits of such exclusion outweigh the benefits of specifying such areas as critical habitat, unless the exclusion of such areas would result in the extinction of the species.

Once critical habitat is designated, Section 7 of the Act requires federal agencies to insure that they do not fund, authorize (permit), or carry out actions that are likely to destroy or adversely modify that habitat. This is in addition to other requirements under Section 7 of the Act that insure that actions do not jeopardize the continued existence of the listed species.

HAWAIIAN MONK SEAL NATURAL HISTORY AND STATUS

This section of the report provides background information relevant for understanding the habitat use and specific needs of the species. Following is a discussion on the Hawaiian monk seal's biology, including natural history, range, population status and trends, and habitat including a description of the differences considered between the NWHI and the MHI.

Natural History

Hawaiian monk seals are in the Phocidae family, known as the true seals, which are characterized by a lack of external ear and an inability to draw the hind-flippers under the body for movement on land. Within the family Phocidae, the Hawaiian monk seal is a member of the subfamily Monachinae and the Genus *Monachus*. Of the true seals, only two other species occur in this genus; the recently extinct Caribbean monk seal (*M. tropicalis*) and the critically endangered Mediterranean monk seal (*M. monachus*). Deemed the most primitive phocid genus, the monk seal possesses anatomical features that resemble early monk seal fossils from 14-16 million years ago (mya) ((NMFS) 2007a); specifically the Hawaiian monk seal is considered to be the modern representative of the most ancient of living phocid lineages (Repenning and Ray 1977).

The three most recent monk seal species are widely dispersed geographically (i.e., in the Hawaiian Archipelago, the Caribbean and the Mediterranean), dispute remains regarding the historical biogeography of the monachine seals' dispersal ((Repenning and Ray 1977; Fyler et al. 2005; Arnason et al. 2006). Recent molecular data estimates that the split between the Mediterranean and Hawaiian monk seal lineages may have occurred between 10 and 11.6 mya (Fyler *et al.* 2005). When the split between the Hawaiian monk seal and the Caribbean monk

seal lineages occurred is less clear; however, the closure of the Central American Seaway around 3 mya provides a least estimate for the division (Fyler *et al.* 2005). Regardless of the conflicting origin and dispersal descriptions, the geological evolution of the Hawaiian Archipelago indicates that island habitat was available for seal colonization at and prior to the closure of the Central American Seaway; the islands of Kauai and Niihau formed as early as 5 and 4.9 mya respectively (Juvik and Juvik 1998).

Hawaiian monk seals are wide-ranging, air-breathing aquatic carnivores that spend a majority of of time in the ocean, but continue to be rely on terrestrial habitat. Monk seals utilize aquatic habitat for foraging, socializing, mating, resting, and traveling. Adept at propulsion in the water, individual monk seals may travel hundreds of miles (mi) (or kilometers (km)) in a few days (Littnan *et al.* 2006) and dive to more than 500 m (1,600 ft) (Parrish *et al.* 2002). Although a majority of its time is spent in the water, like many other seals, the Hawaiian monk seal utilizes terrestrial habitat to rest, avoid predators, molt, give birth, and nurse. In contrast to commonly recognized pinnipeds such as sea lions, walrus, and harbor seals, which often haul out[1] in groups of larger numbers, the Hawaiian monk seal is considered solitary, often hauling-out individually. This solitary nature extends both on land and in the water; however, monk seals may congregate in small numbers (e.g., males may haul out with and guard females, or several animals may be found hauled-out in relative proximity to one another) in favorable haul-out areas (Antonelis *et al.* 2006) or when interacting.

Adult monk seals reach a length of 2.3 m (7.5 ft) and weigh up to 273 kg (600 lb). On average adult males are smaller in size than females ((NMFS) 2007a). It is thought that Hawaiian monk seals have a lifespan of up to 30 years in the wild. Females reach breeding age at about 5 to 11 years of age in the wild (NMFS 2010d), depending on body condition. Little is known regarding the sexual maturation of males of the species, but behavior and size suggest similar maturation rates to that of the females (Antonelis *et al.* 2006). Mating occurs at sea, and gestation is thought to be approximately 11 months. Females typically will haul out on land near the birth site and give birth to a single pup (Johanos *et al.* 1994). Monk seal births are most common between February and August, but births have been documented at all times of the year ((NMFS) 2007a). Upon birth the female will nurse the pup for approximately 6 weeks; throughout this time period the mother remains with the pup, usually fasting and decreasing in mass (Kenyon and Rice 1959). The nursing period concludes when the mother returns to the marine environment to forage weaning the pup (Johanos *et al.* 1994). Females will mate about 3-4 weeks after weaning her pup, and 5-6 weeks after mating she will haul out to molt (Johanos et al. 1994; (NMFS) 2007a). At least several months are required for the pup to teach themselves to successfully forage, during which time pups survive on fat stores built up during nursing, resulting in considerable weight loss ((NMFS) 2007a). Juveniles (up to 3 years old) are typically longer but than recently-weaned pups, and juveniles in the NWHI typically do not regain the post-weaning weight until approximately 2 years of age (Johanos *et al.* 1994).

Adult seals appear silvery white ventrally with dark silvery tinged brown or slate gray pelage (fur) dorsally, and as the hair ages, the ventral pelage takes on a yellow tinge while the dorsal pelage may appear dull brown or darker (Kenyon and Rice 1959). When monk seals stay at sea for an extensive period, a red or green tinge may develop from algal growth on the pelage

[1] Haul out is a term used to describe the behavior of seals leaving water to be on land.

(Kenyon and Rice 1959). Monk seals undergo an annual molt, which is termed a catastrophic molt because the entire layer of pelage (skin and hair) is shed annually, leaving a silvery grey coat underneath. At birth pelage is black and may occasionally be marked with small white patches, referred to as natural bleaches (Kenyon and Rice 1959). The black pelage is lost during the postnatal molt, which occurs around the time of weaning.

Range

Hawaiian monk seals are found throughout the Hawaiian Archipelago and on Johnston Atoll. The six main reproductive sites for the species are in the NWHI: Kure Atoll, Midway Islands, Pearl and Hermes Reef, Lisianski Island, Laysan Island, and French Frigate Shoals. Based on the 2008 Stock assessment approximately 79% of the monk seal population utilizes these main reproductive sites ((NMFS) 2009). Smaller reproductive sites also occur on Necker Island (Mokumanamana) and Nihoa Island, and monk seals have been observed at Gardner Pinnacles and Maro Reef. Monk seals are found throughout the MHI, where births have been documented on all of the major islands with the exception of Lanai ((NMFS) 2001; (NMFS) 2007a).

Information from Johnston Atoll is sparse, but monk seals have been observed on several occasions. A tagged yearling male monk seal from Laysan Island was first seen in Johnston Atoll in July 1968 (Schreiber and Kridler 1969) and remained until at least August 1972. In January 1969, an untagged adult female monk seal arrived on Sand Island (a secondary island within Johnston Atoll) and gave birth to a female pup. The mother-pup pair remained on or near the pupping beach until March 1969, when the pup was weaned and the mother disappeared. The pup remained until 1971 when it died from a deep flesh wound, probably from a shark attack (Amerson and Shelton 1976). In July 1999, a tagged adult female from French Frigate Shoals arrived at Johnston Atoll and remained there for about a year ((NMFS) 2001).

Additionally, unconfirmed, but probable sightings of Hawaiian monk seals outside the Hawaiian Archipelago and Johnston Atoll have been reported from Palmyra Atoll (1,118 mi (or 1,800 km) south of NWHI), and Wake Island (1,243 mi (or 2,000 km) southwest of NWHI). These reports include, two seals sighted on Palmyra Atoll in 1990, a seal sighted on Wake Island in early summer 1966, and a tagged seal sighted on Wake Island in February 1987 (Westlake and Gilmartin 1990; NMFS 2010c). Other more poorly-documented sightings have also been reported from Bikini Atoll and Mejit Island in the Marshall Islands (1,491 mi (or 2,400 km) southwest of NWHI) (NMFS 2010c).

In addition to the above reported natural occurrences of monk seals, NMFS has historically relocated animals within the geographic range to manage serious threats to the population or individual animals. In 1994 NMFS relocated 21 adult male monk seals from the NWHI to the MHI in order to reduce male aggression and female deaths at Laysan Island, where males greatly outnumbered females at the time. In 2008, a minimum of five of the 21 relocated male monk seals remained in the MHI. No female monk seals have been relocated from the NWHI to the MHI; thus all female monk seals in the MHI occur there naturally. NMFS has relocated three female monk seals (a juvenile in 1981, a pup in 1991, and an adult in 2009) from the MHI to the NWHI. In 1984, nine adult males were relocated from the NWHI to Johnston Atoll, because of attacks on adult females and immature seals. At least three of these males were still at Johnston Atoll the following year, and at least one male was still there in 1986. In 1998, two adult males

determined responsible for drowning pups were relocated from the NWHI to Johnston Atoll. In 2003, a sub-adult male was relocated from the MHI to Johnston Atoll. This seal's habituation to humans lead to the seal exhibiting aberrant behavior that posed a threat to the public and the seal's natural development (NMFS 2010j). No sighting history is available for the latter three monk seals (NMFS 2010j; NMFS 2010k). Thus, NMFS has relocated 21 males from the NWHI to the MHI, three females from the MHI to the NWHI, 11 males from the NWHI to Johnston atoll, and 1 male from the MHI to Johnston Atoll.

Population Status and Trends

The current best estimate of the total Hawaiian monk seal population is 1, 161 individuals ((NMFS) 2009). This estimate includes the sum of estimated abundances at the six main NWHI breeding subpopulations[2], an extrapolation of counts at Necker and Nihoa Islands, and an estimate of minimum abundance in the MHI ((NMFS) 2009). Various methods are used to identify the best estimate for these sites annually depending on factors such as field effort. More details about the methods used to estimate population size may be found in the annual stock assessment reports[3]. Minimum population estimates for 2008 based on the number of seals identified from the six main NWHI subpopulations abundance was 913 seals and for the MHI 113 ((NMFS) 2009). The breeding subpopulations identified are geographically separated, but re-sights of identified animals indicate seal movement among the NWHI, among the MHI, and, on rare occurrence, from the NWHI to the MHI (Littnan *et al.* 2006; (NMFS) 2009). A complete history of Hawaiian monk seal population status and trends is unknown; however, data and historical accounts do indicate impacts to population trends from human exploitation and disturbance. The following is a review of pertinent information and trends with regard to population status.

The first beach counts of Hawaiian monk seals in the NWHI occurred in the late 1950s, but prior to that time period, human influenced declines in population can be inferred from historical accounts. The first written accounts of Hawaiian monk seals in the NWHI were recorded by Lisianski during exploration in the early 1800s. While these accounts provide no basis for estimating population size, the accounts indicate a period of time when trading and shipwrecked vessels exploited seals of the NWHI for oil, pelts, or food (Ragen 1993). Reports from the end of the century highlight the impacts from human exploitation on the seal population with accounts of extended visits to Midway Atoll and Laysan Island where no seals were seen compared to previous records indicating numerous seals on the beaches (Ragen 1999). Following the period of exploitation in the 1800s, the atolls and islands were settled for entrepreneurial and military reasons at various points in time. While no seal population data or estimates exist for this time period, impacts to the subpopulations are often described in the rarity of sightings or in behavioral changes, including seals showing a habitat preference for sites less accessible to human inhabitants (Ragen 1999). The lack of information during World War II

[2] Hawaiian monk seals are not genetically distinct; the term subpopulation is utilized for research and management purposes to distinguish seals that primarily utilize different geographic locations (i.e. different atolls or islands) in the Hawaiian Archipelago for pupping, hauling-out, and molting.

[3] Methods used to estimate abundance including closed capture-recapture and discovery curves are described in detail in the following references: Baker JD (2004) Evaluation of closed capture-recapture methods to estimate abundance of Hawaiian monk seals. Ecological Applications 14: 987-998; Baker J, Harting A, Johanos T (2006a) Use of discovery curves to assess abundance of Hawaiian monk seals. Marine Mammal Science 22: 847-861

fails to clearly demonstrate military activity impacts on seal subpopulations; however, the impacts of human occupation of the NWHI were demonstrated following this time period. Starting in the late 1950s, counts were made at the islands almost every year, with a high count of 1,206 seals recorded in the spring of 1958 ((NMFS) 1983). Although these counts do not provide a total population estimate[4], the beach counts do demonstrate a decline between the late 1950s and mid-to-late 1970s. Counts in the 1970s ranged from the low 500s to the high 600s ((NMFS) 1983). This decrease was most evident in the western portions of the range and has been associated with human disturbance related to military settlement (Kenyon and Rice 1959; Ragen 1993). Military activities and presence eventually ceased at these sites, and the islands have been managed as a refuge; in 2006 the islands and surrounding waters were incorporated into the Papahanaumokuakea[5] Marine National Monument. Periods of decline and stability have been documented since the area has been managed as a refuge, with the most recent period of decline beginning in 2001 ((NMFS) 2007a). In 2008, beach counts of juveniles and adults (i.e., all seals except pups) were 68 percent lower than those of the late 1950s ((NMFS) 2009). Total abundance at the six primary NWHI sites (French Frigate Shoals, Laysan, Lisianski, Pearl and Hermes, Midway, and Kure) is declining at a rate of about 4.5% per year ((NMFS) 2009). While the earlier declines are marked by human exploitation and disturbance, the current declines in the NWHI may be driven by food limitations and other sources of mortality, which disproportionally impact juvenile seal survival and consequently reduce recruitment in to breeding age classes. With fewer adults of breeding age, the current age structures of the NWHI subpopulations indicate that declines are likely to continue for at least the next decade (Baker *et al.* 2010). A detailed account of the Hawaiian monk seal population status and trends in the NWHI is provided in the recovery plan (NMFS, 2007a).

It is generally accepted that Hawaiian monk seals colonized the islands of the northwest as discussed earlier; however, conflicting views remain regarding Hawaiian monk seal historical use of the MHI. The lack of seal references in Hawaiian oral tradition has led some to believe that Hawaiian monk seal use of this region is a recent phenomenon. However, a fossil discovery of seal bones at an archeological site from the Island of Hawaii dating from 1,400 – 1,760 years ago (Rosendahl 1994) indicates the potential for seal presence on the MHI well before any of the historically written accounts of seals in the MHI. The fossil evidence, in combination with the geological evolution of the islands, and historical accounts of extirpation of other species by early Polynesians (Olson and James 1982; Diamond *et al.* 1989; Athens *et al.* 2002) has been utilized to present an alternate view. This view presents the possibility that the Hawaiian monk seal likely colonized and eventually utilized the entire Archipelago until the population was forced to peripheral habitat by exploitation or disturbance (Ragen 1993; Baker 2004; Baker and Johanos 2004). The Hawaiian Islands are often presented as a geological conveyor belt; where islands emerge over the hotspot. As the Pacific Plate shifts these islands from the hotspot, the island subsides and eventually erodes over time into atolls and seamounts (Fleischer et al. 1998). Monk seals utilizing the early Hawaiian Archipelago likely would have utilized all available emergent habitats at this time. As the population grew and additional islands emerged, the wide-ranging nature of these animals would have allowed for dispersal throughout the entire chain to all available habitats. Polynesians settlement of the Hawaiian islands did not occur until

[4] Counts did not provide a total population estimate because they did not determine the proportion of the total included in the count. Additionally, counting methods were not standardized.
[5] Originally named Northwestern Hawaiian Islands Marine National Monument; name was changed in 2007.

approximately 1400 years ago, long after Hawaiian monk seals were recognized to be separated from other species of monk seals and located in the Pacific basin (Kirch *et al.* 2004; Fyler *et al.* 2005). The settlement of early Polynesians in the Hawaiian Islands is linked to the extirpation of many bird and plant species through hunting, habitat destruction or introduction of invasive species (Olson and James 1982; Diamond *et al.* 1989; Athens *et al.* 2002). In that same manner, monk seals may have been extirpated from the MHI through hunting or disturbance, following Polynesian settlement, and accordingly driven to the NWHI where human settlements were limited by the availability of fresh water (Ragen 1999; Baker and Johanos 2004). Additional fossil evidence of seal use of the MHI prior to Polynesian settlement may be rare due to the dynamic and eroding nature of the coastal habitat favored by seals. In summary, this view presents the growth and dispersal of the Hawaiian monk seal population in the MHI as a re-colonization event.

