APPENDIX H: NATIONAL MARINE FISHERIES SERVICE ENDANGERED SPECIES ACT - SECTION 7 CONSULTATION BIOLOGICAL OPINION

Agency:	United States Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS), Sustainable Fisheries Division, Southwest Region, Pacific Islands Area Office
Proposed Action:	Management of the Bottomfish and Seamount Groundfish Fisheries in the Western Pacific Region According to the Fishery Management Plan for the Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region
Consultation Conducted By:	The National Marine Fisheries Service, Southwest Region and the Office of Protected Resources, Endangered Species Division
Approved By:	David Cottingham
Date of Issuance:	March 8, 2002

Section 7(a)(2) of the Endangered Species Act (ESA) (16 U.S.C. § 1531 et seq.) requires that each Federal agency shall ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. When the action of a Federal agency may affect a protected species, that agency is required to consult with either the National Marine Fisheries Service (NMFS) and/or the U.S. Fish and Wildlife Service, depending upon the protected species that may be affected. For the actions described in this document, the action agency is the Southwest Region, Pacific Islands Area Office (Sustainable Fisheries Program) of NMFS. The consulting agency is the Protected Resources Division, also of NMFS. Section 7(b) of the Act requires that the consultation be summarized in a biological opinion detailing how the action may affect protected species.

This document is NMFS' biological opinion (opinion) on the implementation of the Fishery Management Plan for the Bottomfish and Seamount Groundfish Fishery in the Western Pacific

Region (Bottomfish FMP)[1], that includes management areas in the waters surrounding Hawaii, Guam and American Samoa, and the effects of this action on the endangered blue whale (*Balaenoptera musculus*), endangered fin whale (*Balaenoptera physalus*), endangered humpback whale (*Megaptera novaeangliae*), endangered right whale (*Eubalaena glacialis*), endangered sei whale (*Balaenoptera borealis*), endangered sperm whale (*Physeter macrocephalus*), endangered/threatened[2] green turtle (*Chelonia mydas*), endangered hawksbill turtle (*Eretmochelys imbricata*), endangered leatherback turtle (*Dermochelys coriacea*), threatened loggerhead turtle (*Caretta caretta*), endangered/threatened[3] olive ridley turtle (*Lepidochelys olivacea*), endangered Hawaiian monk seal (*Monachus schauinslandi*), and the designated critical habitat for the Hawaiian monk seal, in accordance with section 7 of the ESA.

Consultation History

The Bottomfish FMP has been amended seven times since its implementation in 1986. Two section 7 consultations have been completed for the Bottomfish FMP. The first was completed in 1986, and considered the effects of the implementation of the newly established Bottomfish FMP. The second was completed in 1991, and considered the effects of the fishery on Hawaiian monk seals and the proposed action to close certain portions of the Northwestern Hawaiian Islands (NWHI) to fishing to create a "protected species study zone" as per Amendment 4 to the Bottomfish FMP, which included the following measures: 1) expansion of the 50 nm study zone to include Nihoa Island, Necker Island, and Maro Reef; 2) institution of a framework process for NMFS to modify the study zone; and 3) a requirement that vessels fishing in the NWHI take an observer upon request of NMFS. The protected species zone was initially implemented through emergency regulation (55 FR 49050), later amended to include modification of the zone at the discretion of NMFS (56 FR 24351). The rule-making allowed NMFS to place observers on bottomfish vessels in the protected species zone to collect information on protected species interactions in the fishery. Both the 1986 and the 1991 consultations determined that the fishery was not likely to jeopardize the continued existence of the Hawaiian monk seal or listed sea turtles.

The NMFS Southwest Region Pacific Islands Office Sustainable Fisheries Program, requested reinitiation of consultation under section 7 of the ESA on October 16, 2000, regarding the proposed continued operation of the bottomfish fishery in the NWHI according to the Bottomfish

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[1]The Western Pacific Regional Fishery Management Council is developing an amendment to the bottomfish FMP to include the Commonwealth of the Northern Mariana Islands and the U.S. Pacific Remote Island Areas as bottomfish management areas under the Bottomfish FMP.

[2]In 1978, under the ESA, the green turtle was listed and classified as threatened, except for the breeding populations in Florida and on the Pacific coast of Mexico, which were classified as endangered (50 CFR 17.11).

[3]The nesting populations of olive ridleys along the Pacific coast of Mexico are listed as endangered and all others are listed as threatened (50 CFR 17.11).

The Western Pacific Regional Fishery Management Council (WPRFMC) prepared a Preliminary Draft Environmental Impact Statement on November 2, 2000, (PDEIS) that reviewed the Bottomfish FMP.[4] The PDEIS outlines several alternatives for the operation of the fishery, including one alternative to close the fishery. The preferred alternative analyzed in the PDEIS is the continued operation of the fishery according to current regulations. The PDEIS discusses the potential effects of the bottomfish fishery component located in the NWHI on the endangered Hawaiian monk seal and sea turtle species (WPRFMC, 2000a). The continued operation of the fisheries under the Bottomfish FMP is the proposed action considered in this consultation, and the reader is directed to the PDEIS prepared in accordance with the NEPA for full details of the proposed action (WPRFMC, 2000a). To ensure completeness, this consultation considers the proposed action as it occurs for all areas covered by the bottomfish FMP, however, the analysis concentrates on the effects of the action around the NWHI due to concerns about interactions with the monk seal as identified in the PDEIS.

The NWHI Coral Reef Ecosystem Reserve (Reserve) was established on December 4, 2000, by Presidential Executive Order (E.O.) 13178. On January 18, 2001, E.O. 13178 was amended by E.O. 13196. This amendment included conservation measures that made permanent certain Reserve Preservation Areas within the Reserve. With some exceptions, all fishing activities are prohibited within the Reserve. Bottomfishing is allowed only under permit and limitations are placed on area, catch, and depth of fishing. Bottomfish fishing by Native Hawaiians for subsistence will be allowed under the Reserve system. This consultation considers the effects of the Bottomfish FMP, as modified by the Reserve based on the above mentioned Executive Orders and regulatory implementation of these orders as of October 2001, on species listed as endangered or threatened under the ESA (listed species). Bottomfishing in the Reserve Preservation Areas is more fully described in the Description of the Proposed Action.

I. Description of the Proposed action

NMFS, Sustainable Fisheries Division proposes to continue operation of a fishery under the Bottomfish FMP, in accordance with the principles of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended. The following describes the principles of the MSA, the areas affected by the fishery, and the techniques used to capture bottomfish.

A. Principles of the Magnuson-Stevens Fishery Conservation and Management Act

The MSA is the principal Federal statute governing the management of Federally permitted marine fisheries. The MSA's purpose and policy statements (§2(b)-(c)), elaborated upon through a declaration of ten National Standards (Table 1), serve as the overarching objectives for fishery conservation and management (§301(a)). The MSA has been amended frequently since 1976, most recently by the 2000 Shark Finning Prohibition Act (H.R. 5461). However, several basic

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[4] NMFS announced its intention to prepare a comprehensive Environmental Impact Statement (DEIS) for the Bottomfish FMP on August 16, 1999 (64 FR 44476).

principles have not changed over the course of its amendment history. These include: 1) the biological conservation of a fishery resource is of high priority; 2) conservation and management decision making must be based on the best available scientific information; and 3) information considered must include social, economic and ecological factors.

Table 1. MSA National Standards (16 U.S.C. 1851, Sec. 301(a)).

(a) IN GENERAL. – Any fishery management plan prepared, and any regulation promulgated to implement any such plan, pursuant to this title shall be consistent with the following national standards for fishery conservation and management:	
-1	Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.
(2)	Conservation and management measures shall be based upon the best scientific information available.
(3)	To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.
(4)	Conservation and management measures shall not discriminate between residents of different States. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.
-5	Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.
(6)	Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.
(7)	Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.
(8)	Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.
(9)	Conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.
(10)	Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

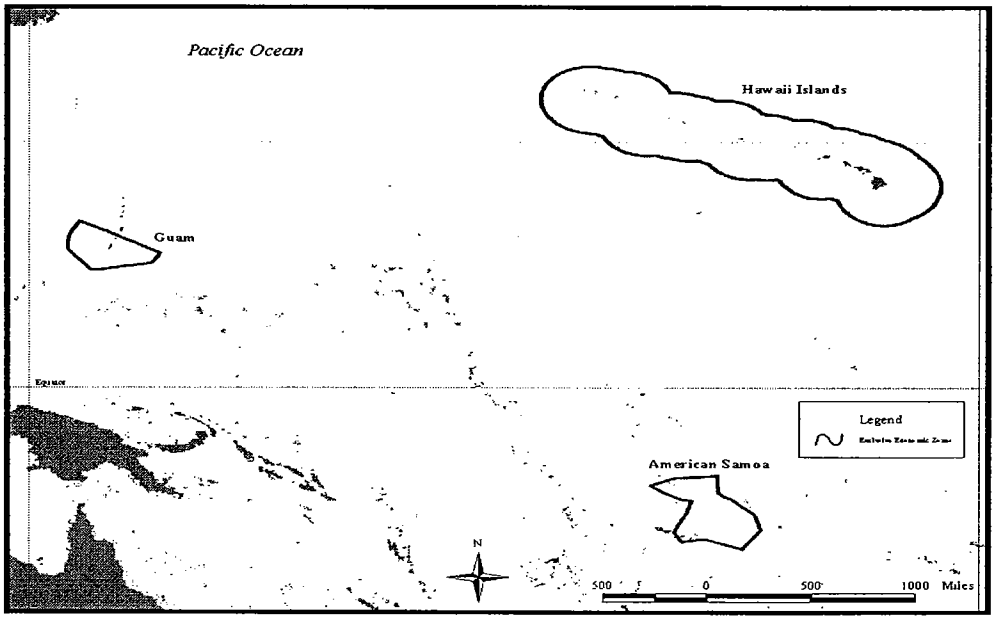
B. The Fishery Management Plan for the Bottomfish and Seamount Groundfish Fisheries of the Western Pacific and Description of the Action Area

The action area is all the areas that will be affected directly or indirectly by the fisheries managed under the Bottomfish FMP. These fisheries occur within the Exclusive Economic Zone (EEZ) around U.S. islands in the central, western, eastern and northern Pacific Ocean. These islands include the Northwestern Hawaiian Islands (a chain of largely uninhabited islets, atolls and banks), the main Hawaiian Islands, American Samoa, and Guam (Figure 1).