During recent MHI history, the occasional presence of seals is indicated by historical accounts of seal sightings. In 1900, Hilo residents reported that solitary monk seals were seen in the area about once every 10 years (Bailey 1952). From 1928 to 1956, seven monk seal sightings were documented in the MHI (Kenyon and Rice 1959) and Niihau residents reported that seals appeared regularly after 1970 (Baker and Johanos 2004). While seal tagging efforts were becoming consistent in the NWHI, seal sightings were starting to be recorded in the MHI. From 1980-1986, 125 seal sightings were recorded throughout the MHI; all of which happened prior to the first critical habitat designation (NMFS 2010e). These sighting do not represent a discrete number of seals, because the sightings are incidental and seal identification is unknown; however, it does reveal the presence of seals throughout the islands in the early 1980s. By as early as 1994, a small naturally-occurring population of male and female monk seals was present in the MHI. Since the mid-1990s, an increasing number of documented sightings and annual births of monk seal pups have occurred in the MHI. Systematic population surveys have been rare in the MHI but aerial surveys in 2000 and 2001 provided estimates of minimum populations around 45 and 52 seals, respectively (Baker and Johanos 2004). A majority of the current information about seal identification and terrestrial habitat use in the MHI is provided through a volunteer network in which the general public provides information regarding seals. Reporting from the general public such as this is not systematic and not representative of the overall seal use of the MHI shorelines[6]; however, this information does provide a basis for identifying unique individuals in the population[7]. The annual stock assessment reports for the species reveal that the number of individually identifiable monk seals in the MHI has grown from 77 in 2005 to 113 in 2008 ((NMFS) 2007b; (NMFS) 2009). This growth in numbers in the MHI is not likely to be a consequence of increased migration from the NWHI; only five seals have been documented to have migrated from the NWHI to the MHI since the 1980s when regular tagging efforts began (Baker *et al.* 2010). It is likely that seals in the MHI are growing in numbers due to the increase in births and have been dispersing from under-documented areas (such as Niihau) to the rest of the chain (Baker and Johanos 2004). The evolutionary, historical, and geological

[6] Non-systematic surveys by the general public are subject to biases that have the potential to misrepresent monk seal habitat use. For example a high number of sightings are likely to be recorded in areas that the public frequents. However, remote areas that are known to be favored by monk seals generally may be less visited by the public and as such fewer sightings will be received from these areas.

[7] Sighting information received from the public may still provide unique seal identification if the report provides information with a unique identifier such as flipper tag numbers, bleach marks, unique scars, or a photo that allows for matching in the PIFSC identification database. Not all public reports are able to provide this level of details.

evidence combined with the dispersion and increased numbers of Hawaiian monk seals throughout the MHI chain suggests that monk seals have been re-colonizing the MHI in recent years. The exact catalyst for this re-colonization is unknown; however, the next section of this report discusses how favorable habitat conditions in the MHI may support this growing population.

Northwestern Hawaiian Islands (NWHI) vs. Main Hawaiian Islands (MHI)

The Hawaiian monk seal consists of one population distributed throughout the Hawaiian Archipelago. That is, there is no evidence that monk seals occurring in any part of the archipelago are genetically distinct from monk seals elsewhere in the range (Schultz *et al.* 2009). While the population is not genetically differentiated, for management and research purposes, a distinction is often made between seals utilizing the NWHI and MHI. Differences between Hawaiian monk seal population status, habitat, research efforts, and threats to the species in these two regions support the separate approach to management and conservation efforts (Baker *et al.* 2010). The following discussion summarizes some of the differences identified between the two management areas and refers to the seals in these geographic areas as separate populations due to these differences.

Recruitment trends differ between the NWHI and MHI. In the NWHI, many of the reproductive subpopulations are experiencing a decline that is primarily attributed to food limitation ((NMFS) 2007a). Evidence supporting this association has been demonstrated by comparing seal's growth, juvenile survival, and fecundity among the breeding subpopulations. Craig and Ragen (1999) presented this association by demonstrating that juveniles at French Frigate Shoals (FFS), a site with low juvenile survival, were found to be smaller in size in comparison to juveniles at Laysan Island, a site with relatively higher juvenile survival. Shortly after in 2001, necropsies from an unusual juvenile mortality event all indicated chronic negative energy balance (Baker 2008). At FFS females demonstrated delayed reproduction, achieved adult size at an older age and showed overall lower age-specific reproductive rates compared to females at the relatively stable subpopulation at Laysan Island (Harting et al. 2007; Baker 2008). These rates of high juvenile mortality result in fewer females achieving reproductive maturity; thereby, causing an imbalanced age structure, which in turn contributes to the continued decline. In contrast, the MHI portion of the population is increasing. This is evident by the growing number of identified individuals and number of pups born annually (Baker and Johanos 2004). In addition to the difference in population growth, monk seals in the MHI appear to be in better physical condition than those in the NWHI. In general, MHI females begin reproducing at a younger age, and attain higher birth rates than females in the NWHI (Baker *et al.* 2010). In 2008, a 4 year old MHI female became the youngest documented Hawaiian monk seal of known age to pup (NMFS 2010g). The successfully reproducing females of the MHI are also producing robust pups. Measurements from axillary girths and standard lengths of weaned pups from the MHI were significantly greater in comparison to the same measurements from weaned pups from the NWHI, which are thought to have better foraging conditions for the mothers in the MHI (Baker and Johanos 2004; Baker et al. 2006b). Additionally, the estimated survival from weaning to age 1 is 77 percent in the MHI, which is much higher than the 42-57 percent survival estimated for breeding subpopulations in the NWHI. This disparity in population status between the two regions is well reflected in recent estimates of population growth and decline of monk seals in

the separate areas. If demographic trends continued at the current rates, the MHI and NWHI portions of the population would equalize in 15 years (Baker *et al.* 2010).

Factors influencing foraging success may explain the disparity between the two regions. These factors can be attributed to an inequity in ecological competition on several levels. First, low numbers of monk seals in the MHI may point to a greater per capita availability of prey than in the NWHI (Baker and Johanos 2004). Specifically, the lower number of seals in the MHI across a large expanse of available foraging habitat allows for less intra-specific competition for food resources. Secondly, the NWHI are located within Papahanaumokuakea Marine National Monument, one of the largest and best-protected marine areas in the world, where commercial fishing efforts have been minimized in past years and recently completely ceased[8]. The protected ecosystem of the NWHI, in comparison to the MHI, has a greater number of large predators. The sharks, jacks and other demersal fish that have been observed to compete directly with monk seals in the NWHI are much less abundant in the MHI and inter-specific competition(i.e., competition with predators of other species feeding on similar prey) is likely lower in the MHI (Baker and Johanos 2004; Parrish 2008). Additionally, competition between humans and monk seals may be limited in the MHI because seals prefer small (usually less than 20 cm or 8 in) eels, wrasses, and other benthic species not commonly sought by fishermen (Parrish *et al.* 2000). All of these factors appear to positively influence the population status of monk seals in the MHI at this time, but these favorable dynamics may shift as the population grows in the MHI.

Additional differences between the two regions are further reflected in the threats to the species, and consequently in the management priorities and activities for each population. The Recovery Plan outlines the threats to the species and discusses in which locations those threats are most prevalent as well as the differences in those threats. One of these threats includes that of habitat loss ((NMFS) 2007a). The low-lying islets and islands of the NWHI are particularly susceptible to the global threat of sea level rise, an impact that results from several factors associated with climate change, including thermal expansion of the warming oceans and melting of glaciers and ice caps (Baker et al., 2006). In the 20th century sea levels rose 15 cm, and increases are expected to continue (Baker et al., 2006). As a result of sea level rise, important pupping and haul-out habitat may be lost (Baker et al., 2006). While the threat of sea level rise may be accelerated by anthropogenic forces, activities which influence this threat are considered to be of a complex global scale. Management efforts that are within the scope of a Section 7 consultation (dealing with a single action or activity) would likely focus on the preservation of specific areas for pupping and hauling-out. In the NWHI, management measures may include regular monitoring for changes in elevation at the various islets and islands. Long-term mitigation planning at specific sites may also play a role in conserving habitat in the NWHI. In the MHI, habitat loss is equally a threat, but in this geologically younger area, coastal anthropogenic development plays a pronounced role by exacerbating the threat to coastal habitat. Like most other coastal states, Hawaii's dependence on coastal resources has led to increased development of shorelines. In response to natural erosion processes, urban shorelines were often hardened to protect assets. Efforts to harden shorelines alter the natural hydrodynamic system of waves and

[8] The presidential proclamation establishing the Papahanaumokuakea Marine National Monument (PMNM) called for the closure of commercial fisheries by June 15, 2011. That closure deadline was completed a year early in 2010, with compensation funding that was provided under the Consolidated Appropriations Act of 2008.

currents, affecting sand transport rates that control the erosion-accretion process of beaches (Defeo *et al.* 2009). Consequences of armoring (i.e., shoreline securing structures e.g., seawalls, or rip rap), vary dependent on the placement of the structure and the surrounding hydrodynamics, but have included passive erosion on the armored beach, flanking erosion of shorelines adjacent to engineered structures and possibly the enhanced erosion on protected coasts (Venter *et al.* 2006). On Oahu past reliance on shoreline armoring to mitigate coastal erosion has resulted in widespread beach narrowing and sand loss (Fletcher *et al.* 1997). While current management measures are aimed at coastal setbacks (i.e., planning development in land from erosion threats), the increased demand for the use of coastal areas for industry, recreation, and private use puts pressure on developers to increase access to "new" beach areas. In the future, remote beaches may be squeezed between seaward directed development and rising sea levels, leaving no room for natural sediment dynamics (Defeo *et al.* 2009). As the number of Hawaiian monk seals increases in the MHI and development continues, available habitat for hauling-out and parturition will become increasingly important.

Direct anthropogenic threats from activities within the Papahanaumokuakea Marine National Monument have been minimized through management measures aimed at protecting the unique resources within the NWHI. Despite being located in this highly protected area, Hawaiian monk seals continue to face threats in the NWHI that require management. Twenty years of robust population monitoring data in the NWHI aids in making these management decisions. Poor juvenile survival, reflected in the data has accordingly focused management efforts towards positively influencing population trajectories by increasing efforts which support monk seal health during the fragile first years. These measures included past efforts to supplement the nutrition of animals in poor condition as well as more current efforts that include relocating newly weaned animals to more protective areas of the various Atolls and attempting to remove parasitic loads from juvenile animals. Conversely, the MHI population is only in the early stages of scientific monitoring efforts, as previous research efforts were concentrated towards NWHI. Currently a great deal of information regarding MHI seals is received from a growing volunteer network, and management efforts in the MHI have been focused on threats centered on anthropogenic influences. Growth in seal numbers in the MHI has increased human and seal interaction and many coastal residents and visitors are unfamiliar with the specific needs of the species. This increased overlap in use of coastal and marine habitat has led to fishery interactions (hookings and entanglements), disturbance and harassment of seals, and sometimes injuries to humans (Baker *et al.* 2010). Impacts from pollution and runoff into the aquatic environment also pose health hazards to the species in the MHI; these threats are not factors considered in the declining population in the NWHI (Littnan *et al.* 2006). In addition to these unintentional anthropogenic threats, three seals were documented recently shot and killed in the MHI.

As discussed above, differences between the NWHI and MHI portions of the population present unique research and management challenges for the Hawaiian monk seal. With the continued decline in numbers and the fragile status of reproductive classes in the NWHI, the survival of the species as a whole may become increasingly dependent on the success of the portion of the population in the MHI along with management efforts taken to ensure that success.

Habitat

The Hawaiian monk seal depends on marine and aquatic environments as well as terrestrial environments for survival. While Hawaiian monk seals spend a majority of time in the water, the terrestrial component of habitat plays a vital role throughout all life stages. Monk seals utilize terrestrial habitat to haul out for resting, molting, giving birth, nursing and avoiding predators. Since monk seals may remain at sea for several days or more at a time, resting on land is essential to conserve energy. Resting commonly occurs on sandy beaches, but may also occur on rocky shores, rock ledges, emergent reefs, and even shipwrecks (Antonelis *et al.* 2006). While on shore, monk seals may take shelter from wind and rain under shoreline vegetation. When ocean conditions are rough, monk seals may spend a greater proportion of time resting on land. Resting on land is typically done for a few hours to several days at a time (Antonelis *et al.* 2006).

Terrestrial habitat is essential for parturition and nursing of pups. Monk seal births are most common between February and August, but have been documented in all months of the year (Johanos et al. 1994; NMFS 2007a). Pupping and nursing areas are usually sandy beaches adjacent to shallow protected water (Westlake and Gilmartin 1990). Individual females appear to favor certain pupping locations, returning to them year after year. Pregnant females come ashore a few days before giving birth on land to a pup weighing approximately 16 kg (35 lb). Pups nurse for 5 to 6 weeks (Johanos *et al.* 1994) and weigh 50 – 100 kg (110 – 220 lb) at weaning. During nursing, mother and pup remain in close proximity to each other, and the mother is protective of her pup. Although the pup is able to swim at birth, nursing is done on land and the mother-pup pair usually remains on land for the first few days after the pup is born. The mother gradually begins swimming with her pup in the shallows, returning to the general area around the pupping site. As weaning approaches, the mother-pup pair spends more time in the water, venturing further away from the pupping site. After weaning, pups typically remain alone in the shallows near the nursing area for several weeks before venturing into deeper foraging areas (Kenyon and Rice 1959; Henderson 1988). Hauling-out on land is also required for molting, when old pelage is shed. Monk seals usually remain on land during the annual molting; the process lasts approximately 1 to 2 weeks (Kenyon and Rice 1959).

Hawaiian monk seals utilize the aquatic components of the environment for thermoregulating, resting, interacting, mating and foraging. Observation of 24 adult male monk seals wearing animal-borne video cameras showed that most of the time spent underwater was spent resting (34%) or interacting with other seals (9%) and that much of these activities were spent in shallower depths (Parrish, 2000; Parrish 2004).. Resting may also occur at sea or in shallow, submerged caves. Little has been observed regarding monk seals mating behavior in the marine environment; however, gains in foraging research provide new insight into the monk seal foraging since the time of the previous critical habitat designation.

Previous understandings of monk seal foraging assumed monk seals were feeding on localized prey species on near shore coral reef structures and on offshore banks surrounding the haul-out areas in the NWHI (NMFS, 1983). Although transit and deeper diving behavior was acknowledged in the 1983 recovery plan, little was known regarding monk seal foraging behavior at deeper depths, and the extent and frequency of foraging transits were not well understood. Information from satellite transmitter studies began to transform these concepts by

regularly demonstrating seals transiting to neighboring banks (Parrish and Littnan, 2007). Additionally, digestion studies of captive seals demonstrated that seals were able to pass a meal in less than eight hours; demonstrating scat found on the beach might only represent prey from close reefs and not the seals' entire diet (Goodman-Lowe, 1998; Goodman-Lowe et al., 1999; Parrish and Littnan, 2007). Later, Crittercam footage (or head-mounted cameras) revealed seals ignoring reef fish in the coral shallows in favor of foraging on deeper atoll slopes and neighboring banks. Additionally, depth recordings from these animals demonstrated foraging at depths greater than previously recognized (Parrish et al., 2000; Stewart, 2006). These data combined have reshaped the knowledge of how seals utilize their foraging habitat and where seals are feeding.

Today monk seals are known to be foraging generalists consuming a wide variety of prey species. Goodman and Lowe (1998) identified inshore, benthic, and offshore teleosts, as the most represented prey items in monk seal scat followed by cephalopods and crustaceans. From the 940 scats sampled the study was able to identify 31 families of teleosts and 13 families of cephalopods. Additionally, fatty acid analysis of the monk seal diet has begun to identify an even broader number of prey species consumed by the Hawaiian monk seal (Iverson, 2006). These fatty acid analysis studies have also demonstrated substantial variation in diet among individuals, demographic groups (between juveniles and adults/sub adults), and locations (Iverson, 2006), indicating that individual monk seal foraging preferences and capabilities play a role in selection of foraging habitat. Recently, increased resolution of regurgitation samples has identified the remains of morid cod, which are a species typically found at subphotic depths or depths greater than 95 m (Longnecker et al., 2006). These dietary analyses, that indicate individual seal foraging preferences and seals foraging at greater depths, are consistent with seal foraging ecology studies discussed below.

Recent studies using new advances in technology have demonstrated that Hawaiian monk seals forage in marine habitats anywhere from a meter to several hundred meters in depth. Time-depth recorders from several studies revealed a large portion of effort at depths between 50 and 300 m (164 – 984 ft), which coincides with the bank and slope habitats used by prey species often detailed in monk seals'diet (Parrish 2004; Parrish and Abernathy 2006). Foraging studies by Parrish describe these preferred foraging habitats as low-relief substrates such as sand and talus in areas of habitat uniformity (Parrish and Littnan, 2007; Parrish, 2008), where adult seals are able to move large, loose talus fragments found in the premium foraging habitat to reach the prey hiding underneath (Parrish et al., 2000). Although these sites are often greater distances from haul-out sites, it appears that the less sheltered prey in the uniform habitat may make this area energetically preferable to the seals (Parrish et al., 2000).

Studies in the NWHI (Parrish et al., 2002; Stewart, 2006) have also shown that monk seals may forage in subphotic zones, or depths greater than 300 m (984 ft), sometimes visiting patches of deep corals (Parrish 2004; Parrish et al., 2002). A summary of telemetry data from 37 male and female adults tagged throughout the NWHI revealed that 17 seals appeared to be specializing in subphotic foraging (Parrish 2004). This calculates out to 46% of the adults tracked, which Parrish (2004) extrapolated out to be about a fourth of the entire population. The use of these deeper habitats may reflect monk seals taking advantage of readily available prey in a habitat with decreased inter-specific competition (Parrish, 2008). The maximum depth at which seals

have been documented to forage is around 500 m (1640 ft) (Parrish 2004); however, monk seals are almost certainly capable of exceeding depths of 550 m and the extent of foraging depth may still be unknown (Parrish 2004; Stewart et al. 2006).