The Bottomfish FMP's management areas are further subdivided for Hawaii. These areas are: 1) The Main Hawaiian Islands (MHI) EEZ; and 2) the waters around the NWHI which are further divided into the Ho'omalu zone (area west of 165° 00' W longitude) and the Mau zone (area between 161°20' W longitude and 165°00' W longitude); and 3) Hancock seamount (west of

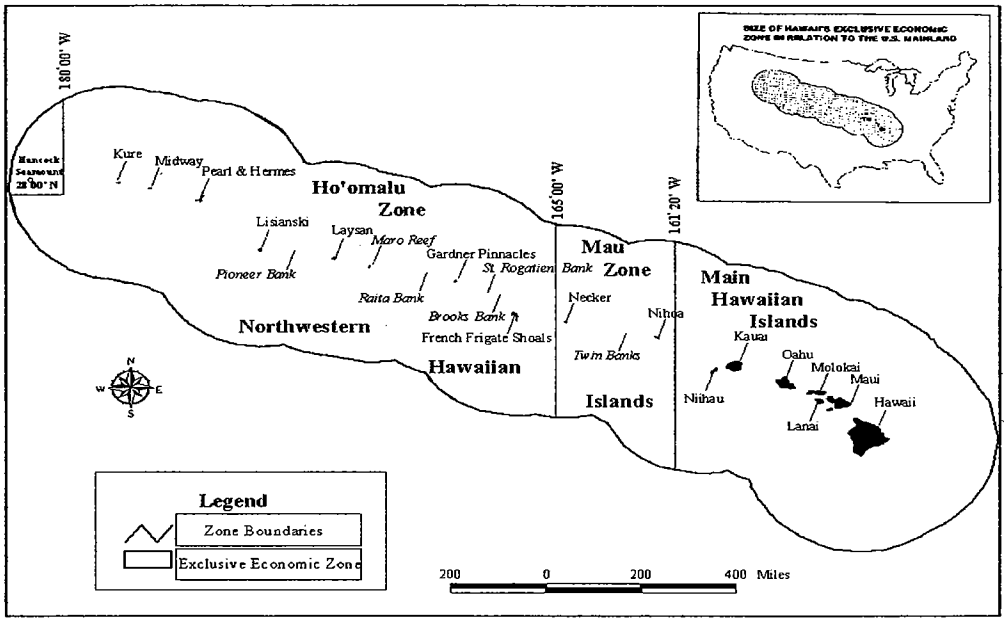
1) The Main Hawaiian Islands (MHI) EEZ; and 2) the waters around the NWHI which are further divided into the Ho'omalu zone (area west of 165° 00' W longitude) and the Mau zone (area between 161°20' W longitude and 165°00' W longitude); and 3) Hancock seamount (west of 180°00' W longitude and north of 28°00' N latitude) (Figure 2)[5]. The management area for Guam extends to boundaries that are equidistant between Guam and the Commonwealth of the Northern Mariana Islands (CNMI).

Figure 1. Western Pacific Bottomfish Fishery Management Areas



[5]A moratorium on fishing at the Hancock seamounts began in 1986 and continues through August 31, 2004 (50 CFR 660.68). There are no plans to re-open this fishery.

Figure 2. Bottomfish Fishery Management Subareas in the Hawaiian Archipelago (Source: WPRFMC, 2000a)



In the MHI, an estimated 20 - 30 percent of the bottomfish landed are caught in federal waters, with the remainder of bottomfish caught in State waters (Katekaru, pers. comm., 2001). In American Samoa and Guam, information on bottomfish landed from federal and territorial waters is not available; however, NMFS estimates that most of the emperor fishes and other shallow complex bottomfish are caught within territorial waters and most of the eteline snappers and deep complex bottomfish are caught from the offshore federal waters. The bottomfish fishery around the MHI, Guam, and American Samoa is currently not regulated under the Bottomfish FMP.

C. Management Unit Species (MUS).

Several target species of bottomfish and seamount groundfish are managed under the Bottomfish FMP. The bottomfish management unit species include snappers (*Lutjanidae*), jacks (*Carangidae*), groupers (*Serranidae*) and emperor fishes (*Lethrinidae*). A list of the Management Unit Species (MUS) is provided in Table 2.

Table 2. MUS included in the Bottomfish FMP

Management Unit Species Habitat	HAWAII	GUAM	AMERICAN SAMOA
Shallow water	(Depth 0-100 m) Snappers: *Aprion virescens, Lutjanus kasmira* Jacks: *Pseudocaranx dentex, Caranx ignobilis, C. lugubris, Seriola dumerili*	(Depth 0 - 100 m) Snappers: *Aprion virescens, Lutjanus kasmira* Jacks: *Caranx ignobilis, C. lugubris, Seriola dumerili* Groupers: *Epinephilus fasciatus, Variola louti* Emperor Fishes: *Lethrinus amboinensis, L. rubrioperculatus*	(Depth 0-100 m) Snappers: *Aprion virescens, Lutjanus kasmira* Jacks: *Pseudocaranx dentex, Caranx ignobilis, C. lugubris, Seriola dumerili* Groupers: *Epinephilus fasciatus, Variola louti* Emperor Fishes: *Lethrinus amboinensis, L. rubrioperculatus*

Management Unit Species Habitat	HAWAII	GUAM	AMERICAN SAMOA
Deep water	(Depth 100-400 m) Snappers: *Etelis carbunculus, E. coruscans, Pristipomoides filamentosus, P. auricilla, P. sieboldii, P. zonatus, Aphareus rutilans* Groupers: *Epinephelus quernus*	(Depth 100 - 400 m) Snappers: *Etelis carbunculus, E. coruscans, Pristipomoides filamentosus, P. auricilla, P. flavipinnis, P. sieboldii, P. zonatus, Aphareus rutilans*	(Depth 100 - 400 m) Snappers: *Etelis carbunculus, E. coruscans, Lutjanus kasmira, Pristipomoides filamentosus, P. flavipinnus, P. zonatus,*
Seamount Groundfish (seamounts 80-600 m) Closed Fishery	(Depth 80 - 600 m) *Psedopentaceros richarsoni, Hyperoglyphe japonica, Beryx splendens*		

Bycatch and incidental catch in the bottomfish fishery includes pelagic species[6] such as tuna, marlin, ono, and mahi mahi; carangids (jacks), various shark species, and miscellaneous reef fish (Table 3). Fish species that are in the near shore environment, including those of the inshore reef complex and coastal pelagic species, are not managed under the Bottomfish FMP. These species include goatfishes (weke), soldier fishes (menpachi), hogfishes (a'awa), scorpionfishes (hogo), bigeye scad (akule), and mackerel scad (opelu). These species are not covered by any other FMP or Federal regulations at this time.[7]

Table 3. Percent Discards from Bottomfish Fishing Trips with NMFS Observers, 1990-1993 (Source: Nitta 1993)

[6]These pelagic species are also sometimes targeted by bottomfishers. Presently, the bottomfish observer forms are being modified to provide more information regarding target, bycatch, and incidental catch species by trip and fishing day.

[7]The WPRFMC has prepared a new FMP for the Coral Reef Ecosystems of the Western Pacific Region. This FMP includes management unit species inhabiting the nearshore habitat. If approved by the Secretary of Commerce, this FMP is expected to be implemented in 2002.

SPECIES	NO. CAUGHT	NO. DISCARDED	% DISCARDED
Kāhala	2438	2266	92.9
Kalekale (yellowtail)	40	22	55
Sharks	176	92	52.3
Misc. fish	115	59	51.3
Ulua (white)	127	62	48.8
Misc. snapper/jack	189	91	48.1
Butaguchi	3430	1624	47.3
Ulua (black)	23	10	43.5
Ta'ape	110	40	36.4
Misc. fish unidentified	174	26	14.9
Kalekale	874	52	6
'ōpakapaka	5092	107	2.1
Ehu	1185	20	1.7
Uku	2209	28	1.3
Hāpu'upu'u	1593	19	1.2
Gindai	459	3	0.7
Onaga	1141	8	0.7
Alfonsin	1	0	0
Armorhead	1	0	0
Lehi	3	0	0

Federal observer program data from 1990-1993 indicate a 0 - 92.9 percent species discard rate for the NWHI portion of the Hawaii bottomfish fishery (Table 3). This includes damaged target species or non-target species. Many fish are not kept because of their low marketability. Association with ciguatera biotoxins is another reason for the discard of certain species, such as

jacks, and amberjacks (WPRFMC, 2000a). [8]

As discussed below in the status of the species section, the bottomfish fishery affects listed species only during operations around the Hawaiian Islands. Therefore, after a full description of the proposed action, the remainder of this opinion will focus on fishing activity in the U.S. EEZ around Hawaii only. The regulations implementing the Bottomfish FMP may be found at 50 CFR 660 and are summarized in the PDEIS. For the purposes of this consultation, it is important to note that the following sections apply to activities under the Bottomfish FMP: 1) gear restrictions (no bottom trawls, bottom set gillnets, poisons, explosives, or other intoxicating substances are to be employed in the management areas); 2) a limited entry permit program for fishing in the NWHI which, as of October 1, 2001, consisted of 12 permit holders: six in the Ho'omalu Zone and six in the Mau Zone; 3) a requirement that vessel operators in the NWHI bottomfish fishery attend a NMFS protected species workshop; 4) 72 hour notification requirement and observer placement option for NMFS for fishing in the protected species zone[9]; 5) a discretionary observer requirement throughout the fishery; and 6) reporting and record keeping of MUS, which includes the calculation of Maximum Sustainable Yield (MSY), an annual evaluation of the conditions of the fishery, and information on habitat degradation.

From October 1990 through December 1993, the NMFS conducted an observer program for the bottomfish fishery in the Protected Species Study Zone of the NWHI. Observer coverage began on a voluntary basis in October 1990, and became mandatory (i.e. vessels were required to carry observers on board as ordered by the Southwest Regional Administrator) in November of that same year due to the proximity of bottomfishing operations to monk seal habitat. The objectives of the observer program were to document and characterize any interactions of the bottomfish fishery with protected species and to collect catch and effort data for the bottomfish fishery (Nitta, 1993). NMFS is considering the reactivation of the observer program for the bottomfish fishery. However, the form of the program (e.g. period of coverage, coverage beyond the Protected Species Study Zone, possible use of video technology, etc.) has not been determined as of October 2001. The objectives of the reactivated program will be consistent with prior objectives. In short, the level and character of interactions with protected species and other information will be recorded for analysis and development of fishery management, as

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[8] Ciguatera poisoning may result from the ingestion of fish or other marine animals containing high concentrations of naturally occurring toxins. The toxins are produced by epibenthic dinoflagellates associated with many coral reef communities. These toxins are transferred to through he food chain from smaller fish to larger fish. Ciguatera poisoning in humans may result in modification of nerve and muscle communication and other critical physiologic processes. (Woods Hole Oceanograhic Institution, 1993)

[9]The Protected Species Zone was created in 1991 (56 FR 1991, 24731). The zone is a 50 nm area around Nihoa, Necker Island, French Frigate Shoals, Gardner Pinnacles, Maro Reef, Laysan Island, Lisianski Island, Pearl and Hermes Reef, Midway Islands, and Kure Island. Longline fishing within this zone is prohibited unless the vessel operator has notified the NMFS Regional Administrator and provided an opportunity for NMFS to place an observer aboard the vessel.

appropriate.