Foraging studies with instrumented juvenile monk seals (1 – 3 years old) in the NWHI illustrated foraging behavior similar to that of adult monk seals. Feeding occurred both within shallow atoll lagoons 10 – 30 m (33-98 ft) and on deep reef slopes (50 – 100 m/160 – 325 ft), usually over sand rather than talus (Parrish *et al.* 2005). Video footage of juvenile seal foraging showed seals moving along the bottom, flushing prey with a variety of techniques, including probing the bottom with their nose, using their mouth to squirt streams of water at the substrate, and flipping small rocks with their heads and shoulders (Parrish *et al.* 2005). While juvenile seals are able to dive to depths similar to adults, the smaller seals likely do not yet have the size or experience to engage in the successful large talus-foraging behavior exhibited by adults (Parrish *et al.* 2005). In addition to the preferred habitat, limited data also indicate that juvenile seals may occasionally forage at the deeper ranges used by adults (Parrish 2004).

Although much less information is available regarding monk seals foraging in the MHI, 11 juvenile and adult monk seals were tracked in 2005 using satellite-linked radio transmitters showing location but summaries of dive depths. This study indicated that seals usually remained in near shore waters within the 200 m (650 ft) isobath (Littnan *et al.* 2006). Additionally, more recent tracking of Hawaiian monk seals with cell phone tags in the MHI demonstrates some diving depths up to 489 m (1,604 ft) (NMFS 2010o).

In general, the selection of foraging habitat by monk seals may be influenced by many factors, including environmental conditions that influence abundance and composition of prey assemblages; conditions that influence prey availability and capture success such as intra-specific and inter-specific competition; as well as individual differences in size and age class, preferred prey, and individually favored foraging tactics. These variables all influence where, how and when Hawaiian monk seals utilize foraging habitat within the marine environment.

In summary, features that support resting, reproduction, and foraging are essential for the conservation of this species. Therefore, Hawaiian monk seal critical habitat must include terrestrial and marine areas. Terrestrial areas include haul-out sanctuary for resting, molting, pupping, nursing and avoiding predators. Terrestrial habitat consists of near shore or emergent surfaces where monk seals can haul out. Those areas preferred for pupping consists of a subset of haul-out habitat and is usually on sandy beaches adjacent to shallow marine areas. These shallow marine areas provide protection for pups while becoming accustomed to unaccompanied life in the marine environment and learning to forage successfully. The marine habitat includes areas used for thermoregulating, resting, interacting, mating and foraging. Foraging habitat for Hawaiian monk seals has been demonstrated to be at depths as great as 500 m in the NWHI. Recent declines in the Hawaiian monk seal population point to food limitations in the NWHI, especially for juvenile monk seals, making marine foraging areas particularly critical components of monk seal habitat.

PHYSICAL OR BIOLOGICAL FEATURES ESSENTIAL FOR CONSERVATION

Joint NMFS-U.S. Fish and Wildlife Service regulations at 50 CFR 424.12(b) state that in determining what areas are critical habitat, the agencies "shall consider those physical and biological features that are essential to the conservation of a given species and that may require special management considerations or protection." Features to consider may include, but are not limited to:

(1) Space for individual and population growth, and for normal behavior;

(2) Food, water, air, light, minerals, or other nutritional or physiological requirements;

(3) Cover or shelter;

(4) Sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and generally;

(5) Habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.

The regulations also require agencies to "focus on the principle biological or physical constituent elements" within the specific areas considered for designation, which "may include, but are not limited to, the following:… spawning sites, feeding sites, seasonal wetland or dryland, water quality or quantity, … geological formation, vegetation type, tide, and specific soil types." For the purposes of this report these elements will be referred to as the essential features.

In preparation for the 12-month finding, NOAA Fisheries released five preliminary features to demonstrate to the public the types of areas that may be affected by the critical habitat designation. Following the 12-month finding, the CHRT was formed and members were tasked with determining the essential features for Hawaiian monk seal critical habitat using the best scientific and commercial information available. The CHRT recognized that essential features for the Hawaiian monk seal must include terrestrial and marine areas and take into account the information that has been gained with regards to Hawaiian monk seal habitat use since the prior designation. Due to the varied functionality of the habitat, the CHRT has used the best scientific information available to identify areas used by Hawaiian monk seals along with the features essential to the conservation of the species including the following:

1. *Areas with characteristics preferred by monk seals for pupping and nursing.* As indicated in the natural history section of this report, Hawaiian monk seals have been observed to give birth and nurse in a variety of terrestrial coastal habitats; however, certain beaches may be preferred for pupping at the various atolls and islands within the range. Preferred pupping areas generally include sandy, protected beaches located adjacent to shallow sheltered aquatic areas. Terrestrial pupping habitat may include various substrates such as sand, shallow tide-pools, coral rubble, or rocky substrates, as long as these substrates provide accessibility to seals for hauling-out. Characteristics of preferred sites may also incorporate areas with low lying vegetation utilized by the pair for shade or cover. Preferred coastal areas may attract multiple mothers to the same area year after year for

birthing; however, due to the solitary nature of the species, some mothers may prefer to return to a lesser used location year after year.

2. *Shallow, sheltered aquatic areas adjacent to coastal locations preferred by monk seals for pupping and nursing*. Preferred pupping and nursing sites are often adjacent to shallow, sheltered aquatic areas. These sheltered marine areas provide protection for the mother and pup pair from predators and extreme weather events, as well as habitat for thermoregulatory cooling and swimming. Upon weaning, the newly-independent pup will utilize the sheltered marine area to acclimate to life on its own; utilizing the habitat for swimming, exploring, socializing, thermoregulatory cooling and the first attempts at foraging. Characteristics of the sheltered aquatic sites may include reefs, tide pools, gently sloping beaches, and shelves or coves that provide refuge from storm surges and predators.

3. *Marine areas from 0 to 500 m in depth preferred by juvenile and adult monk seals for foraging*. Food limitation is identified in the recovery plan as a critical threat to the Hawaiian monk seal; therefore, foraging grounds within the marine environment are an essential component in the recovery and conservation of the species. As identified in the habitat section of this report Hawaiian monk seals forage in marine habitat anywhere from 0 to 500 m. This habitat includes barrier reefs of atolls, leeward slopes of reefs and islands, at sites along the Hawaiian Islands Archipelago's submarine ridge, nearby seamounts, and submerged reefs and banks (Stewart 2006). Preferred foraging habitat of adult monk seals is characterized by sand terraces and talus slopes that may range in depths of 50 – 100 m (160 – 325 ft) deep around home atolls or islands (Parrish and Littnan 2007). These habitats provide substrate and materials for preferred benthic and cryptic prey species to hide. While the slopes are characterized as preferred feeding areas, recent diving, camera, and fatty acid analysis studies demonstrate that seals are feeding at depths greater than previously believed (300m -500 m, or 984 ft – 1640 ft) (Parrish *et al.* 2002; Iverson 2006; Stewart 2006). The use of these deeper habitats may reflect monk seals taking advantage of readily available prey in a habitat with decreased interspecific competition (Parrish 2008). Habitat at these greater depths may be comprised of deep water coral beds or the barren habitats prey species move among (Parrish *et al.* 2002). Fatty acid analysis studies have demonstrated substantial variation in diet among individuals, demographic groups (between juveniles and adults/sub adults) and locations (Iverson 2006); indicating that individual monk seal foraging preferences and capabilities play a role in selection of foraging habitat. The steady decline of the species (attributed mainly to food limitation) coupled with individual foraging tactics and prey preferences reveals a need for protection that incorporates the entire range of foraging areas for this species.

4. *Areas with low levels of anthropogenic disturbance.*
Hawaiian monk seals utilize terrestrial habitat to haul out for resting, pupping and nursing, molting and as a refuge from predators. The high energetic demands of

life in the marine environment make resting behavior essential to the fitness of individual animals and the overall population. Human interactions with monk seals have the potential to cause disturbance and subsequent abandonment of a favored haul-out site or pupping area for less suitable locations. New locations may lack refuge characteristics leaving the seals more vulnerable to predation or other environmental threats. Generally, Hawaiian monk seals seek areas that are undisturbed by large numbers of humans or human induced interactions (such as interactions with dogs or vehicles). In the NWHI, the Hawaiian monk seal's intolerance of human disturbance was evident in the distribution of seals found at Midway Islands, French Frigate Shoals and Kure Atoll during periods of human occupation after the 1950s (Kenyon 1972; Ragen 1999). Throughout these times, Kenyon (1972) reports that inhabitants observed seals utilizing sand spits and islands that were less frequented by humans. Additionally, fewer seals were observed to give birth or haul out on the islands where the main human settlements occurred (Kenyon, 1972). At Kure, Kenyon (1972) also reported an overall decrease in monk seals counts, depressed rates of reproduction and decreased juvenile survival. Changes in human occupation and management to mitigate disturbance at Kure and Midway has encouraged seal use of formerly abandoned habitat (Ragen 1999; NMFS 2007a). Hawaiian monk seal behavior in the MHI also indicates a general preference for more remote sites that are less prone to human disturbance (e.g., Rabbit or Manana Island) (Baker and Johanos 2004).

5. *Marine areas with adequate prey quantity and quality.* Food limitation is identified in the recovery plan as a critical threat to the Hawaiian monk seal; therefore, prey quantity and quality within the marine foraging habitat is an essential component in the recovery and conservation of the species. Monk seals are considered foraging generalists that feed on a wide variety of prey species. Goodman and Lowe (1998) identified inshore, benthic, and offshore teleosts, as the most represented prey items in monk seal scat followed by cephalopods and crustaceans. From the 940 scats sampled the study was able to identify 31 families of teleosts and 13 families of cephalopods. Additionally, fatty acid analysis of the monk seal diet has identified a broad number of prey species consumed by the Hawaiian monk seal (Iverson 2006). While the broad number of prey species makes identifying an individual prey species for specific protections difficult, knowledge of the foraging habits of seals helps to identify areas and habitat types that are regularly utilized for foraging, including the sand terraces, talus slopes, submerged reefs and banks, nearby seamounts, barrier reefs, slopes of reefs and islands, and deep coral beds (Parrish et al. 2000; Parrish et al. 2002). Within these habitats, conditions, such as water quality, substrate composition and available habitat, should support growth and recruitment of prey species to the extent that monk seal populations are able to successfully forage. Current evidence from shrinking populations in the NWHI indicates that prey quantity and quality are essential to recovery; but further research is necessary to identify direct correlations to specific threats to the prey species as well as to identify appropriate management actions.

6. *Significant areas used by monk seals for hauling-out, resting or molting.* As described above, Hawaiian monk seals utilize terrestrial habitat to haul out for resting, pupping and nursing, molting, and as a refuge from predators. Energetic requirements of life in the marine environment make resting behavior important and, consequently, terrestrial haul-out areas are an essential component for conservation. These haul-out sites are generally characterized by sandy beaches, sand spits, or low shelving reef rocks accessible to seals. Favored sites may also reflect areas that are remote or with low levels of human disturbance. Although Hawaiian monk seals are considered to be a solitary species (in comparison to other gregarious pinnipeds such as sea lions), seals may still haul out in small numbers or chose to utilize nearby areas along the same stretch of coastline. In general, seals are likely to frequent areas utilized by other seals due to shared preferences for accessible and remote habitat.

GEOGRAPHICAL AREA OCCUPIED BY THE SPECIES AND SPECIFIC AREAS WITHIN THE GEOGRAPHICAL OCCUPIED AREA

One of the first steps in identifying critical habitat is determining the geographical area occupied by the species. As discussed previously, and announced in the 12-month finding, Hawaiian monk seals are found throughout the Hawaiian archipelago and on Johnston Atoll. This geographic range may be considered occupied throughout the NWHI and MHI based on systematic surveys and sighting information from these areas. Verified past accounts from Johnston Atoll were used to determine that the Atoll may be considered as part of the geographical area occupied by the species. Having discussed the range of the species in the 12-month finding, the next identified step was to determine "specific areas" within the geographical area occupied essential to the conservation of the species.

To identify areas that fit the criteria of critical habitat, each specific area must have one or more of the essential features, that may require special management or protection. The CHRT identified areas that met the criteria of critical habitat within the range of the species, including areas in the NWHI and the MHI. The CHRT discussed the possibility of incorporating areas of Johnston Atoll, but determined that the lack of recent seal use (the last sighting in the area was a single seal in 2004 (NMFS 2010m)), the remote nature of the Atoll from the Hawaiian Archipelago (750 nm west of Hawaii), and the hazardous conditions associated with past human use (including contamination, erosion, and debris (Force 2007; NMFS 2010n) rendered the features in this area inadequate for seal conservation.

Acknowledging that Hawaiian monk seals are dependent on both terrestrial and marine habitat, the CHRT delineated the specific areas to incorporate both marine and terrestrial habitat. Each area was selected to reflect current seal use as well as anticipated habitat needs for recovery for the species. Although specific areas are identified across the range, areas have been grouped according to the NWHI and MHI management units to express similarities in population status, presence of essential features, and the activities that may affect the essential features such that

special management and considerations or protections are needed. Figures depicting the specific areas may be found in Appendix I to this report.

Northwestern Hawaiian Islands (NWHI)

The majority of the Hawaiian monk seal population is currently concentrated in the NWHI. The six major subpopulations within the NWHI include Kure Atoll, Midway Islands, Pearl and Hermes Reef, Lisianski Island, Laysan Island, and French Frigate Shoals. Two smaller subpopulations are located at Necker and Nihoa Islands. Seals have also been sighted regularly at Maro Reef and Gardner Pinnacles. Despite the demographic differences between the islands and atolls, averages of 10-15% of the seals migrate among the NWHI subpopulations ((NMFS) 2009). The total number of seals identified at the six main NWHI sites is estimated at a minimum population of 914 individuals ((NMFS) 2009). Since 2001, the numbers of seals at these six main sites has been decreasing causing a downward population trend for the species as a whole. The smaller populations estimated at 48 for Necker and 86 for Nihoa have suggested a positive growth trend, but these estimates are based on sporadic site surveys over the years.

The current critical habitat designation for the Hawaiian monk seal 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 (18.3 m) around Kure Atoll, Midway Islands (except Sand Island due to modifications to the habitat by the Navy), Pearl & Hermes Reef, Lisianski Island, Laysan Island, Maro Reef, Gardner Pinnacles, French Frigate Shoals, Necker Island, and Nihoa Island in the NWHI (51 FR 16047; April 30, 1986: 53 FR 18988; May 26, 1988).

The CHRT recognized that the 1988 designated areas continue to exhibit all of the identified essential features that fit the criteria for Hawaiian monk seal critical habitat. Specifically Kure, Midway Islands, Pearl and Hermes Reef, Lisianski Island, Laysan Island, French Frigate Shoals, Necker Island, and Nihoa Island provide pupping and nursing areas with adjacent sheltered marine areas, low levels of anthropogenic disturbance, and significant areas preferred by all age classes of Hawaiian monk seals on which to haul out. The marine waters that surround the aforementioned islands and atolls provide sheltered areas for pups, foraging habitat, and prey for foraging. The marine waters that incorporate and surround Maro Reef and Gardner Pinnacles are utilized by Hawaiian monk seals for foraging and fit the criteria of critical habitat. The CHRT identified two revisions that were necessary to Hawaiian monk seal critical habitat in the NWHI. The first revision identified by the team was to extend the marine boundary surrounding each identified area out to a depth of 500 m. This revision incorporates foraging habitat that has been identified in foraging studies since the previous designation, as discussed prior in the habitat section of this report. The second revision the team identified was the inclusion of Sand Island at Midway Atoll, because this island supports pupping and nursing, as well as terrestrial haul-out habitat. While Sand Island was identified as having the essential features, Midway Harbor, on Sand Island, was identified as lacking the essential features due to the hardened shoreline, and was not included in the designation.

Specific areas identified by number in the NWHI for proposed critical habitat include 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 the 500 m depth contour around the following numbered islands, atolls and reef:

Area 1. Kure Atoll (28° 25' 10.999"N/ 178° 19' 45.001"W)
Area 2. Midway Islands (not including Midway harbor) (28° 14' 12.001"N/ -177° 22'05.999"W)
Area 3. Pearl and Hermes Reef (27° 50' 37.000"N/ 175° 50' 31.999"W)
Area 4. Lisianski Island (26° 3' 49.000"N/ 173° 58' 0.001"W)
Area 5. Laysan Island (25° 46' 10.999"N/ 171° 43' 57.000"W)
Area 6. Maro Reef (25° 25' 27.001"N/ 170° 35' 19.000"W)
Area 7. Gardner Pinnacles (25° 0' 0.000"N/ 167° 59' 55.000"W)
Area 8. French Frigate Shoals (23° 45' 31.000"N/ 166° 14' 37.000"W)
Area 9. Necker Island (23° 34' 36.001"N/ 164° 42' 1.001"W)
Area 10. Nihoa Island (23° 3' 23.000"N/ 161° 55' 18.998"W)

The NWHI proposed areas fall under the Papahanaumokuakea Marine National Monument. This remote area of the Hawaiian archipelago has been largely protected since and prior to the 2006 designation of the marine monument but anthropogenic stressors still have environmental impacts on the area. Despite protections, the Papahanaumokuakea Marine National Monument Plan identifies some of the stressors to the habitat to include activities such as coastal development, marine pollution, terrestrial pollution, dredging, invasive species, fishery debris, climate change, and vessel groundings (Monument 2008). Many of these stressors are brought on from past use of the area, as well as outside influence, but some activities do occur that may require special management or protections to prevent impact to essential features. The management plan for the Monument does present a means for providing protections to the Hawaiian monk seal; however, the plan does still allow for the following activities to occur within the Monument: management activities by jurisdictional agencies, research, education, Native Hawaiian practices, as well as a small number of recreational trips, vessel passage and visits to historical sites at Midway Atoll. Activities within the Monument may present several management concerns associated with either the potential to cause disturbance to Hawaiian monk seals at preferred areas, to limit haul-out and pupping areas, and/or to impact prey species of the Hawaiian monk seals. The activities that may require special management include research activities, infrastructure building or maintenance activities, visitor activities, and vessel activities.

Main Hawaiian Islands (MHI)

The 1988 Critical Habitat Designation for monk seals did not incorporate the MHI. At that time a limited number of seal sightings were recorded annually from the MHI and research efforts were concentrated on the larger numbers of breeding groups in the NWHI. Since that time seals have begun to increase in the MHI, with seals utilizing available coastal and marine habitat throughout the MHI including all major islands and offshore islands and islets with accessible haul-out area. Births have been recorded on Niihau, Kauai, Oahu, Molokai, Maui, Kahoolawe, and Hawaii. The minimum abundance estimate for the MHI in 2008 was reported at 113 seals ((NMFS) 2009). This number was determined using the total number of individually identifiable seals from sightings throughout the MHI. This estimate is considered below true total abundance

due to an inability to account for seals in remote and less accessible areas including Niihau, Lehua Island, and Kaula Island (Baker *et al.* 2010). Aerial survey work in the MHI indicates that seal distribution decreases from the northwest to the southeast along the chain and demonstrates seal numbers are lower in densely human populated areas (Baker and Johanos 2004). However, individual seals have been sighted at multiple islands throughout the chain, indicating that movement between islands occurs often. Based on increases in numbers of identified individuals and work with aerial survey data, seal numbers in the MHI appear to be steadily growing from the initial low levels. Projections utilizing seal abundance and growth rates estimate that numbers in the MHI will reach numbers equal to those in the declining NWHI in 15-16 years (Baker *et al.* 2010).

During the delineation process, the CHRT discussed the possibility of identifying key beaches and areas on each MHI island currently utilized by the Hawaiian monk seal, but in deliberation the CHRT found that several factors did not support partitioning the habitat in this fashion. First, Hawaiian monk seal behavior does not support defining small habitat areas and rating them based on importance. Hawaiian monk seals are unlike pinniped species that congregate in large numbers at specific or discrete sites (e.g., rookeries or colonies). The species is considered solitary and wide ranging, which results in individuals spreading out and utilizing a large range of areas in the terrestrial and marine environment. Monk seal habitat preferences vary greatly between individuals, and additionally may change throughout the life span of the animal. With this consideration in mind, the number of seals currently utilizing the MHI is small and employing current Hawaiian monk seal habitat use for designation may only reflect individual monk seal preference rather than accurately characterize essential habitat for the species as a whole. In conjunction with this concern is the fact that data gathered in the MHI is currently dependent mostly on voluntary sighting information. This data is not systematic and as such is biased. More sightings are likely to come from areas that are high in human activity which is in direct contradiction with most seals' preferences for more remote areas.

Second the CHRT considered the definition of critical habitat and how it applies to the species. Critical habitat is defined by the ESA as area essential to the conservation of the species. "Conservation" is defined under the Act as not only survival of the species but also recovery (i.e., measures pursuant to the Act are no longer necessary). The Hawaiian monk seal population as a whole is in decline. Poor juvenile recruitment in the NWHI over the past decade indicates that the populations will continue to decline and abundance rates may not see a reversal for some time. Thus, MHI habitat, where seals are experiencing favorable conditions, has become vital to the survival of the species as a whole. In considering the MHI habitat, the CHRT recognized that designating critical habitat in the MHI based on current seal use would fail to take into account enough area to support the growing population or, more importantly, a recovered population. A more expansive designation will best meet the recovery needs of this wide ranging and solitary species. In addition to these factors, as a coastally dependent species, the Hawaiian monk seal will be impacted by sea level rise throughout its range. Habitat loss at low lying Atolls in the NWHI will continue to be experienced and coastal habitats in the MHI may be impacted as well. This type of threat is not easily managed and only a proactive approach in habitat protection will temper future losses and provide hope for the recovery of the species.

The CHRT identified that current seal use indicates that all of the Islands in the MHI are utilized by Hawaiian monk seals and that areas with current low abundance of seals are likely to increase in use with natural expansion of the population. All of the identified essential features are present on land or offshore marine areas of the islands of Niihau, Kauai, Oahu (including Rabbit Island), Molokai, Maui, Kahoolawe, and Hawaii. Kaula Island, Lehua Island, Lanai, islets offshore of the MHI and the surrounding offshore areas of all the aforementioned, provide habitat with low levels of anthropogenic disturbance, foraging habitat as well as prey for foraging and significant areas preferred by all age classes of Hawaiian monk seals to haul out. Current foraging information indicates that foraging monk seals in the MHI may have a smaller range than seals foraging in the NWHI, but recent tracking data indicates that some seals are utilizing habitat in deeper areas (NMFS 2010o). As discussed earlier, in the NWHI vs. MHI section, the MHI may provide less interspecific as well as intra-specific competition for foraging monk seals. As populations increase in the MHI and intra-specific competition increases, seals will likely be forced to greater foraging depths and ranges to meet foraging needs. Thus, foraging patterns of monk seals in the MHI will begin to mimic foraging patterns of seals tracked in the NWHI. With this consideration in mind, the CHRT recommended that marine habitat for each specific area should be consistent with the marine habitat in the specific areas of the NWHI to reflect the foraging needs of the growing MHI population. Terrestrial habitat in the MHI is not consistent with the small islands of the NWHI, in that the MHI represent much larger land masses much of which are not accessible to the Hawaiian monk seal. Not all terrestrial habitat in the MHI is equal in seal accessibility and use; however, portions of the MHI coastal habitat can be considered hardened shorelines or developed areas that do not have the essential features and would not support Hawaiian monk seal conservation. These areas identified by the CHRT include boat harbors and large bays with extensive runoff. These locations are identified under each specific area as regions that have not been included in the designation. Other stretches of hardened shoreline do exist in the MHI; these stretches are often positioned between accessible haul-out locations and identification of every area would cause a piecemeal delineation. Such areas have been included into the designation with the understanding that terrestrial areas inaccessible to seals for hauling-out do not have the essential features necessary for critical habitat.

Specific areas identified by number in the MHI for proposed designation includes marine habitat from the 500-m depth contour (relative to mean lower low water), through the water's edge into the terrestrial environment where the inland boundary extends 5 m inland from the shoreline described by the upper reaches of the wash of the waves, other than storm or seismic waves, at high tide during the season in which the highest wash of the waves occurs, usually evidenced by the edge of vegetation growth or the upper limit of debris around the following areas (except those portions of the areas that have been identified as not included in the designation):

Area 11. Kaula Island
Area 12. Niihau
Area 13. Kauai
Area 14. Oahu
Area 15. Maui Nui
Area 16. Hawaii

Areas that do not meet the definition of critical habitat, and are **Not Included** for proposed Hawaiian monk seal critical habitat in the MHI (essential features are either absent or lacking in quality to be considered essential for Hawaiian monk seal conservation at these sites):

Kauai:

KA1. Hanalei Bay and Pier
KA2. Kikiaola Harbor
KA3. Kilauea Pt.cliff area
KA4. Na Pali coast cliff region
KA5. Nawiliwili Harbor
KA6. Hanapepe Bay and Port Allen Harbor
KA7. Waikaea Canal
KA8. Wailua Ramp

Oahu:

OA1. Area from Pearl Harbor to Kapua Channel(includes areas listed below)
   a. Ala Wai Harbor
   b. Honolulu Harbor
   c. Keehi Harbor/Lagoon
   d. Kewalo Basin
   e. Pearl Harbor
   f. Sand Island Launch Ramp Facility
   g. Waikiki Beach Waters (aka Kapua Channel moorings)
OA2. Haleiwa Boat Harbor
OA3. Hawaii Kai Harbor and Maunalua Bay
OA4. Kalaeloa Barbers Point Harbor and Koolina Harbor
OA5. Kaneohe Bay and Heeia Kea Harbor
OA6. Waianae small Boat Harbor

Lanai:

LA1. Nakalahale Cliff
LA2. Kaholo Pali
LA3. Manele Harbor
LA4. Kamalapau Harbor

Maui:

MA1. Hana Wharf and Ramp
MA2. Kahului Harbor and Ramp
MA3. Kihei Boat Ramp
MA4. Lahaina Harbor
MA5. Maalaea Harbor
MA6. Mala Wharf and Ramp

Molokai:

MO1. Haleolono Harbor
MO2. Kaunakakai Pier
MO3. Kalaupapa Harbor

Hawaii:

HA1. Hilo Harbor (includes areas listed below)
  a. Reed's Bay
  b. Wailoa Sampan Basin and Boat Harbor
HA2. Honokohau Boat Harbor
HA3. Kailua-Kona Wharf
HA4. Kawaihae Harbor
HA5. Keauhou Boat Harbor
HA6. Mahukona Harbor
HA7. Kau Coast's active lava flow areas

In contrast to the remote nationally protected areas in the NWHI, the MHI have a population estimated at over one million in 2009 (Bureau ; NMFS 2010i), with over 6 million tourists visiting the MHI in 2008 alone (State of Hawaii Department of Business 2008). The increased population, development and resource utilization in these areas creates many stressors on the marine and the coastal environments. Although some of the threats in the MHI are found to be similar to the stressors identified in the NWHI, the proximity to the developed areas brings more attention to user conflicts. Terrestrial pupping and haul-out features may be affected by activities such as coastal development or construction that may remove potential haul-out area, decrease the quality of the habitat or introduce additional disturbance to remote areas. Marine foraging habitat and prey quantity and quality may be impacted by activities such as water pollution, fishing, dredging, in-water construction, energy development, aquaculture/mariculture, and vessel activities. Such activities may require special management considerations or protections to safeguard the features of terrestrial and marine habitat essential to Hawaiian monk seals.

UNOCCUPIED AREAS

Section 3(5)(A)(ii) of the ESA authorizes the designation of "specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of this Act, upon a determination by the Secretary that such areas are essential for the conservation of the species." Further guidance in 50 CFR 424.12(e) stipulates that areas outside the geographical area occupied may be designated "only when a designation limited to its present range would be inadequate to ensure conservation of the species." There is insufficient evidence at this time to indicate that areas within the present range would be inadequate for conservation of the species. Therefore, the CHRT determined that no unoccupied areas outside the geographical range of the species would be essential to the conservation of the species.

SPECIAL MANAGEMENT CONSIDERATIONS OR PROTECTION

Joint NMFS and USFWS regulations at 50 CFR 424.02(j) define "special management considerations or protection" to mean "any methods or procedures useful in protecting physical and biological features of the environment for the conservation of listed species."

Activities that may require special management or protection were identified by reviewing the threats identified in the Hawaiian Monk Seal Recovery Plan ((NMFS) 2007a). These threats were evaluated and grouped as either impacting the seal, the essential features of the habitat, or both. Threats identified as impacting the individual seal were considered jeopardy protections that are addressed with the listing of the species. Threats impacting the essential features and, or, habitat were considered to be potential threats to critical habitat. Human activities with potential for generating or contributing to these habitat-related threats were then identified in order to determine special management considerations or protections that may be necessary. Past Pacific Island Regional Office (PIRO) section seven consultations were also reviewed to further identify activities that occur in the Hawaiian Islands that may impact the essential features. Additionally, threats recognized in the Petition (Center for Biological Diversity 2008) were reviewed for potential associated activities. In consideration of the economic analysis, several forms of human activities were identified that have the potential to threaten the features that are essential to the conservation of the Hawaiian monk seal such that special management considerations or protection may be necessary. Major categories of activities that are related to habitat were defined as the following (1) in water and coastal construction; (2) dredging and disposal of dredged materials; (3) energy Development (renewable energy projects); (4) activities that generate water pollution; (5) aquaculture ; (6) fisheries; (7) oil spills & vessel groundings response activities; (8) military activities. All of these activities have the potential to affect one or more of the essential features by altering the terrestrial environment so as to alter the physical habitat or quality of the habitat; or by altering the marine environment in such a way that the prey quantity, quality, or availability is changed. This is not an exhaustive or complete list of potential effects, but rather a description of the primary concerns and potential effects that we are aware of at this time and that should be considered in the analysis of these activities in accordance with section 7 of the ESA.

Under section 7 of the ESA, Federal agencies are not only required to insure that activities that they fund, authorize or carry out do not jeopardize the continued existence of the monk seal, they must also insure that those activities do not destroy or adversely modify its critical habitat. Mitigation or management measures to prevent destruction or adverse modification are determined during the section 7 consultation process and are project specific. Modifications may vary from project to project depending on such factors as location; the scope or extent of the project; number and type of essential features potentially impacted; or project duration. Projects with no federal nexus are not subject to the section 7 consultation process, but nonfederal entities may chose to use information from critical habitat designations to protect and conserve Hawaiian monk seal habitat.

In-Water & Coastal Construction

This category consists of a broad range of activities associated with construction in marine habitats or along the coast and may include any activities that would alter marine or terrestrial habitat. Activities of concern are those that decrease space or cause disturbance to preferred pupping and haul-out areas, decrease available marine area associated with pupping or foraging, or alter water quality in such a way that the quantity or quality of available prey species is altered. Activities that decrease space for available preferred pupping or haul-out areas include the construction of new facilities on the beach (such as piers or resorts) as well as activities that may alter the coastal terrain including those activities that result in increased erosion or have the

potential to alter coastal dynamics and environments (such as construction or repair of breakwaters, docks, piers, bridges, marinas, pilings, bulkheads, boat ramps, rip-rap, jetties, groins, revetments or seawalls). Activities that may create potential for increased anthropogenic disturbance includes those activities that may create facilities or allow for increased human access to currently remote areas preferred by seals (such as construction of hotels or resorts in remote settings with access to seal preferred beaches, or construction of roads or marinas in low disturbance areas frequented by seals). Activities that might affect water quality include any of the above activities that have the potential to introduce sediment or other foreign material into the water column potentially impacting Hawaiian monk seal prey species.

Dredging

Dredging activities, which include the disposal of dredged material, has the potential to affect the benthic habitat, depth, sediment quality, and water quality and in turn affect prey resources for the Hawaiian monk seal. Studies have indicated that activities from dredging have the potential to alter the macrobenthic community structure in both a negative and positive manner (Ansell *et al.* 1998). Negative impacts include the removal of macrobenthic community at the action area, but positive impacts have been seen in the density of organisms outside the immediate zone of deposition of particulate matter this is likely due to a release of organic material from the operations (Ansell *et al.* 1998). An additional negative impact from dredging operations could be the contamination of prey species through re-suspension and spread of contaminants embedded or buried in the dredged sediments (Ansell *et al.* 1998). This type of contamination could adversely affect monk seal prey and lead to bioaccumulation of contaminants in Hawaiian monk seals. Along with factors affecting prey, prolonged dredging activities in areas adjacent to preferred terrestrial haul-out areas could cause disturbance and subsequent abandonment of haul-out or pupping sites. The effects of dredging and disposal activities on critical habitat would be dependent on factors such as location, scale, frequency, method of dredging and disposal, local oceanographic and physical characteristics, and duration of these activities. Dredging activities primarily occur within the harbors and navigable waterways along the coast of Hawaii. Most large harbor dredging projects do not overlap with areas of Hawaiian monk seal critical habitat; however, three disposal sites for the dredged materials, determined to be suitable for ocean disposal by the Environmental Protection Agency (EPA), overlap with the areas being proposed for Hawaiian monk seal critical habitat.

Energy Development

Renewable energy development activities may be considered similar to construction activities but are separated in this report due to the variation in the types of projects, and the uncertainties associated with the potential impacts. Renewable energy projects and associated activities having the potential to overlap with the proposed Hawaiian monk seal critical habitat may include those that seek to generate electricity from ocean thermal energy, wave energy, and offshore wind energy. All three types of projects anticipated in the area likely would require the construction or placement of a structure in the marine environment, anchoring of the structure to the ocean floor, the installation of cables to conduct electricity ashore, possible anchors for those cables and periodic maintenance of any associated structures. While some projects have been tested on a small scale, commercial size projects have yet to be consulted on and the impacts to the marine environment of a large scale project are still not fully understood. In general, the anticipated energy projects pose a potential threat to the essential features of critical habitat for the Hawaiian

monk seal in several ways, similar to those associated with in-water and coastal construction projects. Activities of concern include those that would reduce marine habitat associated with pupping or foraging areas, those that reduce water quality and subsequently impact prey species, and those that increase disturbance causing monk seals to abandon preferred areas. Future energy projects have many uncertainties associated with the impacts to the marine environment and the potential for impacts to Hawaiian monk seal prey species exists. Impacts that require project specific details and possible further investigation include those associated with hydrodynamic alterations, substrate and sediment transport and deposition, habitat alterations, electromagnetic field emissions, long term release of chemicals, and impact from Ocean Thermal Energy Conversion (OTEC). The *Report to Congress on the Potential Environmental Effects of Marine and Hydrokinetic Energy Technologies* identifies projects and studies where impacts such as those described have been acknowledged; the report goes on to identify that project location plays the biggest role in minimizing potential effects (Energy Decemeber 2009). Therefore, energy projects will need to be addressed on a project-specific basis to determine the nature of potential impacts to Hawaiian monk seal critical habitat.