D. Fishing Methods Practiced in Action Area

Bottomfishers use mechanical handlines with electric, hydraulic or hand powered reels to raise and lower the lines. The main line used is made of various materials woven into 400-450 lb test line. The hook leaders are usually within the range of 80-120 lb test monofilament. The hooks utilized in the bottomfish fishery are circle hooks, generally of the Mustad sizes11/0, 12/0 and 13/0. A typical bottomfish rig has 6-8 hooks branching off the main leader. The lead weight at the end of the main leader typically weighs 5-6 lbs. The lines off the main leader to each hook may be 2-3 ft long and connected to the main leader with a 3-way swivel. The spacing between each "hook" line may be 6 ft. The bait generally used is squid, but this may be supplemented with a chum bag containing chopped fish (anchovies) or squid suspended above the highest hook (Nitta and Henderson 1993). Additional shark distracting line may be used to distract sharks from fishing activities. These lines are usually rope or some other heavy line with a float, hook, and discard fish attached.

Vessels fishing in the NWHI range in size from 40 - 65 feet, and are usually equipped with electronic navigation and fish-finding equipment that allow a skilled captain to harvest target species with little bycatch (WPRFMC, 2000a). Bottomfish trips usually last 10 to 25 days, and vessels travel as far as Kure Atoll. Historically, bottomfish fishing was not restricted in the NWHI. Table 4 details the approximate percentage of total catch some areas have historically represented.

Implementation of the Reserve in the NWHI may result in decreased catches and a redistribution of bottomfishing effort in the NWHI. Due to the closed area and fishing caps, change(s) in fishing effort and potential decrease in catch are unknown at this time. However, future (post-Reserve) landings will be no greater than the average of those over the last five years as required by E.O. 13178 as amended by E.O. 13196. Furthermore, the area fished by the bottomfish fishery is restricted under the these executive orders as they establish closed areas in the NWHI such that some of the areas formerly fished by the bottomfish fishery are now closed. These areas include: areas out to 25 fathoms around Nihoa, Necker, Gardner Pinnacles, Maro Reef, Laysan Island, and Lisianski Island. Furthermore, Reserve Preservation Areas now exist around French Frigate Shoals, Pearl and Hermes Reef, Kure Atoll, Brooks Bank, St. Rogatien Bank, Raita Bank, and Pioneer Bank. Bottomfish fishing, although allowed under around St. Rogatien, Raita , and Pioneer Banks, is subject to the restrictions set forth in 7(a)(1) and 7(a)(2) of the E.O.13178 as amended by E.O. 13196 which charges the Department of Commerce to establish fishing caps tied to bottomfishing activities over the preceding five years (not to exceed average of prior five year catch levels) and may provide for a one time increase in the total catch to allow for the use of two Native Hawaiian bottomfishing permits. Additionally, bottomfish fishing around Raita and St. Rogatien Banks will be allowed for only five years if it is determined that the continuation of the fishing activity will have no adverse impact on the resources of these banks. ((Exec. Order No. 13196 (January 18, 2001) 7(a)(1) and 7(a)(2) apply to all Preserve Areas in which bottomfishing is allowed.

At the present time, resource managers are devising regulatory mechanisms and policies to implement these executive orders, potentially including the conversion of the boundaries (and restricted areas) to straight-line boundaries for clarity and ease of identification as well as setting fishing caps. The current (pre-Reserve) prohibition on bottomfish fishing within the boundaries of the Midway Atoll National Wildlife Refuge between the parallels of 28°5' and 28°25' North latitude and between the meridians of 177°10' and 177°30' West longitude remains intact and does not constitute a change in the bottomfish fishery area of operation. (Exec. Order No. 13022, 63 Fed. Reg. 11624 (1998)) The current proposed fishing cap scenarios (Scenarios A-E) are listed at Appendix 1.

Table 4. Approximate Percentage of Total Catch in NWHI Bottomfish Fishery from Selected Areas Based on Historical Fishing Data. (Source: WPRFMC, 2000a)

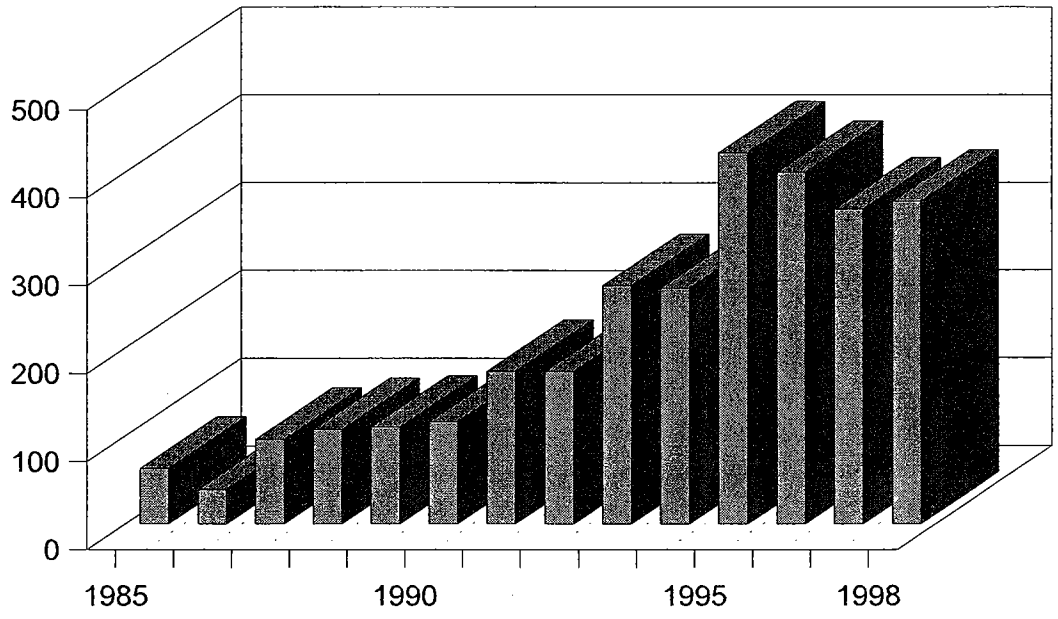
AREA	PERCENT OF TOTAL CATCH
Nihoa Island and Twin Banks	16.6
Brooks Bank and St. Rogatien Bank	14.2
Laysan Island	13.6
Necker Island	13
Gardner Pinnacles	12.9
Lisianski Island	6.8
French Frigate Shoals	5.6
Kure Atoll	4.4
Maro Reef	4.2
Pioneer Bank	4
Raita Bank	2.6
Pearl and Hermes Reef	2.1
Midway Atoll	0

Bottomfishing in the MHI employs methods similar to those in the NWHI. However, MHI vessels are typically smaller and return to port after a single day of fishing. Commercial fishers and some larger vessels in the MHI with larger vessels make trips longer than 24 hours, typically to the islands of Kauai, Niihau, east Maui, and Penguin Banks. The favored fishing grounds within state waters in the MHI are off the islands of Molokai, Maui, Lanai and Kauai. Bottomfish fishing grounds within Federal waters around the MHI include Middle Bank, most of Penguin Bank, and approximately 45 nm of 100 fathom bottomfish habitat in the Maui-Lanai-Molokai complex. The NWHI fishery is not expected to differ substantially from the average participation patterns as shown over the last five years. However, the fishing effort (location) may change because of the Reserve restrictions, with the total amounts of fishing days, catch rates, and total catch of individual fish species dependent upon the reaction of the bottomfishers to the Reserve restrictions, markets, and environmental factors. These figures show the increase in the number of bottomfish vessels participating in the MHI and the stability of the number of vessels participating in the NWHI since 1989 and 1999 when the Bottomfish FMP was amended to establish a limited entry permit system for the Ho'omalu Zone and Mau Zone, respectively. (WPRFMC, 2000a). In 1999 the number of vessels participating in the Mau and Ho'omalu Zones were 7 and 6, respectively. In 2000, the number of vessels participating in the Mau and

Ho'omalu Zones were 6 and 5, respectively. This indicates a drop in vessel participation from 13 in 1999 to 11 in 2000 (WPRFMC, 2001a).

In Guam the bottomfish fishery has two distinct components. The deepwater component (500 - 700 ft) targets snappers and groupers. The shallow-water component, that occurs primarily within Guam territorial waters, targets reef dwelling snappers, groupers, emperors, and jacks. Guam bottomfish vessels are typically 25 ft and utilize small spincasting reels in the shallower waters and electric reels with main lines with multiple hooks in the deeper waters. Skipjack tuna is used for bait, and chumming is used to attract fish. The Guam fishery is seasonal due to weather conditions, with most bottomfish fishing occurring during the summer months (May through September) (DEIS p. 3-61). Figure 5 shows the increase in the number of vessels participating in the Guam bottomfish fishery 1965 through 1998.

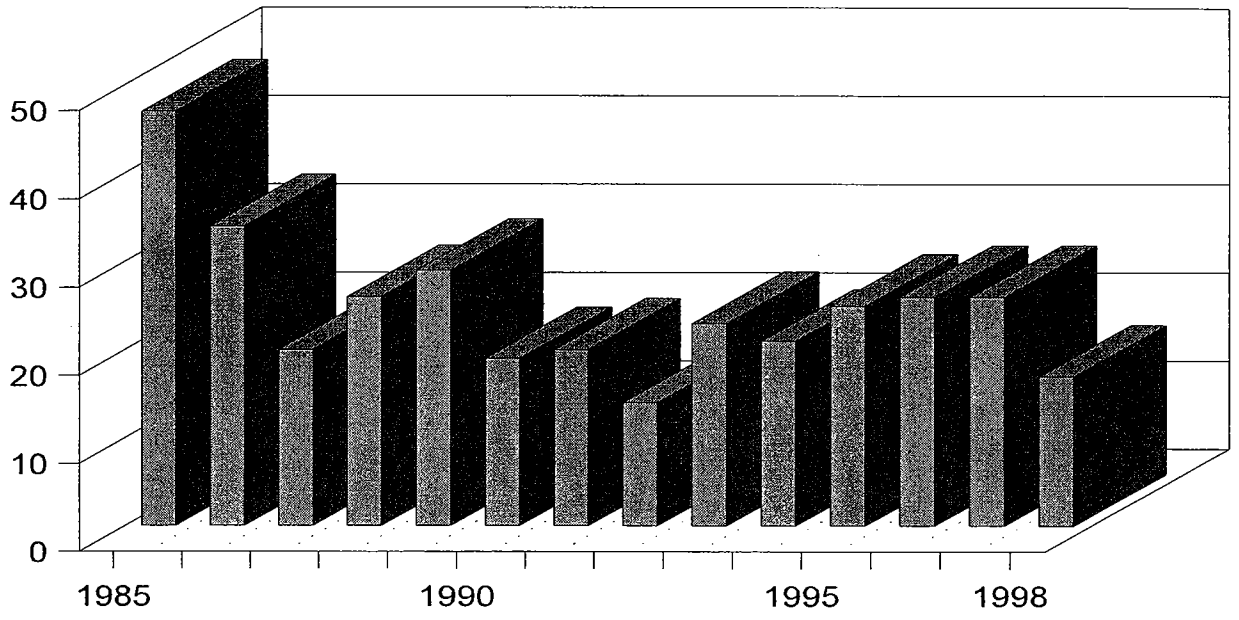
Figure 5. Number of Vessels Participating in the Guam Bottomfish Fishery, 1985-1998 (Source: WPRFMC, 2000a)



In American Samoa, the small boat fleet uses wooden hand reels for both trolling and handlining, and skipjack tuna is used for bait. American Samoa bottomfish vessels are typically 28 ft aluminum catamarans, and are not equipped with electronic navigation and fish-finding equipment. Most boats do not carry ice, making it unfeasible to fish longer than one over night trip at a time. Recently, vessels larger than 35 ft with cold storage capabilities have joined the fleet, allowing the potential for expanded bottomfish fishing operations. Further expansion may not be realized, however, as bottomfish vessels convert to pelagic longlining operations (WPRFMC, 2000a). Figure 6 shows the increase in the number of vessels participating in the

American Samoa bottomfish fishery 1965 through 1998.