Activities that Generate Water Pollution

Point source and nonpoint source pollution (including but not limited to: agricultural pesticide applications, industrial discharge, and storm water runoff) have the potential to degrade the quality of the water and adversely modify the essential features of the critical habitat by reducing the quantity or quality of available prey species and consequently making the habitat toxic to seals which consume these prey items. Changes in water quality may include: increased turbidity, increased eutrophication, increased temperature, the introduction of toxic chemicals or the introduction of disease. Changes in turbidity, temperature and eutrophication may shift dynamics in a marine ecosystem favoring certain species over others and subsequently reducing biodiversity. Increased temperatures in the marine environment have been linked to higher disease risks for marine species; some pathogens, including those linked to coral bleaching, have been found to grow well at temperature close to or exceeding the hosts optimum temperature (Harvell *et al.* 2002). Raised temperatures and increased eutrophication from runoff have been linked to harmful algal blooms, which have the potential to cause acute morbidity or mortality in Hawaiian monk seals (Gilmartin *et al.* 1980). Additionally eutrophication, a common consequence of coastal development, has also been linked to raised rates of parasitism(Lafferty et al. 2004) further concern with regards to pollution may be the introduction of terrestrially known disease by means of runoff into the marine environment. Toxoplasmosis has been indicated in the death of a Hawaiian monk seal from Kauai (Honnold *et al.* 2005); this type of infection is most commonly linked to domestic cats which are known to shed infective oocysts in fecal material that may be carried through runoff and consumed in marine and terrestrial systems (Harvell *et al.* 2004). Water quality may also be altered with the introduction of chemicals and contaminants into the marine system. Chemicals such as polychlorinated biphenyls (PCBs), DDTs, and organometals, can bioaccumulate in the food chain and may be persistent in marine mammal tissues (Harvell *et al.* 2004). Bioaccumulation of such compounds has been linked to impaired immunological response, or reproductive impairment in some marine mammal species (de Swart *et al.* 1996; Willcox *et al.* 2004). Many of these types of chemicals are no longer in production in the U.S.; however, impacts continue to be a reality from global and past use of these persistent chemicals. Activities that contribute to these stressors in the marine environment are regulated by baseline protections to promote healthy waterways; however, a stronger

understanding of the impacts that water pollution has on open oceans systems, including the synergistic effects of multiple stressors, is still necessary. As successful epidemiological models for ocean systems are applied, more precise measures may be taken to minimize the role that anthropogenic activities play in impacting the essential features of Hawaiian monk seal critical habitat.

Aquaculture/Mariculture

Commercial aquaculture farms exist on the islands of Oahu, Kauai, Maui, Molokai and Hawaii. The USDA 2007 Census of Agriculture reported 74 farms with aquaculture sold for the State of Hawaii. Hawaii's commercial aquaculture sector has expanded over the last few decades and interest in aquaculture technology and industries continues. With ocean resources readily available, and the demand for fish high in the Island communities, new technologies are being tested to farm pelagic species offshore. Aquaculture activities may positively impact wild stocks by decreasing commercial fishing pressure (lowering the demand on commercial fish species); however, these activities also have potential negative impacts that need to continue to be monitored and managed in the marine environment. Concerns associated with aquaculture and mariculture operations include impacts that are similar in nature to both construction activities and to water pollution activities. Potential impacts to water quality and subsequently to prey species include habitat destruction, waste disposal (pollution via euthrophication, pesticides or antibiotics), exotic species or pathogen introduction, and/or increased direct pressure on fishery resources (wild stock seeding, or feed made from wild fish) (Naylor *et al.* 2000). Concerns similar to those associated with construction include the construction of facilities which decrease space or cause disturbance to preferred pupping and haul-out areas, or decrease available marine area associated with pupping or foraging. Some of the coastal farms off of Hawaii are well established and section 7 "jeopardy" impacts to Hawaiian monk seals have been addressed; and impacts to the habitat appear minimal. However, the impacts that new technologies or facilities may have on critical habitat depending on the location and scope of the project may not be fully realized. These effects would need to be determined and addressed during a section 7 consultation; impacts may be dependent on factors such as location, size of operations, and the scale and frequency of chemical use.

Fisheries

Fishery-seal interactions are generally categorized as direct and indirect within the *Hawaiian Monk Seal Recovery Plan* ((NMFS) 2007a). Direct interactions include interactions with active fishing gear of various fisheries, feeding of fishing discards, and entanglement in derelict fishing debris. Indirect interactions are defined as those that result in a reduction of prey availability, impacts of fisheries to important habitat, and impacts to feeding or other behavioral changes. Direct interactions, including hookings and entanglements, are considered to be associated with jeopardy to the species. Management measures and protections to prevent these interactions are associated with the listing of the species, not with measures to protect critical habitat. Activities that may affect essential features include those activities (or fisheries) that reduce prey availability, or impact the quantity and quality of the habitat. Fisheries that may impact Hawaiian monk seal critical habitat are those fisheries which directly or indirectly (by catch) remove Hawaiian monk seal prey species from the habitat, or those fisheries having the potential to impact the quantity or quality of available prey species (e.g. modifications to ecosystems that cause prey decreases).

While the potential for this threat is clear, uncertainty remains regarding the extent of impacts and the need for additional management efforts outside of those measures already taken to manage federal fisheries. The uncertainty exists due to insufficient evidence regarding fisheries competition and Hawaiian monk seals, and may be confounded by factors regarding current monk seal population status in the MHI. As identified in the NWHI vs. the MHI islands section of this report, the decline in Hawaiian monk seal populations of the NWHI has been attributed to food limitations. However, Hawaiian monk seal prey species in the NWHI are not currently being impacted by commercial fisheries since recent management measures have halted commercial fishing activity in this region. Additionally in the recent past fishing efforts in the NWHI have been restricted and managed to address stock sustainability as well as threats to listed species within the region. Despite these past and current management measures, food limitation remains a key threat to monk seals in the NWHI. In the MHI, where managed commercial fishing continues and subsistence and recreational fishing exists, the Hawaiian monk seal subpopulation is increasing and seals are considered to be generally robust in nature. The divergence in population status between these two regions appears to indicate that impacts from fisheries are low, especially in the MHI. However, factors currently favoring seals in the MHI, including low intra-specific and inter-specific competition may be concealing fishery impacts to Hawaiian monk seal prey communities. As Hawaiian monk seals increase in number in the MHI, dynamics may shift, and in turn point to a need for further management of specific species or fisheries. There is insufficient information to predict with confidence if, and at what point, food resources may become a limiting factor for seals in the MHI and to what extent fisheries impacts will contribute to the food limitations.

Oil-spill and Vessel grounding Response Activities

Oil-spill and vessel groundings response activities are identified as threats to essential features of Hawaiian monk seals due to the potential impacts on prey resources as well as the potential to cause disturbance to Hawaiian monk seals at preferred areas during response and recovery efforts. While these incidents are unplanned and accidental in nature, the response and recovery efforts to such events are planned, and special considerations and management efforts may be necessary to address potential impacts to Hawaiian monk seal critical habitat. Oil-spills may have the potential to cause devastation to foraging grounds for the Hawaiian monk seal or render prey species toxic. The severity of oil spill impacts are dependent on the volume of the spill, duration, and the type of petroleum product, in combination with the physical factors at the location of the spill such as wind, wave and current conditions. The severity of impact due to grounding events are determined by the surrounding substrate, the possible release of fluid, plans for removal and the physical factors at the location. Groundings (and subsequent removal of vessels) in marine areas has the potential to disrupt habitat important to prey species and to increase sediment deposition in nearby areas impacting water quality and potentially prey health. Vessel groundings also have the potential to release toxic chemicals (such as oil or petroleum products) into the marine environment which in turn may impact the quantity and quality of prey species available to the Hawaiian monk seals. Groundings causing damage to coral reefs have also been linked to incidence of ciguatera outbreaks (de Sylva 1994); such algal blooms may impact Hawaiian monk seals through bioaccumulation. Actions that are associated with response and restoration efforts for either of these activities may increase the potential for disturbance in areas preferred by Hawaiian monk seals, potentially causing habitat abandonment. Although

these events are unplanned the repercussions of the events and subsequent recovery efforts may have long term impacts to Hawaiian monk seal critical habitat. Management efforts may include contacting appropriate NMFS staff, identifying the essential features present in the location of the spill and identifying the appropriate response to protect those features during the recovery efforts. Response efforts will be unique to each area and multiple variables will play into the most appropriate protocol for response; variables include: the severity of the spill, the number of essential features present, or the expected duration of the impacts to the essential features.

Military Activities

For the purposes of this report, military activities include a wide variety of training and research activities that may have the potential to impact the essential features of Hawaiian monk seal critical habitat. Activities of concern include those that may have the potential to: limit the amount of available preferred pupping or haul-out area, limit the amount of marine areas adjacent to preferred pupping or foraging areas; impact the quantity or quality of prey species available, or increase the potential for disturbance and resulting in preferred habitat abandonment. NMFS works in consultation with DOD to determine impacts to the environment and to listed species. Activities are consulted on for a five year time period and an annual review of monitoring reports and activities is conducted to minimize impacts to listed and protected species as well as the environment. The location, essential features present, and the specific activity (including other variables regarding scope and duration) will determine whether the essential features of critical habitat may be impacted. Thus military projects will need to be addressed on an activity-specific basis to determine the nature of potential impacts to Hawaiian monk seal critical habitat.

Additional Threats addressed in the Petition

NMFS recognizes that the petitioners identified global warming as an overarching threat to the habitat of the Hawaiian monk seal (Center for Biological Diversity 2008); in describing this threat the petitioners identified sea level rise, warming ocean temperatures, and ocean acidification as having the potential to alter the terrestrial and marine habitat of the Hawaiian monk seal. These threats are discussed below with respect to the relevance to Hawaiian monk seal critical habitat and may be considered processes associated with the threat of global climate change.

As recognized in the petition, rises in sea level will decrease terrestrial haul-out areas utilized by Hawaiian monk seals for: refuge from predators, parturition, nursing, resting, and molting; especially in the low lying areas of the Northwest (Baker 2006). Additionally, there is a general consensus that the intensity of tropical storms may increase as a result of global warming (IPCC 2007). This increase in intensity may lead to dramatic shifts in the coastlines and changes to available haul-out sites, due to erosion from intensified storm activity; however, changes that may occur to the coastline are not predictable at this time. Overcrowding at haul-out sites or competition for suitable haul-out areas from land loss could result in demographic changes for the species. However, these changes would be difficult to understand or predict, since density dependence in terms of the amount of terrestrial habitat available has not been documented for the species (Baker 2006). In the MHI, habitat loss resultant from sea level rise may be less extreme; however, the loss of suitable haul-out areas may increase interaction with humans, as monk seals and humans compete for viable coastal habitat and available resources.

Sea level rise not only has the potential to impact haul-out areas, but resultant changes in ocean biochemistry and currents, coupled with increased ocean temperatures and ocean acidification may impact Hawaiian monk seal foraging habitat by impacting the abundance and, or diversity of prey species. Climatic changes are likely to result in changes to the range and distribution of prey species as well as to the composition and dynamics of the surrounding marine system (Parmesan 2006a). Marine life in the Antarctic have already exhibited changes resultant from warming temperatures ranging from declines in species that are losing important ice habitat (ice algae, krill, Emperor penguins, *Aptenodytes forsteriis*) to range expansions in open-ocean feeding penguins (Chinstrap, *Pygoscelis antarcticus* and Gentoo, *Pygoscelis papua*) (Parmesan 2006a). Warming trends in tropical systems may be associated with range shifts towards more temperate areas (Parmesan 2006a); however, the bathymetric features and isolation of the Hawaiian Islands may not provide the additional available habitat for large scale dramatic shifts. Therefore, the impacts to the Hawaiian ecosystem are not well known. Impacts may be seen locally in changes in species composition and distribution. The biological diversity of tropical systems may be at stake as the combined forces of warming temperatures and ocean acidification put additional stress on ecosystems built around coral reefs (Parmesan 2006b; Parmesan 2006a; Hoegh-Guldberg et al. 2007). With increased acidification, calcium-dependent species seem to be at the highest risk, but when entire systems are built around those species (coral) then habitat loss for the reef-dependent species will result in broad scale shifts that in turn may be felt by higher predators (Hoegh-Guldberg *et al.* 2007). The varied diet of the Hawaiian monk seal is likely to be impacted by changes in prey diversity, abundance or dynamics. However, the effect on the overall health and recovery of Hawaiian monk seals is unclear due to the uncertainty regarding these shifts in biodiversity.

Ocean warming in tropical climates does bring about additional concern with regards to disease. Growth rates of marine bacteria and fungi are positively correlated with temperature and increased ocean temperatures may also increase the range of pathogens (Harvell et al. 2002; Parmesan 2006b). These increases in pathogens could result in toxic prey for foraging Hawaiian monk seals. The complexity of ecological interactions in these marine systems makes it difficult to predict what these large scale global changes will do to the dynamics and demographics of species in the systems.

The impacts resultant from global climate change are threats to Hawaiian monk seal habitat and, therefore, may threaten the survival and conservation of the Hawaiian monk seal. While all of the processes associated with global climate change are recognized as threats to the essential features of the Hawaiian monk seal, activities which influence these threats are considered to be of a complex global scale. Current limitations in predicting the specific changes that will occur within these ecosystems, impedes NMFS' ability to predict the resultant impacts to Hawaiian monk seals with any certainty. As impacts from these forces are demonstrated or better understood, activities that exacerbate impacts to the essential features (e.g., changes to water quality) may be further scrutinized and associated management efforts may be pursued. At this time, no single activity has been identified as contributing specifically to these threats in the economic analysis. Given the complex and uncertain impacts of climate change, this threat is best addressed during the individual consultation process across all activities undergoing consultation. In this manner NMFS will be able to incorporate special management

considerations to specific activities as the extent of impacts from global climate change are demonstrated or better understood.

CRITICAL HABITAT REVIEW TEAM

In the 12-month finding NMFS clearly identified 5 steps to move forward with the designation of critical habitat for the Hawaiian monk seal (1) Determine the geographical area occupied by the species at the time of listing; (2) Identify the physical or biological features essential to the conservation of the species; (3) Delineate area within the geographical area occupied by the species that contain these features, and that may require special management considerations or protections; (4) Delineate any areas outside of the geographical area occupied by the species that are essential for the conservation of the species; and (5) Conduct economic, national security, and other analyses to determine if any areas identified in steps 3 and 4 could be excluded from critical habitat consideration under section 4(b)(2) of the ESA. For the 12-month finding, NMFS convened a preliminary meeting of Pacific Island Fisheries Science Center and Pacific Island Regional Office staff that works on Hawaiian monk seal research and management to discuss the best available scientific and commercial data relevant to critical habitat for the Hawaiian monk seal. This meeting completed step 1 and identified the geographical area occupied by the species. During this meeting, preliminary features were identified that may be considered essential to the conservation of the Hawaiian monk seal. These included sandy beaches preferred by monk seals for pupping and nursing; marine areas less than 20 m (or 66 ft) depth adjacent to pupping and nursing beaches where young pups learn to forage; marine areas approximately 20-200 m (or 66–656 ft) depth in the MHI, and approximately 20-500 m (or 66–1,640 ft) depth in the NWHI, preferred by juvenile and adult monk seals for foraging; low levels of unnatural disturbance; and high prey quantity and quality. These features were identified in the 12-month finding as preliminary to give the public a better idea of areas that may be considered for the proposed rule.

Steps 2, 3, & 4

Following the 12-month finding, NMFS convened a critical habitat review team (CHRT) to assist in the assessment and evaluation of critical habitat areas for the Hawaiian monk seal. The CHRT consisted of 7 biologists from NMFS with experience and expertise in Hawaiian monk seal biology and management. When the CHRT was officially convened members were introduced to the critical habitat designation process, asked to review the preliminary announced essential features and asked to discuss and then identify areas under consideration for Hawaiian monk seal critical habitat. The discussion of the preliminary essential features lead to some additions as well as alterations in language of those published in the federal register for the 12-month finding. In reviewing the preliminary essential features team members expressed a need to emphasize essential features that encapsulate what is known regarding Hawaiian monk seal biology from the extensive monitoring in the NWHI, and information available from the MHI, but to also take into account the long term recovery goals for species.

Having completed the second step (identifying the essential features), the CHRT directed discussions towards identifying the specific areas within the range of the species. As a preliminary exercise to the meeting, and to stimulate discussion regarding the petitioned areas, the team was asked to rate watershed areas according to importance to Hawaiian monk seals

throughout the MHI. In discussion this exercise was discounted; team members felt that current monk seal use of particular locations for parturition and hauling-out in the MHI may only reflect the site specific needs of particular mothers, or the preferences of individual seals. Prioritization of specific sites or beaches would fail to take into account the extensive habitat utilized by the species as it progresses through foraging areas moving back and forth to terrestrial resting locations. Utilizing nonsystematic and biased incidental sighting data to identify beach locations that are more popular for these animals would also fail to take into account the solitary nature of these animals, and may overlook those areas that are less frequented by humans, but critically important to the seals. Locations preferred currently are likely to be a reflection of a small number of animals making use of a large area and may not take into account the needs of a growing population in the MHI. Recovery goals are set at 500 animals for the MHI[9] (NMFS 2007a); with declining numbers in the NWHI and the future projected loss of habitat, all available habitat with essential features present becomes important for the conservation of this species.