Figure 6. Number of Vessels Participating in the American Samoa Bottomfish Fishery, 1985-1998 (Source: WPRFMC, 2000a)



E. Observed Interaction Events

The endangered Hawaiian monk seal (*Monachus schauinslandi*), and the threatened green turtle (*Chelonia mydas*), occur within the NWHI and the MHI in the action area. Critical habitat for the Hawaiian monk seal extends to 20 fathoms, some of which is located within Federal waters of the bottomfish fishery in the NWHI. From October 1990 - October 1993, NMFS observers completed 26 cruises on 11 vessels to document interactions[10] between the bottomfish fishery and protected species (13 percent observer coverage). A later estimate, which included all the observed trips, indicated that monk seals interacted with bottomfish fishing operations once every 67.7 hours of fishing, with no confidence intervals provided (Nitta, 1993). In total, interactions with monk seals and fishing operations were observed on 10 out of 26 of the observed trips, involving a maximum of 26 different seals. In an effort not to overestimate the number of seals interacting with the fishery, the observers noted, to the extent possible, when the

[10]An Interaction was defined in the report as "an instance in which fish caught during bottomfishing operations were stolen or damaged by marine mammals or marine mammals and/or other protected species were caught or entangled in bottomfishing gear." (Nitta, 1993, p. 5). However, it should be noted that observers did not witness any entanglements or hookings of monk seals or any other listed species.

same seal interacted on multiple occasions. No other listed species interactions were observed during these trips.

II Status of Affected Species

A. Listed Species/Critical Habitat in the Action Area

The following endangered and threatened species are present in the action area of domestic fisheries in the Western Pacific Region under the Bottomfish FMP.

Marine Mammals	**Status**
Blue whale (*Balaenoptera musculus*)	Endangered
Fin whale (*Balaenoptera physalus*)	Endangered
Hawaiian monk seal (*Monachus schauinslandi*)	Endangered
Humpback whale (*Megaptera novaeangliae*)	Endangered
Right whale (*Eubalaena glacialis*)	Endangered
Sei whale (*Balaenoptera borealis*)	Endangered
Sperm whale (*Physeter macrocephalus*)	Endangered

Sea turtles	**Status**
Green turtle (*Chelonia mydas*)	Endangered/Threatened
Hawksbill turtle (*Eretmochelys imbricata*)	Endangered
Leatherback turtle (*Dermochelys coriacea*)	Endangered
Loggerhead turtle (*Caretta caretta*)	Threatened
Olive ridley turtle (*Lepidochelys olivacea*)	Endangered/Threatened

Critical Habitat

In May 1988, NMFS designated critical habitat for the Hawaiian monk seal out from shore to 20 fathoms in 10 areas of the Northwestern Hawaiian Islands. Critical habitat for this species 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 around the following: Pearl and Hermes Reef, Kure Atoll, Midway Islands, except Sand Island and its harbor, Lisianski Island, Laysan Island, Maro Reef, Gardner Pinnacles, French Frigate Shoals, Necker Island, and Nihoa Island" (53 FR 18990, May 26, 1988, 50 CFR § 226.201). As described earlier (*See* discussion *supra* part I.D.), the Reserve sets forth Reserve Preservation Areas which encompass critical habitat and exclude all fishing, including commercial and consumptive bottomfishing from in the areas of critical habitat around Pearl and Hermes Reef, Kure Atoll, Lisianski, Laysan, Maro Reef, French Frigate Shoals, Gardner Pinnacles, Necker Island, and Nihoa Island. Around Midway Islands, the current prohibition on commercial bottomfishing remains intact under the regulations set forth for the Midway Atoll National

Wildlife Refuge.[11] (*See* discussion *supra* part I.D.)

Critical habitat for the other species listed above has not been designated or proposed within the action area.

B. Listed Species and Critical Habitat Not Likely to Be Adversely Affected by the Proposed Fishery

Although blue, fin, humpback, right, sei, and sperm whales may be found within the action area and could interact with the FMP bottomfish fishery, there have been no reported or observed incidental takes of these species in the history of the bottomfish fisheries. Also, based upon the dearth of sightings/observations of these species in the area of the proposed action indicate that the probability of an encounter of these species with the bottomfish fishery is extremely low. Therefore, NMFS concludes that the proposed action is not likely to adversely affect blue, fin, humpback, right, sei, and sperm whales, and these species will not be considered further in this Opinion.

Although hawksbill, leatherback, loggerhead, and olive ridley turtles may be found within the action area and could interact with the FMP bottomfish fishery, there have been no reported or observed incidental takes of these species in the history of the bottomfish fisheries. In addition, hawksbill, leatherback, and olive ridley turtle species are likely to occur only very rarely in the action area. Therefore, NMFS concludes that the proposed action is not likely to adversely affect hawksbill, leatherback, loggerhead, and olive ridley turtles, and these species will not be considered further in this Opinion.

Prior biological opinions discussed the potential for adverse effects from vessel lighting and activity near and around nesting beaches utilized by the green turtle. There are no documented green turtle takes resulting from past fishery operations near nesting beaches. There are also no documented takes of green turtles from past fishing operations. The green turtle population has increased in the NWHI in recent years without corresponding interactions with the bottomfish fishery (Laurs, 2000). Therefore, NMFS concludes that the proposed action is not likely to adversely affect green turtles and these species will not be considered further in this Opinion.

Critical habitat was designated in order to enhance the protection of habitat used by monk seals for pupping and nursing, areas where pups learn to swim and forage, and major haul-out areas where population growth occurs. The Bottomfish FMP manages areas included in the critical habitat for the Hawaiian monk seal (i.e. ocean waters out to 20 fathoms depth), although the fisheries operating pursuant to the Bottomfish FMP do not adversely affect the physical features identified as critical habitat, such as substrate, waters, or nesting beaches. However, the

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[11] A charter boat and recreational fishery targeting pelagic fish and including fishing for bottomfish species in lagoons and nearshore waters exists at Midway Atoll. The fishery is operated by a private company, Midway Sports Fishing, as authorized by the U.S. Fish and Wildlife Service.

proposed action may affect forage species of monk seals and therefore the proposed action may affect the critical habitat designated for the monk seal.

C. Status of the Species/Critical Habitat

This section presents the biological and other information relevant to formulating the biological opinion. Appropriate information on each species' life history, its habitat and distribution, and other data on factors necessary to its survival, are included to provide background for analyses in later sections of this document. The Hawaiian monk seal, the only species determined likely to be adversely affected by the proposed action, and its critical habitat are considered in this section.

1. Hawaiian monk seal

The Hawaiian monk seal was listed as endangered under the ESA in 1976[12] (41 FR 33922). They are endemic to the Hawaiian Archipelago, and are one of the most endangered marine mammals in the United States. Hawaiian monk seals are also the only endangered marine mammal which exists wholly within the jurisdiction of the United States. Monks seals are one of the most primitive genus of seals. They are brown to silver in color, depending upon age and molt status, and can weigh up to 270 kg. Adult females are slightly larger than adult males. It is thought that monk seals can live to 30 years. Females reach breeding age at about 5 to 10 years of age, depending on their condition, and give birth about once every year at most. It is estimated that 40 - 80 percent of adult females give birth in a given year (NMFS unpub. data, 2001). After birth, pups take up to 6 weeks to wean. During this time, the mother suckles the pup, rarely leaving it to feed. After weaning, the mother leaves and the pup must forage independently. Newly weaned pups are somewhat more gregarious than adults. Pups tend to stay in the reef shallows, entering into more diverse and deeper waters to forage as they age. Male aggression is somewhat common, as males compete for females for breeding purposes. Male aggression has resulted in a number of injuries and deaths to females, juveniles, and pups. Monk seals may stay on land up for about two weeks during their annual molt. Monk seals are nonmigratory, but recent studies show their home ranges may be extensive (Abernathy and Siniff, 1998). Counts of individuals on shore compared with enumerated subpopulations at some of the NWHI indicate that monk seals spend about one-third of their time on land and about two thirds in the water (Forney et al., 2000).

Population Status

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[12]In 1976, the Hawaiian monk seal was also designated as a depleted species under the Marine Mammal Protection Act of 1972, and its population status is considered to be below the optimum sustainable population. The Hawaiian monk seal Recovery Team was formed pursuant to the ESA to develop a Hawaiian Monk Seal Recovery Plan. Supported by NMFS, the HMSRT is a forum in which expertise regarding species recovery and recovery plan implementation are discussed and recommendations for actions forwarded to NMFS.

Before human habitation of the Hawaiian Archipelago, the monk seal population may have measured in the tens of thousands as opposed to the hundreds of thousands or millions typical of some pinniped species. When population measurements were first taken in the 1950s, the population was already considered to be in a state of decline. The year 1998 minimum population estimate (N_{MIN})[13] for monk seals is 1436 individuals (based on enumeration of individuals of all age classes at each of the subpopulations in the NWHI, derived estimates based on beach counts for Nihoa and Necker, and estimates for the MHI) (Forney et al., 2001). Taking into account the first year survival rates, NMFS Southwest Fisheries Science Center - Honolulu Laboratory estimates the species population to be between 1300 to 1400 individuals (Laurs, 2000). Monk seals are found at six main reproductive sites in the NWHI: Kure Atoll, Midway Island, Pearl and Hermes Reef, Lisianski Island, Laysan Island and French Frigate Shoals. Smaller populations also occur on Necker Island, and Nihoa Island. NMFS researchers have also observed monk seals at Gardner Pinnacles and Maro Reef. Monk seals are also found in the MHI, and preliminary aerial surveys counted fewer than 50 individuals. Additional sightings and at least one birth have occurred at Johnston Atoll, excluding eleven adult males that were translocated to Johnston Atoll (9 from Laysan Island[14] and 2 from French Frigate Shoals) over the past 30 years.

Various surveys of the six islands and atolls in the NWHI that support the six main monk seal breeding subpopulations indicate that the NWHI non-pup population (juveniles, sub-adults and adults) declined 60 percent between the years 1958 and 1993 (See Figure 7). Trends in population are measured by beach counts for each of these populations. Population trends vary within the NWHI. For instance, from 1990 to 1998, the populations at Lisianski Island and Laysan Island have been stable, while the population at Kure Atoll increased at about 5 percent per year from1983 to 1998. The population at Pearl and Hermes Reef experienced the highest increase of 7 percent per year between 1983 and 1998. Researchers have been able to enumerate the main breeding subpopulations, and in 2000 the preliminary number of monk seals identified was 130 at Kure Atoll, 70 at Midway Atoll, 235 at Pearl and Hermes Reef, 205 at Lisianski Island, 316 at Laysan Island, and 348 at French Frigate Shoals (NMFS, unpub. data; see also Figure 8). Population decline over the last decade is attributable to low reproductive recruitment and high juvenile mortality at the largest of the subpopulations at French Frigate Shoals. At this site, the count of animals older than pups is now less than half the count in 1989. Poor survival

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[13]Under the Marine Mammal Protection Act of 1972, PBR is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times FR$. Based on an estimate derived by Wade and Angliss in Barlow et al., 1997 for N_{MIN} (1,436 seals), an estimate of R_{MAX} (0.07) and a default recovery factor (0.1) for this stock, thus, PBR = 1,436 x (0.07 x (0.5)) x 0.1), or PBR = 5.026 or 5 seals (Forney, et al., 2000).

[14]Nine adult male monk seals that had been identified as participating in mobbing behavior were translocated to Johnston Atoll by the NMFS in 1984. This was an attempt to reduce the frequency and/or severity of mobbing incidents involving injury or death of female seals, not to equalize the sex ratio at Laysan Island.

of pups has resulted in a relative paucity of young seals, so that further decline is expected for this subpopulation as adults die and there are few juveniles to replace them. Survival from weaning to age 1 at French Frigate Shoals has declined to as low as 14 percent in 1997 from about 90 percent in the mid-1980s (Figure 9) (Laurs, 2000).

Over the last decade, the causes of the poor survival for these age classes at French Frigate Shoals have been related to poor condition from starvation, and from shark predation, male aggression, habitat loss, and entanglement in marine debris. A decrease in prey availability may be the result of decadal scale fluctuations in productivity or other changes in local carrying capacity for seals at French Frigate Shoals or a combination of factors (Craig and Ragen, 1999; Polovina, 1999). While other subpopulations of monk seals in the NWHI are stable, increasing or declining slightly, the overall population status is being driven by the French Frigate Shoals population, which comprises about 25 percent of the total monk seal population. However, girth of weaned pups (Figure 10), French Frigate Shoals, which may correlate to prey availability to females during gestation and resulting increased ability to nourish pups, has increased in recent years (Laurs, 2000).

In sum, beach counts of the Hawaiian monk seal have declined by 60 percent since the late 1950s, and a recent decline of about 5 percent per year occurred from 1985 to 1993. Counts from 1993 to 2000 remained at about the same level. On the basis of systematic beach counts, long-term Hawaiian monk seal population trends reported in the 2000 Stock Assessment Report (Forney et al., 2000) indicated that the population declined at a rate of 3 percent per year from 1985 to 1998. A more recent statistical evaluation of population trends from 1985 to 2000 (NMFS, unpublished data) identified two distinct trends in population growth, with a trend shift occurring in 1993. Linear regression of beach counts on year for the period from 1993-2000 results in a slope, or rate of change in population growth, of 0.09 per year (95 percent confidence bounds: -1.8 to 2.0). This slope is not significantly different from zero, or the population's growth rate has not changed ($p = 0.93$ for the null hypothesis of zero slope). These results suggest that the population has neither increased nor decreased over the last 8 years, although the total population size is still too small to protect this species from extinction in the foreseeable future.

Population trends for monk seals are determined by the highly variable dynamics of the six main reproductive subpopulations. At the species level, demographic trends over the past decade have been driven primarily by the dynamics of the French Frigate Shoals subpopulation, where the largest monk seal population is experiencing an increasingly unstable age distribution resulting in an inverted age structure.[15] This age structure indicates that recruitment of females and pup production may soon decrease. In the near future, total population trends for the species will

[15]An inverted age structure is present in a population with a relatively low abundance of individuals in younger age classes. Unless a substantial number of individuals immigrate, such a population will dwindle until the number of young individuals increases and survives to breed.

likely depend on the balance between continued losses at French Frigate Shoals and gains at other breeding locations.

Figure 7. Historical trend in beach counts (non-pups) of Hawaiian monk seals at the six main reproductive subpopulations. (Source: Laurs, 2000)

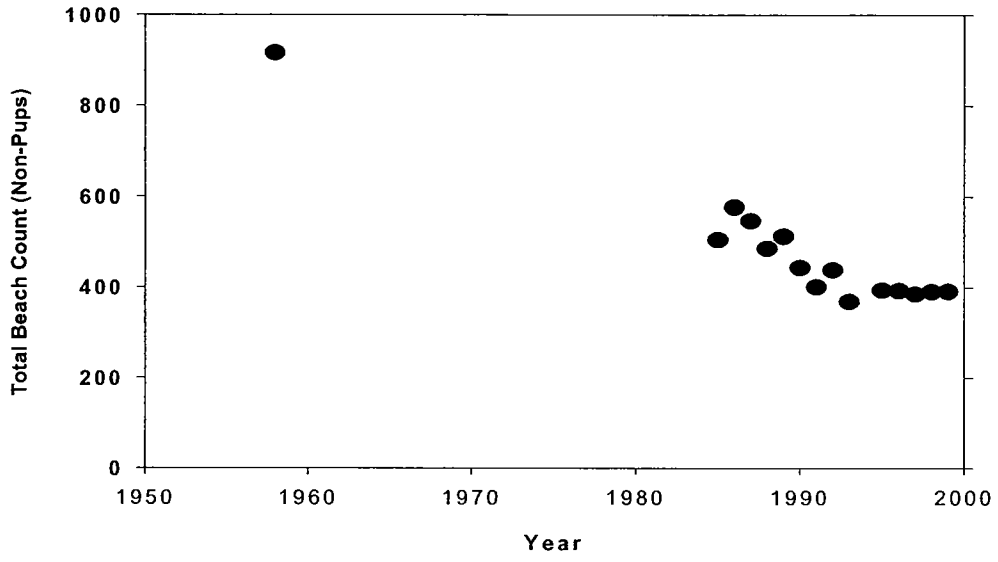


Figure 8. Recent trends in beach counts (non-pups) of Hawaiian monk seals at each of the six main reproductive subpopulations. (Source: Laurs, 2000)

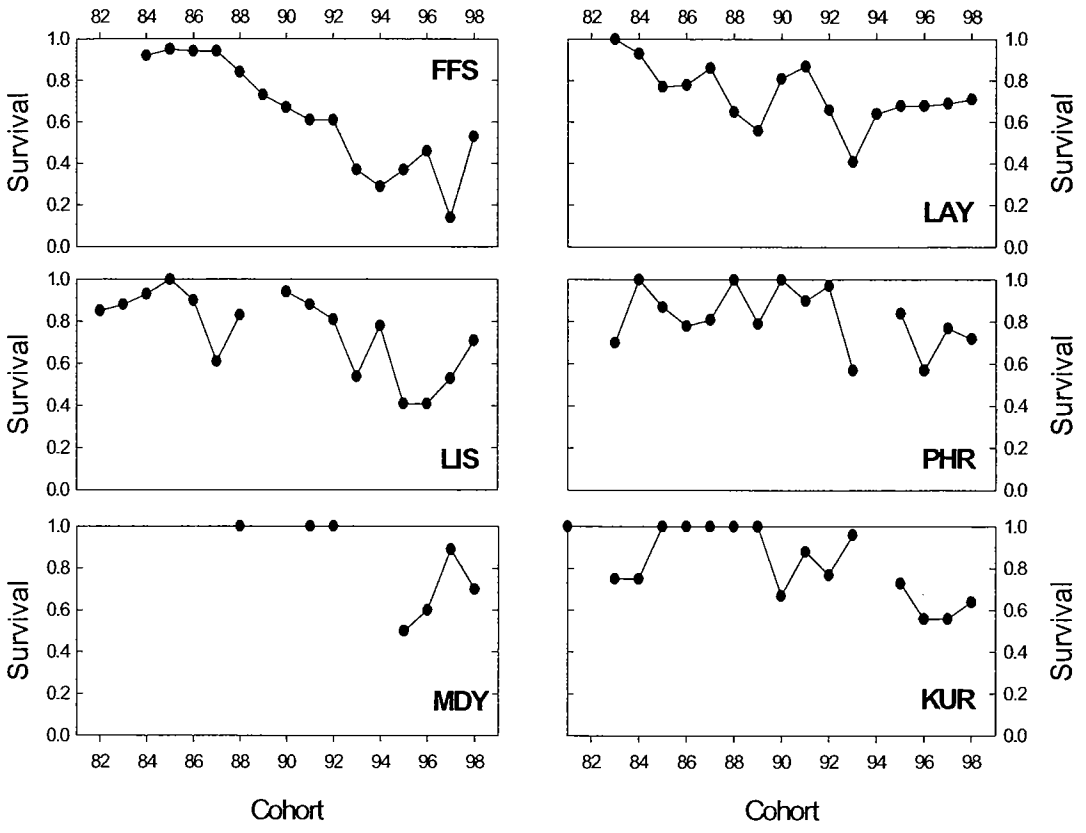


Figure 9. Survival of Hawaiian monk seals from weaning to age 1 year at the six main reproductive subpopulations. (Source: Laurs, 2000)