The CHRT agreed that critical habitat should be a reflection of current seal use, known monk seal biology, and be able to accommodate the conservation needs of the species with the goal in mind of a recovered population in the MHI. The team then identified that each specific area should incorporate terrestrial and marine areas with essential features present. Due to the wide ranging nature of the species, boundaries were selected in order to identify specific biological needs of the species. In discussing the marine boundaries for the species the CHRT took into account the best scientific data available and determined that the petitioned boundary of 500 m (or 1,640 ft) in the NWHI was appropriate for the species given the new information available regarding foraging since the 1988 designation (see the habitat section of this report). However, in discussing the boundary in the MHI the CHRT found that the 200 m (or 656 ft) boundary suggested would fail to take into account the full needs of the species. The CHRT acknowledged that current low competition and expansive habitat of the MHI provides an advantage to foraging monk seals, but also recognized that as the population increases in the MHI competition between seals is likely to change. Increased competition for food is likely to drive seals out to greater depths and foraging depths at that point are most likely to reflect at least the depths observed in the NWHI. Essential habitat that would support a larger population must take into account those needs. Terrestrial boundaries were discussed to reflect the needs of the species. The ephemeral coastline was of greatest concern during this discussion, but team members also identified that seals utilize a wide variety of coastline as long as the area is accessible for hauling-out. While identifying the inner boundary of terrestrial habitat, the team recognized that by adding 5 m (16 ft) to the shoreline, described by, the upper reaches of the wash of the waves, other than storm or seismic waves, at high tide during the season in which the highest wash of the waves occurs, usually evidenced by the edge of vegetation growth or the upper limit of debris that the inland boundary of the habitat should be the best reflection of essential habitat regardless of changes due to coastal or climatic forces. Lastly, the CHRT identified that within the identified specific areas there exists those areas that should not be included in critical habitat because these areas

[9] The 2007 Recovery plan for the Hawaiian monk seal sets the recovery goal for the whole population at 2,900 individuals, with each of the six major NWHI sub-populations above 100 individuals, and the MHI sub-population above 500. These numbers represent a Hawaiian monk seal population that would have a 1% probability of declining to effective extinction within the next 100 years. Further details and assumptions associated with these calculations are given in Appendix B of the 2007 recovery plan.

offer poor habitat for the Hawaiian monk seal to haul out or forage, due to the biological and physical features of the habitat. These areas include hardened shorelines, such as extensive seawalls, rock revetments, rip-rap or bulkheads; sheer cliffs; areas of lava flow; large commercial harbors and some larger bays. These areas were acknowledged and listed as areas to not be included in the designation of specific areas in the MHI and at Midway Islands (see geographical area occupied by the species and specific areas within the geographical occupied area section of this report).

Following this discussion the CHRT was asked to identify any unoccupied areas that may be essential for the conservation of the Hawaiian monk seal. As described in the section titled "Unoccupied Areas" above, unoccupied areas may be designated as critical habitat only if: (a) a critical habitat designation limited to presently occupied areas would not be adequate to achieve conservation of the species; and (b) the unoccupied areas are determined to be essential for conservation of the species. Based on the best available data and their best professional judgment, the CHRT determined that there was insufficient evidence at this time to indicate that areas within the present range would be inadequate for conservation of the species.

A step that was not identified in the 12-month finding included the determination of areas that are ineligible for critical habitat designation. The National Defense Authorization Act (NDAA) of 2004 amended Section 4(a)(3) of the ESA to preclude from critical habitat designation military lands when those lands are covered by an Integrated Natural Resources Management Plan (INRMP) (as stipulated by the SIKES Improvement Act) provided that the Secretary determines that the plan provides a benefit to the species for which critical habitat is proposed for designation. In accordance with this amendment, NMFS reviewed INRMPs identified by DOD as overlapping with areas under consideration for the revision to Hawaiian monk seal critical habitat. This process is summarized in the proposed rule which will be published in the *Federal Register*.

Step 5

Step 5 was identified as conducting an economic, national security, and other analyses to determine if any areas identified in steps 3 and 4 could be excluded from critical habitat consideration under section 4(b)(2) of the ESA. Information was gathered and the results for these analyses were presented to the CHRT for determination. The process, considerations, and decisions are outlined in the 4(b)(2) report for this designation and summarized in the proposed rule which will be published in the *Federal Register*.

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Table 1. Essential features present in the specific areas

Specific Area	Presence of Essential Features					
	Pupping/ nursing beaches	Marine areas adjacent to pupping beaches	Marine areas 0-500 m for foraging	Areas with low levels of anthropogenic disturbance	Adequate quantity and quality of prey	Significant areas used for Hauling-out hauling-out
Area 1. Kure Atoll	Yes	Yes	Yes	Yes	Yes	Yes
Area 2. Midway Islands	Yes	Yes	Yes	Yes	Yes	Yes
Area 3. Pearl and Hermes Reef	Yes	Yes	Yes	Yes	Yes	Yes
Area 4. Lisianski Island	Yes	Yes	Yes	Yes	Yes	Yes
Area 5. Laysan Island	Yes	Yes	Yes	Yes	Yes	Yes
Area 6. Maro Reef	No	No	Yes	Yes	Yes	Yes
Area 7. Gardner Pinnacles	No	No	Yes	Yes	Yes	Yes
Area 8. French Frigate Shoals	Yes	Yes	Yes	Yes	Yes	Yes
Area 9. Necker Island	Yes	Yes	Yes	Yes	Yes	Yes
Area 10. Nihoa Island	Yes	Yes	Yes	Yes	Yes	Yes
Area 11. Kaula Island	No	No	Yes	Yes	Yes	Yes
Area 12. Niihau	Yes	Yes	Yes	Yes	Yes	Yes
Area 13. Kauai	Yes	Yes	Yes	Yes	Yes	Yes
Area 14. Oahu	Yes	Yes	Yes	Yes	Yes	Yes
Area 15. Maui Nui	Yes	Yes	Yes	Yes	Yes	Yes
Area 16. Hawaii	Yes	Yes	Yes	Yes	Yes	Yes

Table 2. Approximate Square Miles of Critical Habitat

Specific Area	Approximate Number of Square Miles (Square Kilometers) of Critical Habitat[10]
Area 1. Kure Atoll	57 mi^2 (148 km^2)
Area 2. Midway Islands	88 mi^2 (228 km^2)
Area 3. Pearl and Hermes Reef	242 mi^2 (627 km^2)
Area 4. Lisianski Island	558 mi^2 (1445 km^2)
Area 5. Laysan Island	294 mi^2 (761 km^2)
Area 6. Maro Reef	960 mi^2 (2486 km^2)
Area 7. Gardner Pinnacles	1489 mi^2 (3856 km^2)
Area 8. French Frigate Shoals	469 mi^2 (1215 km^2)
Area 9. Necker Island	900 mi^2 (2331 km^2)
Area 10. Nihoa Island	547 mi^2 (1417 km^2)
Area 11. Kaula Island	39 mi^2 (101 km^2)
Area 12. Niihau	200 mi^2 (518 km^2)
Area 13. Kauai	326 mi^2 (844 km^2)
Area 14. Oahu	697 mi^2 (1805 km^2)
Area 15. Maui Nui	2510 mi^2 (6501 km^2)
Area 16. Hawaii	1015 mi^2 (2629 km^2)

[10] Square mileage for the Northwest incorporates the land masses out to the 500 m depth contour. Square mileage estimates for the Main Hawaiian Islands only includes marine areas.

Table 3. Threats identified in the Hawaiian monk seal Recovery Plan

Threats Identified in the Recovery Plan	ESA Listing Factor	Threat specific to listed species, the habitat or both
Food Limitation	A	Habitat
Entanglement	E	Listed species
Shark Predation	C	Listed species
Infectious Disease	C	Both
Habitat Loss	A	Habitat
Fishery Interaction	D	Listed species (Entanglements)
Male Aggression	E	Listed species
Human Interaction	B	Both
Biotoxins	E	Both
Vessel Groundings	A	Habitat
Contaminants	A	Both

Table 4. Reference for ESA listing factors associated with threats.

ESA Listing Factors:

A= Habitat Destruction, Modification, or Curtailment
B= Overutilization
C= Inadequate Regulatory Mechanisms
D= Disease and Predation
E= Other Natural or Manmade Factors

Table 5. Habitat related threats and impacted essential features

Habitat Associated Threats from Recovery Plan	Essential Features Potentially Threatened
Food Limitation	3, 5
Infectious Disease	5
Habitat Loss	1, 2, 3, 5, 6
Human Interaction	1, 2, 4, 6
Biotoxins	5
Vessel Groundings	2, 3, 4, 5
Contaminants	5

Table 6. Reference Table for Essential features.

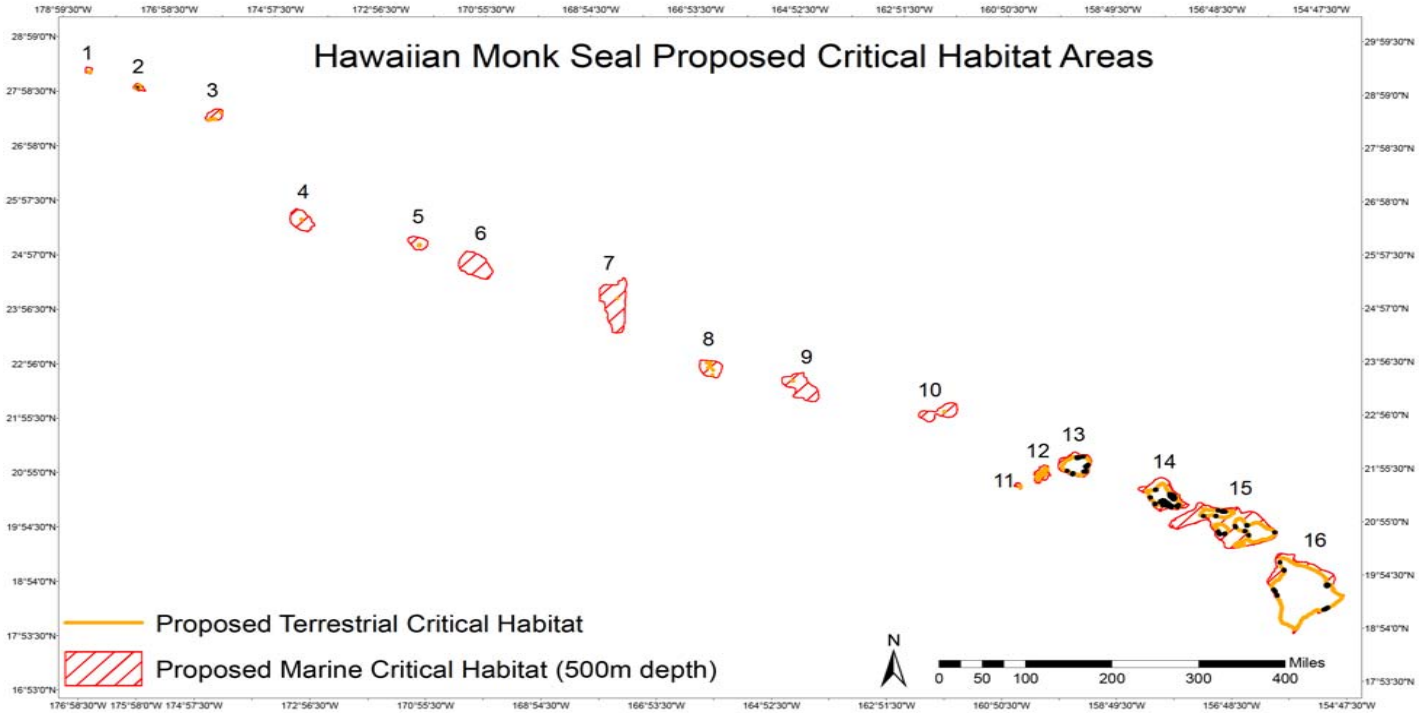
Essential Features:

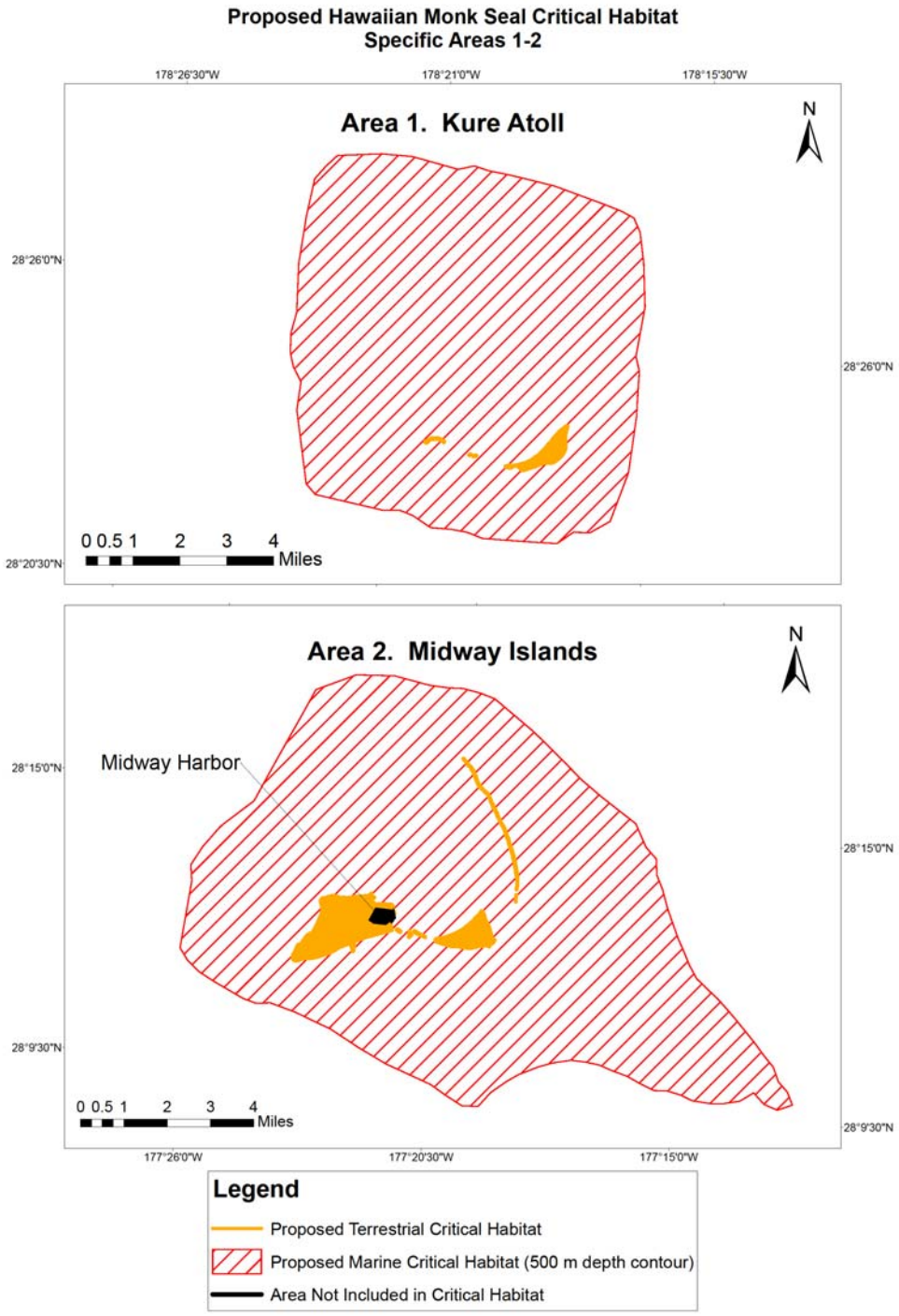
1 Preferred Pupping & Nursing Areas
2 Marine Areas Adjacent to Pupping & Nursing Areas
3 Marine Areas for Foraging
4 Areas with Low Levels of Disturbance
5 Quantity & Quality of Prey Species
6 Significant haul-out areas

Table 7. List of Anthropogenic Activities that may contribute to Identified Threats