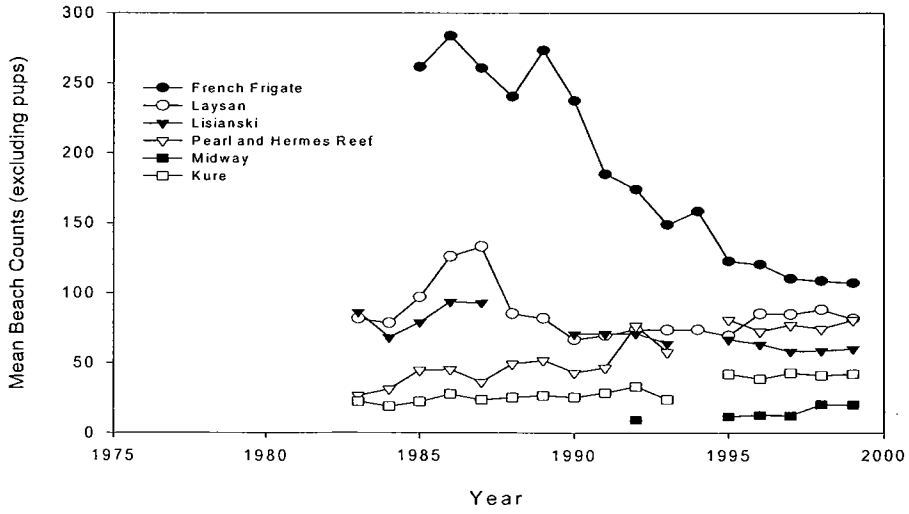
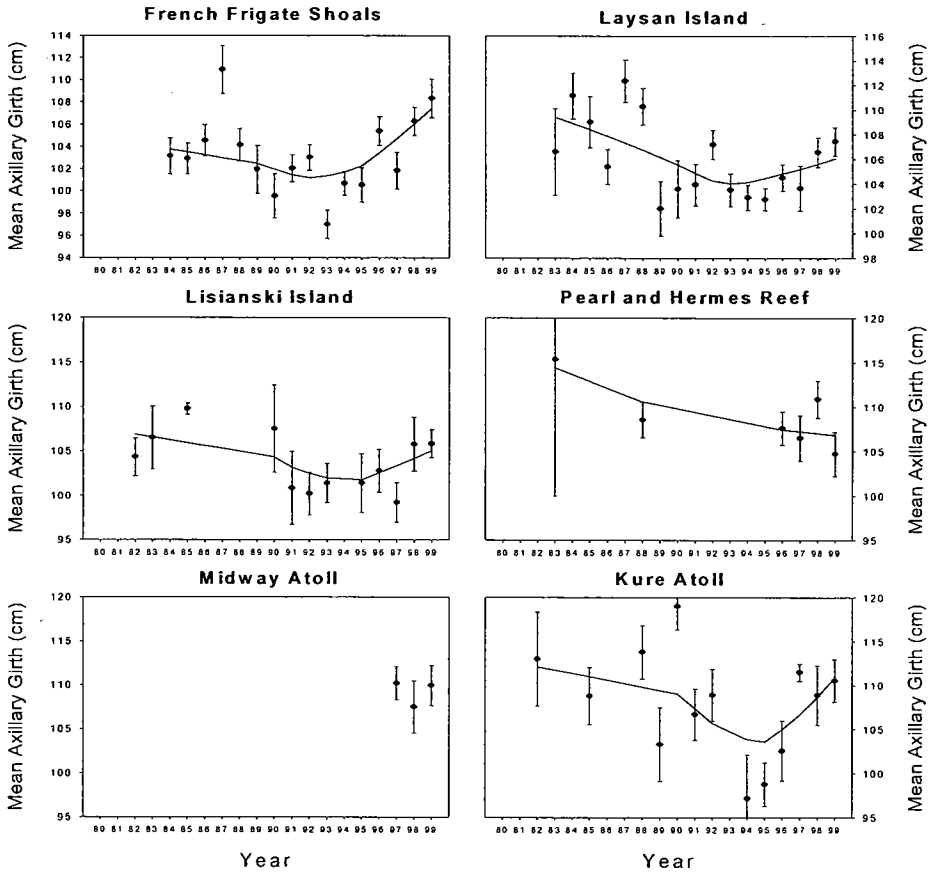


Figure 10. Trends in Axillary Girth of Hawaiian Monk Seal Pups Measured Within 2 Weeks of Weaning at the Six Main Reproductive Islands. (Source: Laurs, 2000)



Diet of the Hawaiian monk seal

Monk seals feed on a wide variety of teleosts, cephalopods and crustaceans, indicating that they are highly opportunistic feeders (Rice, 1964; MacDonald, 1982; Goodman-Lowe, 1999). Research to identify prey species is currently underway using several methods: collection of potential prey items and blubber samples for fatty acid analysis; Crittercam[16] recording of foraging behavior; correlation of dive/depth/location profiles with potential prey species habitat; and analysis of monk seal scat and spew samples for identifiable hard parts of prey. To date, completed studies indicate little or no overlap between monk seal prey items and the target and bycatch/incidental catch species of the bottomfish fishery.

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[16]A Crittercam is a self contained video camera that has been mounted on a monk seal to record its foraging behavior.

Table 5 identifies adult male monk seal prey families as indicated by Crittercam studies at French Frigate Shoals.

Table 5. Crittercam study: Prey Items Eaten by Free Swimming Adult Male Monk Seals at French Frigate Shoals (Data Source: Parrish, et al., 2000; WPRFMC, 2000a)

Family	number seen	Bottomfish Target Species: Y = Yes, ? = Maybe, N = No	Bottomfish Bycatch Species: Y = Yes, ? = Maybe, N = No
Anthiinae	2	N	N
Balistidae	1	N	N
Bothidae	1	N	N
Cheilinninae	2	N	N
Congridae	1	N	?
Pentacerotidae (groundfish)	1	N	N
Pomacentridae	1	N	N
Tetradontidae	1	N	N
Unidentified Eels	2	N	?
Unidentified fish	8	?	?
Octopus	2	N	?

In a study at five of the principle breeding sites for the monk seal (French Frigate Shoals, Laysan Island, Lisianski Island, Pearl and Hermes Reef, and Kure Atoll) focused on identifying items eaten by monk seals, Goodman-Lowe (1998) analyzed scat and spew samples to identify prey, and to obtain size estimates of the more common cephalopod species.[17] This study also examined the temporal differences in diet among years. The frequency of occurrence (FO) was calculated as the number of samples in which an identified prey type was found. The percent frequency of occurrence (percent FO) was calculated as the FO divided by the total number of scat and spew samples (n=940) (Table 6).

[17]Scat and spew analysis is known to be biased due to differential digestion of various prey types. However, scat and spew analysis is, at this time, the best available scientific information for investigating monk seal diets.

Table 6. Goodman-Lowe Results of Prey found in Scat and Spew samples Referenced to Bottomfish MUS and Bycatch Families (Data Source: Goodman-Low, 1998; WPRFMC, 2000a)

Family	FO/%FO n=940	Bottomfish Target Family: Y = Yes, ? = Maybe, N = No	Bottomfish Bycatch Family: Y = Yes, ? = Maybe, N = No
Labridae	194/20.6	N	N
Balistidae	123/13.1	N	N
Scaridae	99/10.5	N	N
Acanthuridae	71/7.6	N	?
Pomacentridae	44/4.7	N	N
Tetraodontidae	41/4.4	N	N
Kyphosidae	32/3.4	N	N
Monacanthidae	29/3.1	N	N
Synodontidae	25/2.7	N	N
Pomocanthidae	17/1.7	N	N
Kuhliidae	14/1.5	N	N
Cirrhitidae	12/1.3	N	N
Chaetodontidae	10/1.1	N	N
Diodontidae	10/1.1	N	N
Bothidae	9/0.9	N	N
Cheilodactylidae	6/0.6	N	N
Scorpaenidae	5/0.5	N	N
Ostraciidae	1/0.1	N	N
Unidentified Eels	207/22.0	N	?
Holocentridae	135/14.4	N	Y
Muraenidae	53/5.6	N	Y
Congridae	52/5.5	N	Y
Priacanthidae	40/4.3	N	Y

Family	FO/%FO n=940	Bottomfish Target Family: Y = Yes, ? = Maybe, N = No	Bottomfish Bycatch Family: Y = Yes, ? = Maybe, N = No
Apogonidae	9/0.9	N	N
Opichthidae	6/0.6	N	N
Mullidae	58/6.2	N	Y
Lutjanidae	24/2.6	Y	Y
Carangidae	11/1.1	Y	Y
Polymixiidae	9/1.0	N seamount groundfish	?
Serranidae	5/0.5	N	Y
Belonidae	1/0.1	N	N
Unidentified remains	330	?	?

Both the Crittercam data and the scat and spew analyses indicate little overlap with the target and bycatch fish families of the bottomfish fishery. Moreover, overlap at the family level may not reflect an overlap at the species level because many species within families occur in both deep and shallow waters. More information about the foraging activities of monk seals is available through the additional analysis of dive/depth/location profiles and the correlation with the habitat of potential prey families. Recent information suggests monk seals may forage in beds of precious corals, which are habitat for known monk seal prey items such as eels (Parrish et al., in press).

Foraging Range and Behavior

The foraging and dive patterns of monk seals and the availability of prey items to monk seals are important to understand when determining the potential impact of the bottomfish fishery in terms of area fished, potential for gear interaction, and prey competition. The foraging range of the monk seal extends to areas managed under the Bottomfish FMP. Various studies have been undertaken to determine the habitat use patterns of monk seals (Schlexer, 1982; DeLong et al., 1984; Abernathy and Siniff, 1998; Stewart, 1998; Parrish et al., 2000). These studies used various technologies, including radio tags, dive depth recorders, Crittercams, and satellite telemetry, to study the foraging behavior of monk seals. The results of these studies vary by location.

DeLong et al. (1984) instrumented seven monk seals at Lisianski Island with radio transmitters

and multiple depth of diving recorders and recorded movements for an aggregate of 94 days in which 4,817 dives were recorded. Most dives (59 percent) were in the 10-40 m depth range, and the remainder of dives were to deeper depths. Thirteen dives were recorded to depths of at least 121 m. The outer edge of the reef around Lisianski Island is generally delineated by the 40 m isobath. DeLong et al., (1984) concluded that males during breeding season at Lisianski Island depend entirely upon the food resources on the coral reefs, sandy beach flats and deeper reef slopes around that island.

Schlexer (1982) also recorded diving patterns of monk seals at Lisianski Island. In this study, eight monk seals (five adult males, one juvenile male, one subadult female, and one juvenile female), tracked with radio transmitters and multiple depth of diving recorders, were recorded diving within the 0 - 70 m range. One subadult female and one juvenile female dove in the shallow range of 10 - 40 m, with some dives recorded from 150 - 180 m. None of the adult males instrumented dove to depths greater than 70 m.

Stewart (1998) investigated diving patterns of 24 monk seals at Pearl and Hermes Reef using satellite-linked radio transmitters to record dive depth and duration. This study concluded that the monk seals at Pearl and Hermes Reef foraged in relatively shallow waters, and that foraging activity was different for males and females and among age classes. At Pearl and Hermes Reef, juveniles foraged almost exclusively within the fringing reef, adult males foraged mostly on the inside and outer edge of the fringing reef, and adult females foraged mostly within the center of the atoll and near the atoll's southwestern opening (Stewart, 1998). Adult males generally dove within the 8 - 40 m range, with a secondary mode at 100 - 120 m. Male juveniles generally dove within the 8 - 40 m range. Adult females rarely dove deeper than 40 m, although one female made a number of dives to 60 - 140 m.

Abernathy and Siniff (1998) instrumented adult seals at French Frigate Shoals with satellite-linked time depth recorders. Data showed that instrumented adult male monk seals appeared to utilize the banks to the northwest, with a daytime diving range between 50 - 80 m and a nighttime range between 110 - 190 m. The study also suggested that seals that did not leave the vicinity of French Frigate Shoals rarely dove deeper than 80 m during the day, but made more dives closer to 80 m at night. The study also identified a few seals that were extremely deep divers. These seals' daytime dives reached depths > 300 m on a ridge to the east of the atoll. The researchers modeled the home range of individuals and concluded that the average home range was 6,467 km^2 (n=28, SE=3,055 km^2). For example, individuals have been documented traveling between French Frigate Shoals and to Gardner Pinnacles, St. Rogatien Bank, Brooks Bank, and Necker Island. (Abernathy and Siniff, 1998). The conclusion of Abernathy and Siniff (1998) is that monk seals forage on benthic and epibenthic species, and on other prey items in the fringing reef complex.

Parrish et al. (2000) provided further information that monk seal foraging behavior and range are extensive. During a recent study, 24 monk seals were outfitted with Crittercams. The Crittercam recorded the habitat depth and bottom type at locations where monk seals were identified as successful in the capture of prey items. Parrish et al. (2000) found that the diurnal pattern of

foraging by male adults occurred mainly at the 60 m isobath. A few seals foraged at depths >300 m. Some of these areas were outside the critical habitat area and overlapped with areas fished by both lobster and bottomfish fisheries.

Since 1995, abundance of shallow water (<20 m) reef fish has been surveyed at French Frigate Shoals and Midway. The data are checked as a potential indicator for changes in abundance of monk seal prey. The surveys are conducted annually by NMFS and are designed to detect changes of 50 percent or greater in fish densities (Laurs, 2000). So far, surveys have not indicated any statistically significant changes in prey abundance at either site (DeMartini, et al., 1999; DeMartini, et al., 1996).

III Environmental Baseline

This section is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated critical habitat) and ecosystem within the action area. This section does not include the effects of the action under review in this consultation. Past effects and expected future effects of the FMP bottomfish fishery are described in the *Effects of the Action* section below.

Hawaiian monk seal

A. Status of the Species within the Action Area

The action area is all areas that will be affected, directly or indirectly, by the fisheries managed under the Bottomfish FMP. These fisheries occur throughout the central, western, eastern and northern Pacific Ocean, including inside the EEZ around U.S. islands in the western Pacific. These islands include the Northwestern Hawaiian Islands (a chain of largely uninhabited islets, atolls and banks), the main Hawaiian Islands, American Samoa, and Guam. The action area does not include the area within the 3 mile limit for state and territorial waters around the State of Hawaii, the Territory of American Samoa, and the Territory of Guam.

Hawaiian monk seals occur only within a subset of the action area, the NWHI and MHI fishing areas. Thus, for the remainder of this opinion, "action area" refers to this subset of the larger area affected by the Bottomfish FMP where monk seals occur. For the status of the species in the action area, the reader is referred to the *Status of the Species* section above.

B. Factors Affecting the Hawaiian Monk Seal Environment within the Action Area

This analysis describes factors affecting the environment of the species or critical habitat in the action area, including state, local, and private actions already affecting the species or actions that occur contemporaneously with the consultation in progress. Unrelated Federal actions affecting (adverse or beneficial effects) the same species or critical habitat are also part of the environmental baseline considered in this section.

(1.) Fisheries

Several fisheries operate in the areas utilized by the Hawaiian monk seal. Some of the fisheries are federally managed fisheries. These are: the bottomfish fishery (this is the action under consideration in this biological opinion), the pelagic longline fishery (transit only), the crustacean fishery, and the precious coral fishery. Other fisheries that operate in areas utilized by the monk seal include fisheries managed by the State of Hawaii. These fisheries include: the state-managed MHI bottomfish fishery, commercial and recreational nearshore fisheries, akule fishery, collection for the aquarium trade, and commercial and recreational gillnet fisheries.

a. The Hawaii-based Pelagic Longline Fishery

The Hawaii-based pelagic longline fishery targets pelagic species of swordfish and tunas. Under the Fishery Management Plan for the Pelagic Fisheries in the Western Pacific Region (Pelagics FMP), NMFS permits up to 164 vessels, but only 114 permitted vessels are currently active.

There was some evidence in the early 1990s that longline operations were adversely affecting the monk seals, as indicated by the sighting of a few animals with hooks and other non-natural injuries. Amendment 2 to the Pelagics FMP required longline permit holders to notify NMFS if intending to fish within 50 miles of any NWHI and required all vessel operators to attend a training session. These measures were later deemed insufficient. In 1991, Amendment 3 established a permanent 50-mile protected species zone around the NWHI that closed the area to longline fishing. Establishment of the protected species study zone around the NWHI in April 1991 appears to have eliminated monk seal interactions with the longline fleet. Since 1993, no interactions with monk seals in the pelagic longline fishery have been reported. Longline observer data recorded only one sighting of a monk seal during transit through the protected species zone near Nihoa Island in 1995 (NMFS unpubl. data).

b. The NWHI Crustacean Fishery

The NWHI lobster fishery is managed under the Fishery Management Plan for the Crustacean Fishery for the Western Pacific Region (Crustaceans FMP). The lobster fishery began in the 1970's and annual landings peaked at 1.92 million lobsters in 1985. Since then, landings have decreased. The number of vessels participating in the lobster fishery has ranged from 0 to 17, with only 5 and 6 vessels participating during 1998 and1999, respectively (Al Katekaru, NMFS, pers. comm., 2001).

Historically, effort has been concentrated near the islands and atolls of the NWHI where monk seals occur. Data reports[18] show no monk seal entanglements or other interactions. However, in

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[18]The lobster fishery was "observed" on a voluntary basis starting in 1997. NMFS scientific data collectors were dispatched on each of the lobster trips during 1997 through 1999. In 2000 and 2001 the

1986 near Necker Island, one monk seal died as a result of entanglement with a bridle rope from a lobster trap. This incident was reported by NMFS research cruise personnel. Separate from the bridle rope incident, a precautionary measure was taken in 1983 to redesign the entrance cone to ensure that monk seals could not get caught in lobster traps entrances.[19]

Lobster is a known prey item of the monk seal, but the importance of lobster in their diet has not been quantified. Ongoing foraging and prey identification studies will help understand the effect, if any, of the lobster fishery on monk seal populations in the NWHI.

The lobster fishery was closed in1993 based on the harvest quota set for the fishery under Amendment 7 of the Crustacean FMP. The fishery re-opened in 1994 with five vessels participating in the fishery; in 1995 the fishery was closed; however, one vessel was allowed to fish under an experimental fishing permit issued by NMFS to obtain scientific information on the lobster stock. From 1996 through 1999 the fishery had 5, 9, 5, and 6 vessels participating respectively. Although the lobster fishery was not overfished, NMFS closed the fishery in 2000 through 2001 because of an increased level of uncertainty in the model assumptions used to estimate the lobster harvests (65 FR 39314). Harvest guidelines for the 2001 fishery were not issued by NMFS (66 FR 11156, Feb. 22, 2001). NMFS intends to extend the closure of the fishery for a portion of the fishery (Area 4: all areas except Gardner Pinnacles, Necker Island, and Maro Reef) until 2002. (NMFS, 2000a)

Under the authority of the National Marine Sanctuaries Act, President Clinton approved Executive Orders 13178 (Dec. 4, 2000) and 13196 (Jan. 18, 2001) permanently establishing the NWHI Coral Reef Ecosystem Reserve. The Executive Orders effectively close the NWHI lobster fishery as a result of conservation measures that severely restrict all consumptive and exploitative activities throughout the Reserve, including the harvest of lobsters, bottomfish and precious corals (discussed below).

c. The Precious Coral Fishery

Precious corals are harvested under the Fishery Management Plan for Precious Coral Fisheries of the Western Pacific Region (Precious Corals FMP). NMFS has determined that the harvest would not adversely affect the monk seal (NMFS, 2000). Regulatory changes to the Precious Corals FMP recommended by the WPRFMC in 2000, are intended to conserve precious coral resources, promote optimal utilization of the resource and minimize waste, facilitate effective monitoring and enforcement of harvest quotas, and protect precious coral beds that provide foraging habitat for some monk seals in the NWHI (65 FR 53692).

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lobster fishery was closed.

[19]Plastic dome-shaped single-chambered traps with two entrance funnels or cones located on opposite ends are employed in the lobster fishery. All traps are required to have escape vents (for smaller lobster). The traps are usually set in strings of about one hundred per string, with several strings fished at a time.

Pink, gold and bamboo varieties of coral are typically found at depth ranges between 350 to 1500 m, while black coral occurs at considerably shallower depths of less than 100 m. Exploitable beds have been surveyed at seven locations. The six known beds of pink, gold and bamboo corals are Keahole Point, Makapuu, Kaena Point, Wespac, Brooks Bank and 180 Fathom Bank. A seventh bed was recently discovered near French Frigate Shoals. The only exploitable black coral bed is located in the MHIs in the Auau channel. (WPRFMC, 2001).

The contribution of coral beds to prey aggregation and prey availability for monk seals remains unclear. As discussed previously, monk seal diet studies indicate that monk seals are opportunistic and feed on a wide variety of prey (Goodman-Lowe 1998). Research from Parrish et al., (in press) and Abernathy and Siniff (1998) indicate that some seals forage at depths where precious coral beds occur. However, the absence of deep diving activity at Pearl and Hermes suggests that monk seals at French Frigate Shoals may vary their foraging behavior depending on the availability of prey resources.

Potential increases in fishing pressure on precious coral beds near French Frigate Shoals and the possible importance of precious coral beds as foraging areas for monk seals prompted the NMFS and the Western Pacific Regional Fishery Management Council to suspend harvest of all corals at French Frigate Shoals and the MHI Makapuu gold coral bed. Limitations placed on the harvest of black corals will avoid the potential for destruction of foraging habitat.

d. Recreational Fisheries

(i.) NWHI Recreational Fishing

In the NWHI, The U.S. Fish and Wildlife Service allows a concession that operates an ecotourism station at Midway Island. Recreational fishing is allowed in the lagoon and waters around the island. To date, no adverse interactions (e.g. entanglements) with monk seals in this recreational fishery have been reported. Fishers are advised to stop fishing and move out of the area if monk seals approach a vessel. A study conducted in 1998 recorded monk seal interactions at 6 locations during fishing activities. The report indicated that chum in the water may not influence monk seal behavior. However, it was reported that when two monk seals "took note of the fisher/observer" they "swam on and out of the area" (Bonnet and Gilmartin, 1998). Inquisitive, newly weaned pups sometimes approach fishing activities, presumably to investigate human activity. (Shallenberger, pers. comm., 2001).

Three monk seals were reported to have been hooked as a result of recreational fishing during the operation of the U.S. Coast Guard station at Kure Atoll, which closed in 1993 (Forney et al., 2000).

(ii.) The MHI Bottomfish Fishery and Recreational Fisheries (State Managed Fisheries)

In the MHI, the state regulated bottomfish fishery operates off-shore of shoreline areas where

monk seals are sometimes observed. There have been no reported interactions between monk seals and this fishery. Some areas off-shore of regularly utilized monk seal haul-out areas have been closed to bottomfish operations due to concerns about overfishing.