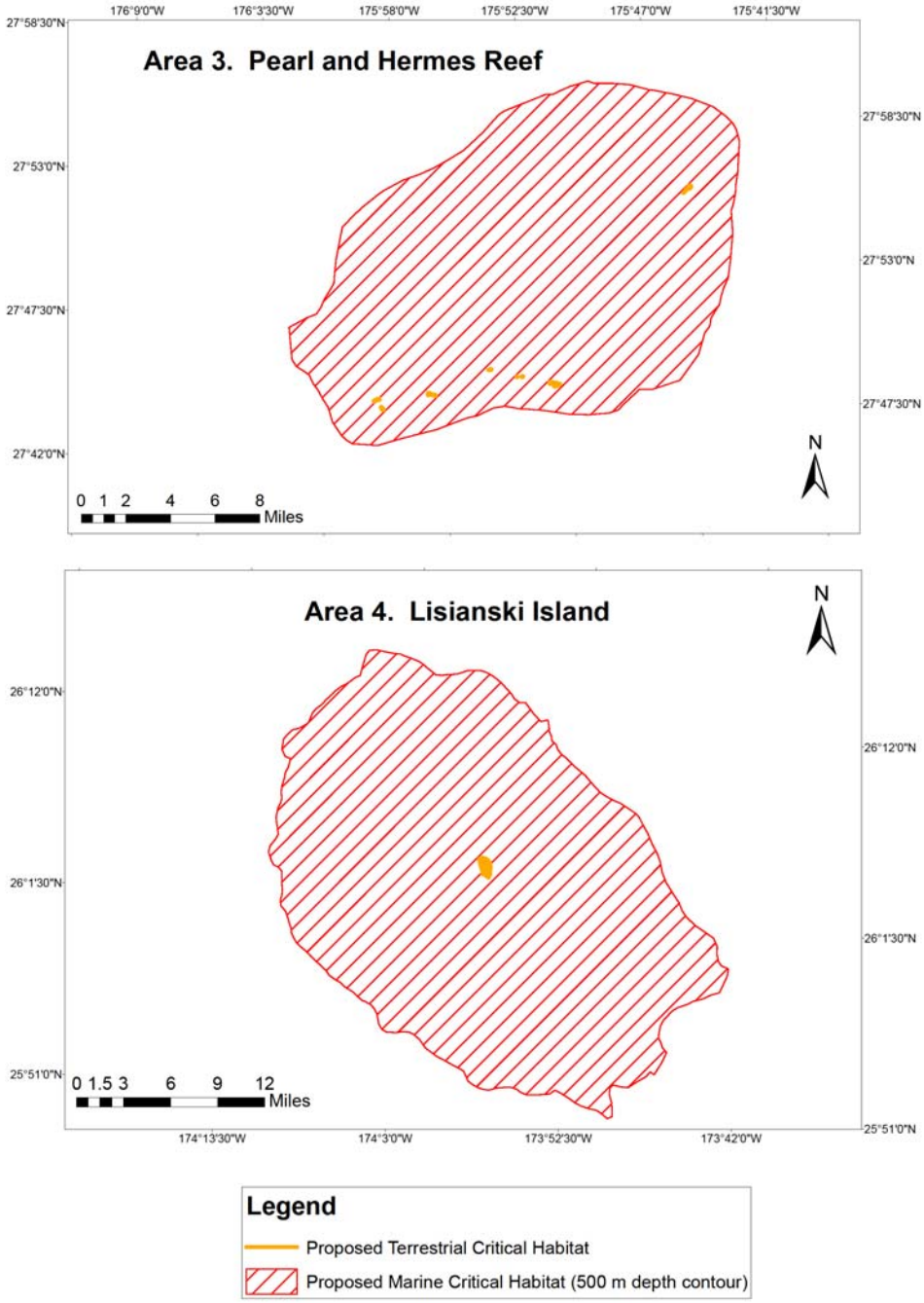
Anthropogenic Activities Potentially Contributing to the Identified Threats:
In-Water & Coastal Construction
Dredging
Energy Development
Point Source Pollution & Nonpoint Source Pollution
Aquaculture
Fisheries
Oil-spill and Vessel grounding
Military Associated Activities

Appendix 1. Maps Depicting Proposed Critical Habitat for the Hawaiian Monk Seal.

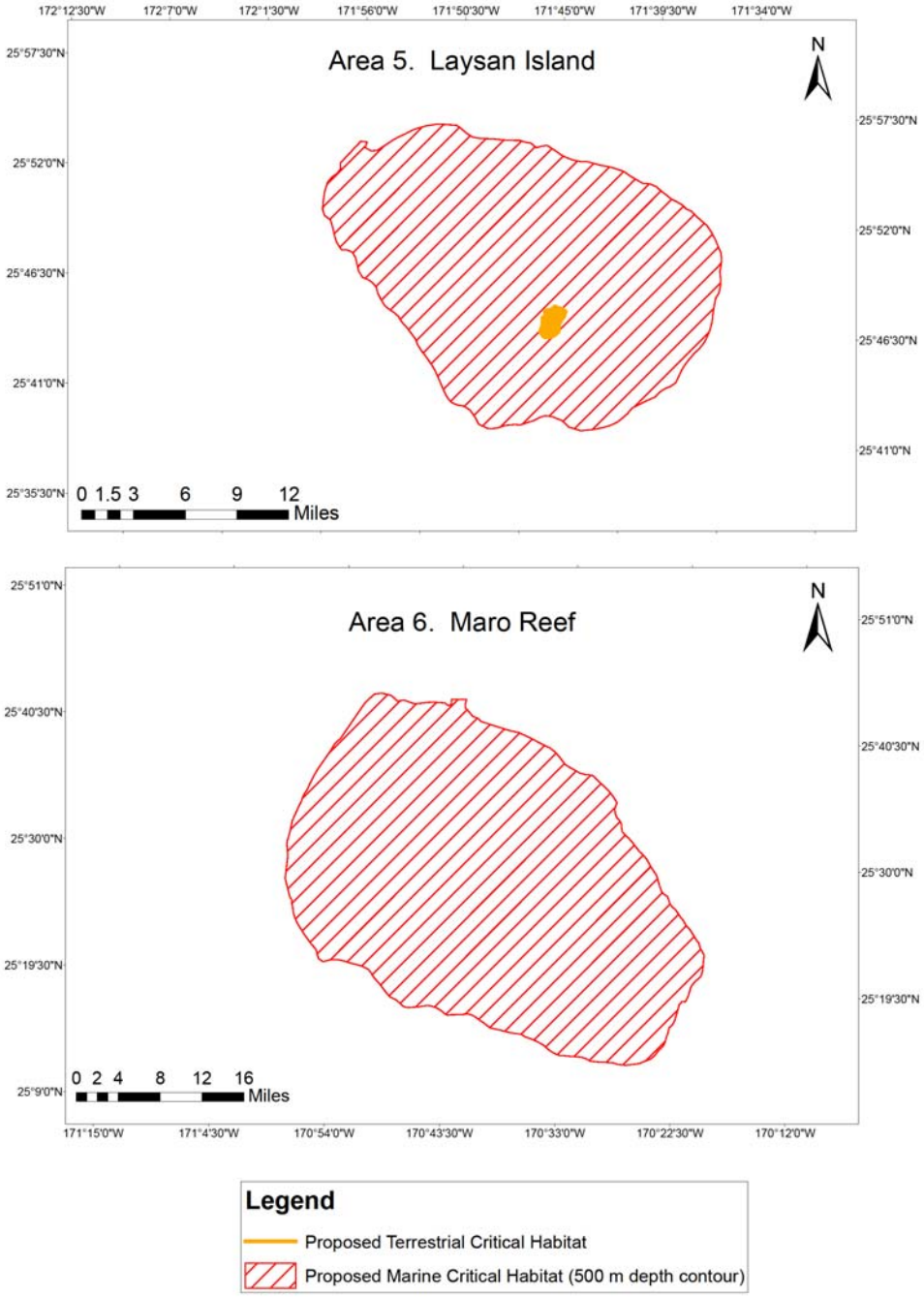



Proposed Hawaiian Monk Seal Critical Habitat
Specific Areas 1-2
178°26'30"W
178°21'0"W
178°15'30"W
Area 1. Kure Atoll
N
28°26'0"N
28°20'30"N
0 0.5 1 2 3 4
Miles
Area 2. Midway Islands
Midway Harbor
28°15'0"N
28°9'30"N
177°26'0"W
177°20'30"W
177°15'0"W
Legend
Proposed Terrestrial Critical Habitat
Proposed Marine Critical Habitat (500 m depth contour)
Area Not Included in Critical Habitat

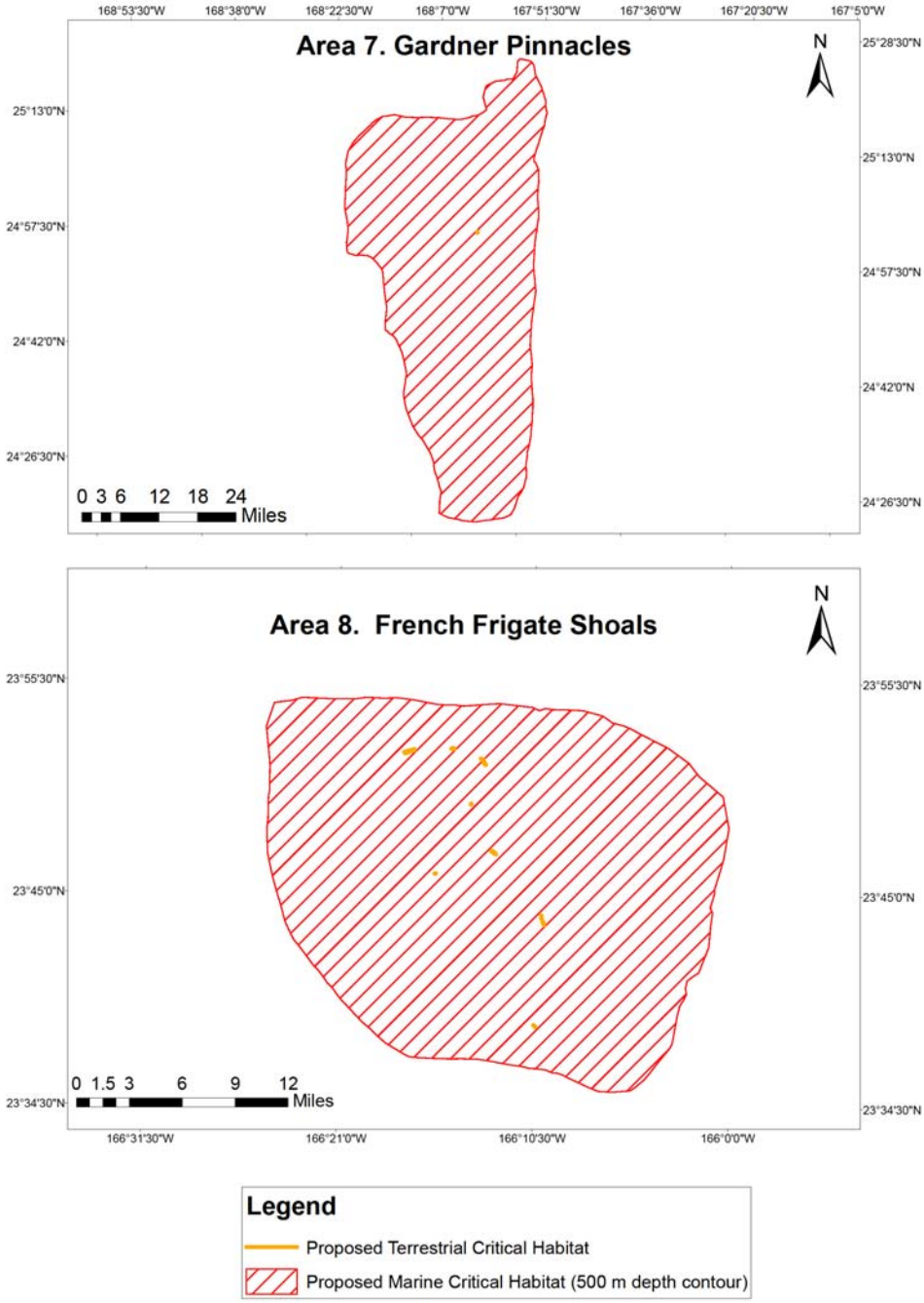
Proposed Hawaiian Monk Seal Critical Habitat
Specific Areas 3-4



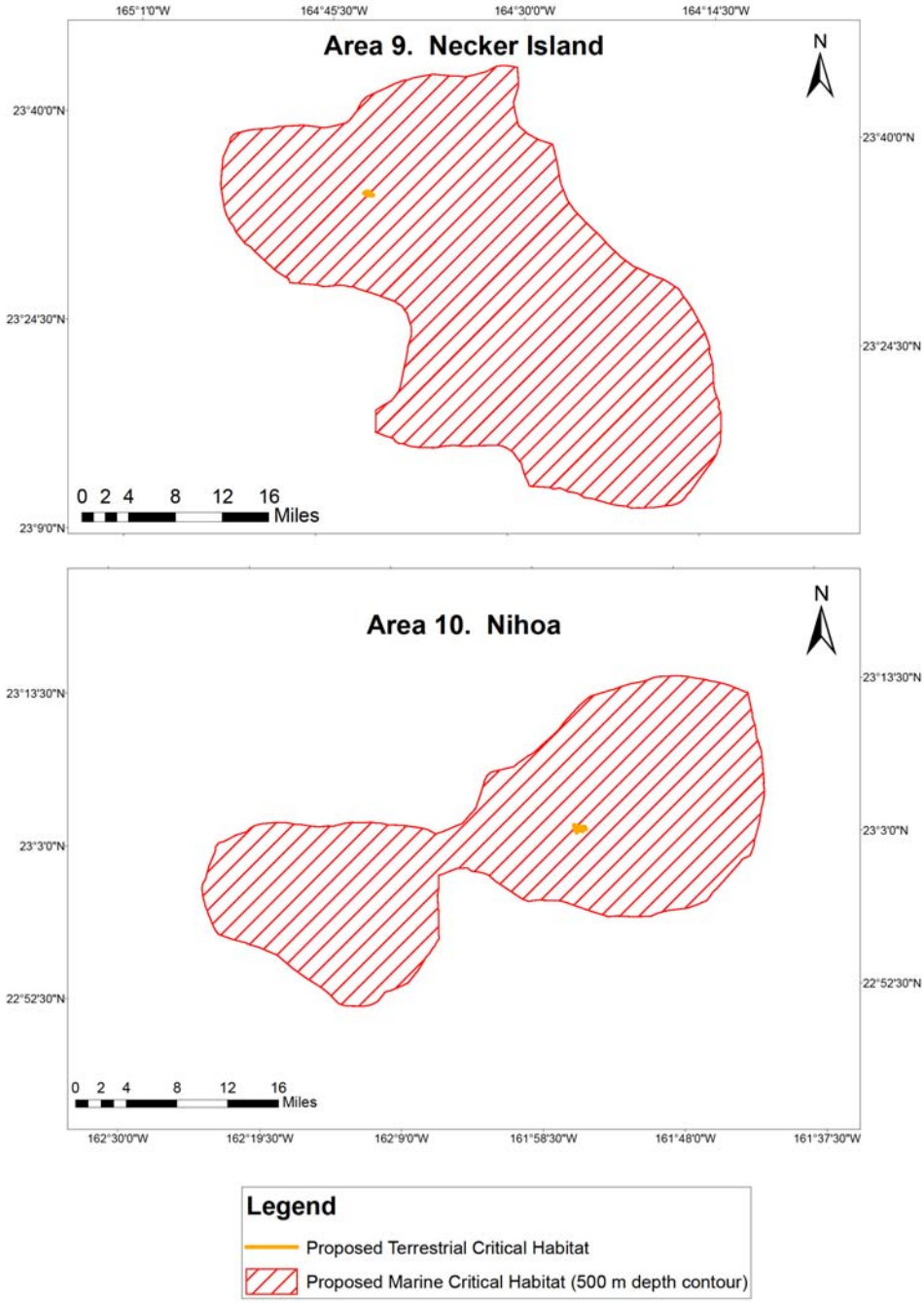
Proposed Hawaiian Monk Seal Critical Habitat
Specific Areas 5-6

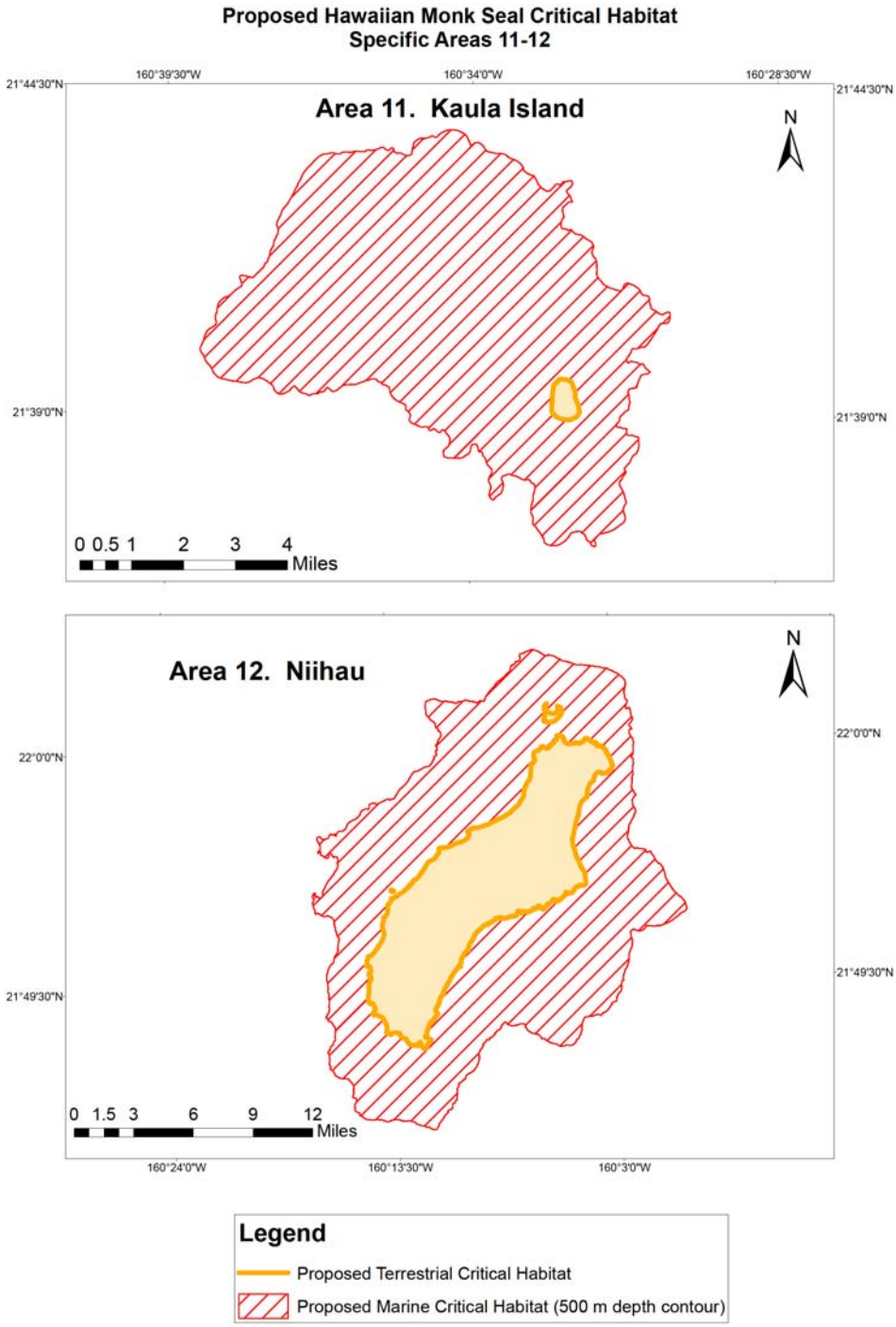


Proposed Hawaiian Monk Seal Critical Habitat
Specific Areas 7-8

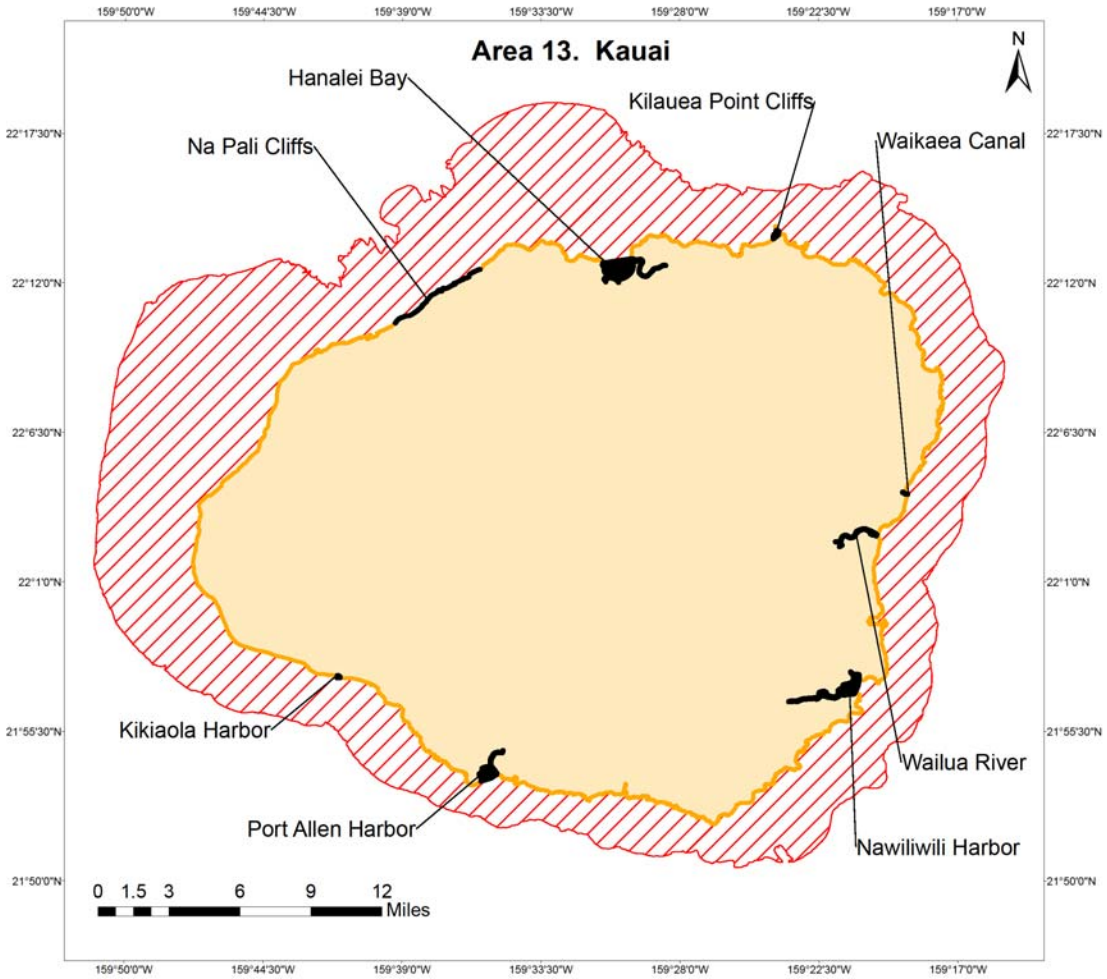


Proposed Hawaiian Monk Seal Critical Habitat
Specific Areas 9-10




Proposed Hawaiian Monk Seal Critical Habitat
Specific Areas 11-12
Area 11. Kaula Island
N
0 0.5 1 2 3 4
Miles
21°44'30"N
21°39'0"N
160°39'30"W
160°34'0"W
160°28'30"W
Area 12. Niihau
N
0 1.5 3 6 9 12
Miles
22°0'0"N
21°49'30"N
160°24'0"W
160°13'30"W
160°3'0"W
Legend
Proposed Terrestrial Critical Habitat
Proposed Marine Critical Habitat (500 m depth contour)

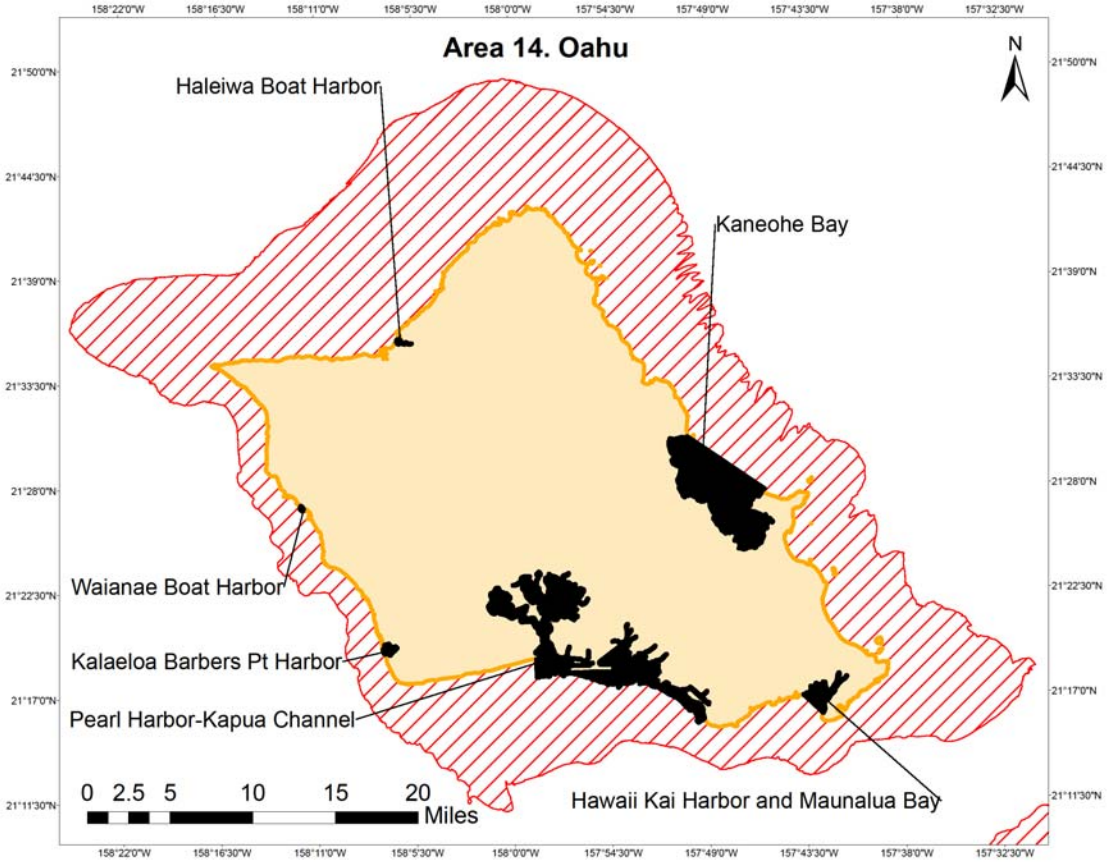
Proposed Hawaiian Monk Seal Critical Habitat
Specific Area 13



Legend

- Areas Not Included in Proposed Critial Habitat
- Proposed Terrestrial Critical Habitat
- Proposed Marine Critical (500 m depth contour)

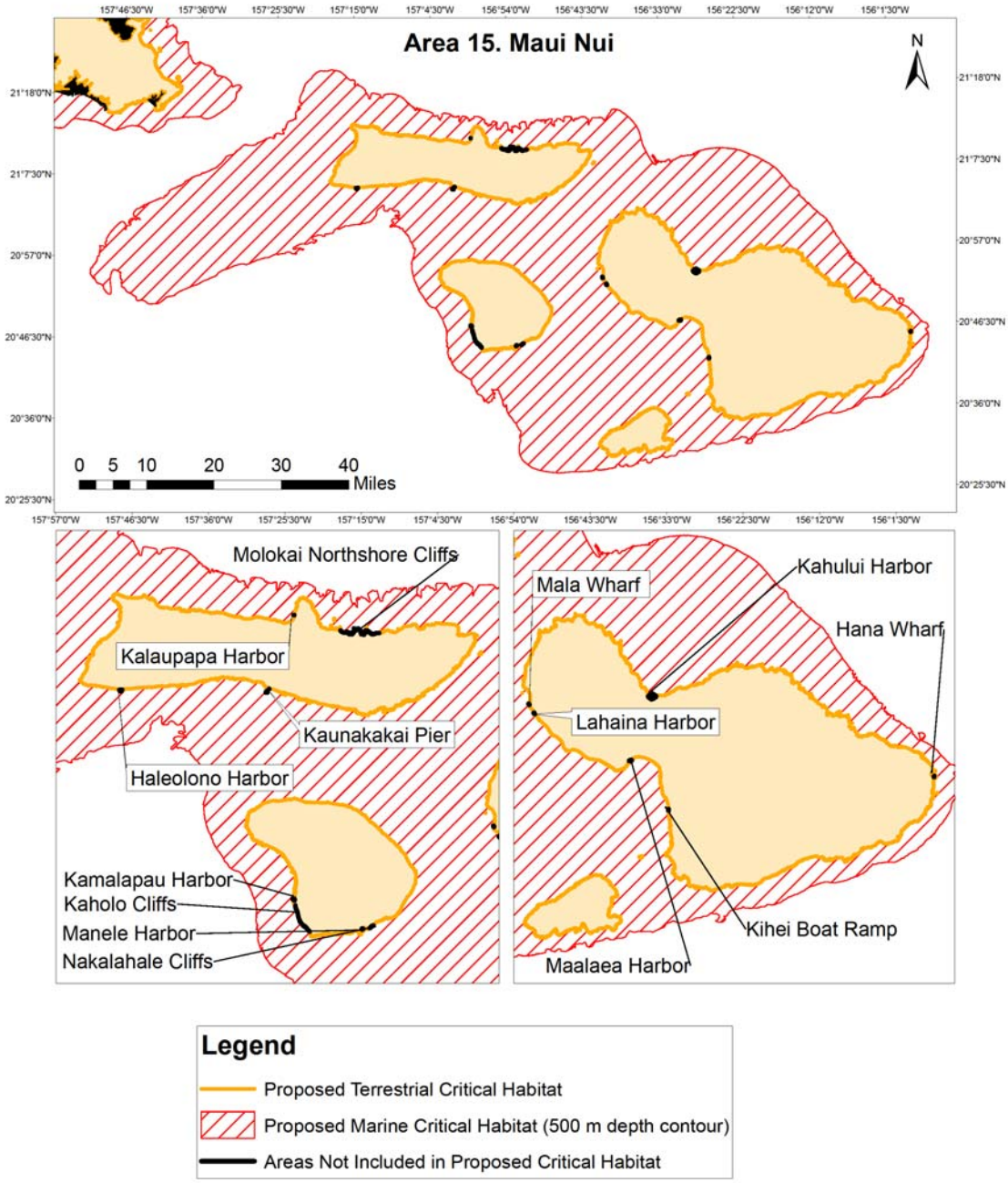
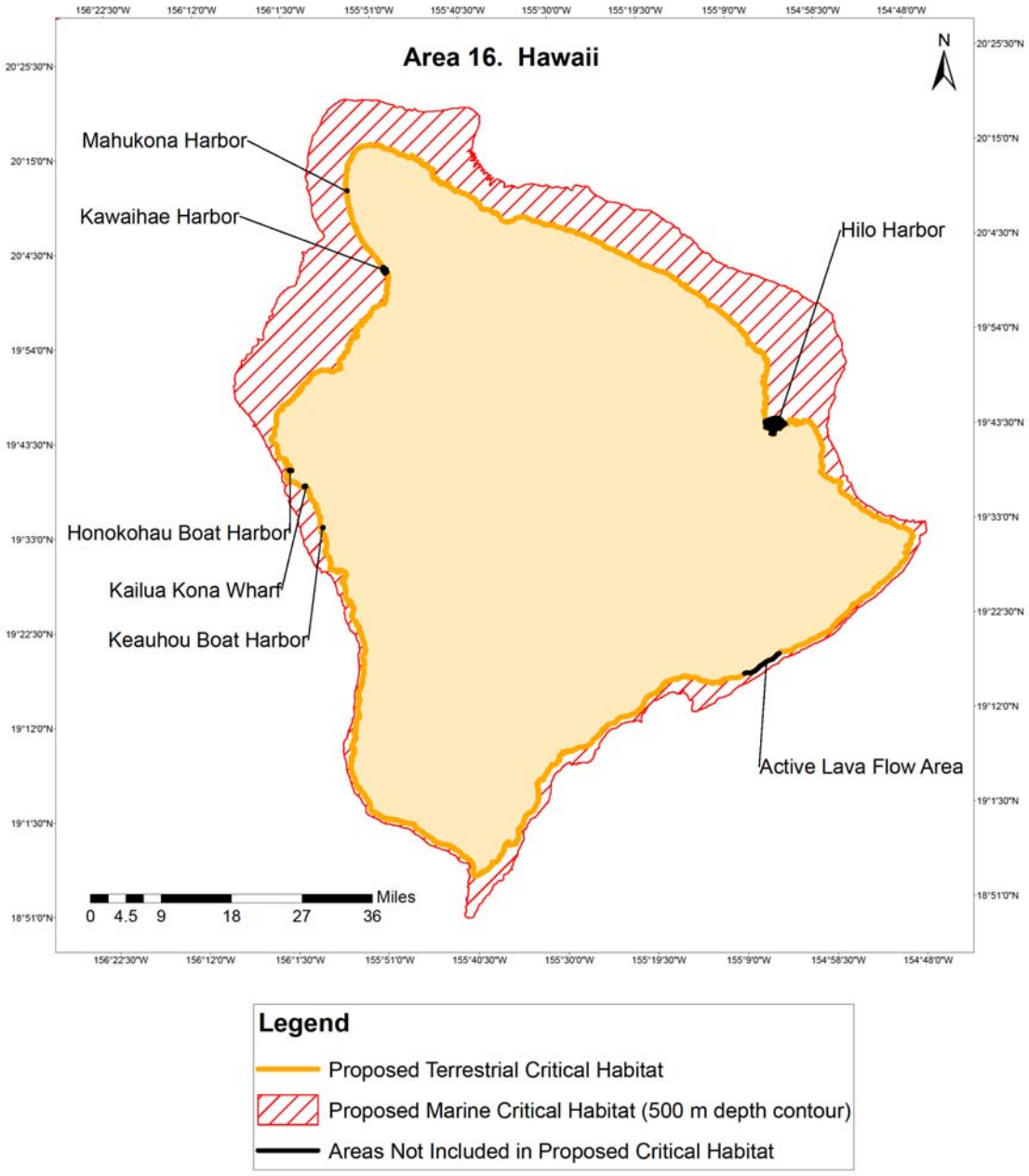
Proposed Hawaiian Monk Seal Critical Habitat
Specific Area 14



Legend

- Proposed Terrestrial Critical Habitat
- Proposed Marine Critical Habitat (500 m depth contour)
- Areas Not Included in Proposed Critical Habitat

Proposed Hawaiian Monk Seal Critical Habitat
Specific Area 15



Proposed Hawaiian Monk Seal Critical Habitat
Specific Area 16