The fisheries for big game (*ulua*) and small game (*papio* and other smaller fish) are two of the largest components of the shore-based recreational fisheries in Hawaii. The term *ulua* mainly refers to two species; the White ulua (*Caranx ignobilis*) and the Black ulua (*C. lugubris*). Ulua can also be used to refer to larger Caranx (ten or more lbs). The term *papio* can refer to *Caranx ignoblis* and *C. lugubris* under 10 lbs as well as to six to eight other smaller Carangids commonly found in near-shore waters. The two fisheries differ more in the gear used rather than the target species. Any of the species can be and are taken in both fisheries. The two predominant fishing methods employed are the "slide-bait" and "shore casting" fisheries.

Big game shorefishing, primarily targeting large ulua (jacks), usually utilizes slide-baiting techniques. Slide bait rigs have a large hook tied or crimped to a short length of wire or heavy monofilament leader which is in turn tied or crimped to a "slide bait" swivel. The slide-bait fishery almost exclusively employs circle hooks of sizes corresponding to Mustad sizes 14/0 and larger. This leader and hook set up is independent of the wired weight set up. These two independent sets of gear combine to make a whole slide bait rig. The weight is cast out and anchored before the slide bait hook rig is attached to mainline and allowed to "slide" down and out to its final fishing position. The preferred baits are moray eels, "white eel" or "tohei"(conger eel), and octopus. Live reef fish of all kinds are also among the preferred baits.

The mainline (line on the fishing reel) used in slide baiting varies according to the individual, but is generally heavy line in the 80-100 lb plus test weight. The fishing weights generally have 4-5 inch soft wires extending from the terminal end. These wires are bent into a grapnel shape to snag onto rocks and coral to provide a solid anchoring point from which to suspend the large baits off the bottom and prevent the rig from moving with the current or swell. The limited movement prevents tangling with other rigs. The wires used are malleable enough to be straightened with pressure from the rod. The line connecting the weight to the swivel is of a lesser strength than the mainline and designed to break should the weight become inextricably stuck on the bottom.

Small game fishing uses a general rig in which a hook(s) and lead is attached to a swivel and is cast as a single unit. It uses smaller hooks and lighter leaders. The major difference between big game fishing and small game fishing is the kind of rig used and the size of the gear and the general kinds of areas that are preferred by each. The slide-bait fishery is generally associated with close proximity of deep water (20-100 ft) because the technique depends on gravity or the live bait to take the bait down the mainline to the strike zone. Shorecasting for small game is done anywhere along the shoreline.

The third shore based fishery is locally referred to as "whipping." Whipping involves standing on the shore, usually a rocky area, and casting and quickly retrieving an artificial lure into breaking waves headed towards shore. The lure usually has treble or double hooks attached.

Fishing line in the 20-50 lb test weight range is commonly used in this fishery. Often the leader, the first few feet of line directly attached to the lure, is a thicker line for protection from chafing on the fish's teeth or the reef and rocks. Whipping is also successfully done from boats.

Ulua are also fished from boats. A variety of gear may be employed; typical are the trolling set-up, with down riggers or trolling planes, and surface plugs or casting jigs. Trolling usually takes place at depths of 50-200 ft, with depth fished highly dependent on local conditions and bottom topography. Artificial lures, e.g. plugs and lead-head jigs, are used just outside the breaking surf. The lures used generally have either treble or double hooks attached directly to the lure. The line weights vary from 20 lb or heavier test weight.

The gear used in these recreational fisheries varies, but the most popular gear composition is a circle hook with a slide bait swivel on a wire leader. There is some overlap with the type of hook used (circle hooks) in the bottomfish fishery although the size of the *ulua* circle hook tends to be larger than that used in the bottomfish fishery. Some of the hooks embedded in monk seals have been identified as gear used in the state *ulua* fishery based on gear, size of hook, and location of the monk seal when discovered, while other hooks have been identified as bottomfish fishery hooks (see Table 7).

Table 7. List of Hooks and Net Entanglements as a Source of Information on Fishery Interactions. (Source: NMFS, unpubl. data 2001)

	Date and Location	Description	Outcome
1	1982 French Frigate Shoals	Adult female was observed with bottomfish hook in mouth.	Resighted without hook at French Frigate Shoals
2	1985 NWHI - Kure Atoll	Female weaned pup hooked in lip	Hook removed by NMFS personnel; small hook and rig characteristic of on-site recreational fishery
3	1990 MHI - Kauai	Juvenile observed with hook	NMFS response included capture and hook removal. Hook identified as type used in the *ulua* shore-based fishery.
4	1991 NWHI - Kure Atoll	Weaned female pup observed with hook in lip	NMFS personnel captured seal and removed hook. Hook was small, characteristic of on-site recreational fishery.

	Date and Location	Description	Outcome
5	1991 NWHI - Kure Atoll	Subadult female observed with hook in corner of mouth	Seal subsequently seen without hook; hook never recovered or identified.
6	1994 NWHI- French Frigate Shoals	Pregnant female with hook	Hook stated by observers to be a swordfish fishery hook. No confirmation of report (NMFS, 1996)
7	1994 MHI - Oahu	Report of dead seal in gillnet off Waianae	reliable but unconfirmed report, no seal recovered
8	1994 NWHI-"No Name Bank"	Active hooking of adult seal during bottomfishing; seal had stolen catch and had become hooked	Fisherman pulled seal to boat and cut leader 12"-18" from the seal.
9	1995 MHI - Kauai	Juvenile male found dead, necropsy revealed fishhook in lower esophagus observed	mortality; hook was "slide rig"characteristic of shore-based *ulua* fishery
10	1996 MHI - Oahu (Ala Moana Beach) (first sighted on Maui)	Adult male observed with hook in mouth. The seal was identified as a seal that had been translocated from Laysan Island, NWHI.	Hook removed by NMFS. Hook identified as from slide rig, shore based *ulua* fishery.
11	1996 NWHI - French Frigate Shoals	Adult male observed with hook in mouth	Hook removed by researchers. Hook identified as type used in the *ulua* shore-based fishery and bottomfish fishery.
12	1998 MHI - Maui	Hooked seal reported to NMFS; Juvenile female. Observers stated it was a #7 or #9 *ulua* hook	NMFS response included capture and physical exam, No hook was found, but some minor trauma was observed in mouth where hook had been present
13	2000 MHI - Molokai	Juvenile male observed with 2 hooks and line embedded in chest (ventral) area.	NMFS response included capture and physical exam of seal. No hooks or line present, but slight injury was documented by veterinarian.

	Date and Location	Description	Outcome
14	2000 MHI - Kauai (Ha'ena Beach)	Adult female observed with hook in mouth.	NMFS response included capture and hook removal. Hook identified as type used in the *ulua* shore-based fishery.
15	2001 MHI - Kauai (Mahaulepu Beach)	Juvenile female with hook in lower lip and base of jaw.	Hook removed by DLNR personnel. Hook and leader determined to be from recreational ulua fishery
16	2001 MHI - Kahoolawe	Adult male with hook in abdomen or front flipper	Hook not removed as of July, 2001. Fishery type unknown.

Although there is only one report of a hooking of a monk seal on gear being actively fished, several monk seals have been observed with embedded hooks. Sometimes the hooks have trailing which poses a potential entanglement hazard. NMFS researchers and veterinarians have responded to some of these reports and have treated the monk seals and provided descriptions of the wounds caused by the hook. Based on these descriptions and outcome (when known), the injuries sustained by monk seals from embedded hooks have been classified into injuries or serious injuries. An embedded hook was considered a serious injury if it hooked in the mouth deeper than the lip. Thus, hooks embedded inside the mouth, in the tongue, the mandible or upper jaw, throat, or deeper are classified as serious injuries, whereas "lip hookings" and other shallow embedded hooks are considered nonserious. The rationale for this division is that foraging would likely be impeded by the serious injuries. Hooks embedded in the lip or shallowly embedded hooks in other body areas would most likely fall out and would not impair feeding or other activities. Considering the information available, the above classification approach is consistent with the views expressed by researchers and veterinarians in a workshop held to discuss the serious injury guidelines.[20]

e. Documented Monk Seal Interactions with Other Fishing Operations in the NWHI

Reports suggest that the distribution of interaction events with monk seals is non-random with respect to location and vessel. Fishery participants have reported seeing monk seals in the vicinity of breeding islands. For example, Humphreys (1981) reviewed three categories of data

[20]"Injury of pinnipeds: A brief discussion of injuries reported for pinnipeds indicated that an animal hooked in the mouth (internally) or trailing gear should be considered seriously injured. Some participants felt that an animal hooked in its body would likely not be seriously injured." (Differentiating Serious and Non-Serious Injury of Marine Mammals taken Incidental to Commercial Fishing Operations: Report of the Serious Injury Workshop held in Silver Spring, MD, April 1-2, 1997)

for observations and interactions with fishing operations in the NWHI (French Frigate Shoals and Lisianski Island). Although the review was undertaken to characterize the interaction level with the lobster fishery in the NWHI, other fishery operations were considered. The review included commercial vessels, NMFS research vessels and charter vessels. Data pooled from all three sources yielded 35 sightings and 3 interactions with listed species. Two of the three interactions occurred near French Frigate Shoals and involved monk seals that seemed attracted to vessel lighting during night research/fishing operations[21]. In one instance, two monk seals interfered with mackerel (scad) fishing under a light by removing hooked fish from lines before the fish could be retrieved. In another instance, a monk seal interfered with night-light operations by chasing fish away from the light and tugging on the light cord with its mouth. No hookings of monk seals were reported. (Humphreys, 1981)

(2.) Vessel groundings/Vessel collisions

In April, 1999, a longline vessel (*F/V Van Loi*) grounded on a reef off of Kapaa, Kauai. The vessel had 16,000 gallons of diesel fuel onboard and was carrying 3 tons of bait and gear. All fuel, bait, and gear (including monofilament line and hooks) went overboard into the marine environment. Monk seals and sea turtles were observed in the area, but no adverse interaction with fuel or gear was reported by wildlife resource managers on scene.

In August 1998, Tesoro Hawaii Corporation fuel operations resulted in a spill of about 5,000 gallons of bunker fuel off of Barber's Point, leeward Oahu. The waters and shoreline of Kauai were affected, and oiled monk seals were reported in the area. During September 1998, up to 5 oiled monk seals were observed. One monk seal had its entire oral mucosa coated with red, blood-like fluid. This monk seal was later resighted and exhibited signs of a respiratory infection. Another monk seal exhibited "gagging behavior". As there were no physical exams conducted on the animals observed, the wildlife resource agencies could not reach a conclusion about the effects of the oil on the monk seals (Natural Resources Trustees, 2000).

In addition to the vessel groundings, a pup born at the Pacific Missile Range Facility on Kauai was reported dead in 1999. There was an anonymous and unconfirmed report that the pup may have been hit by a zodiac-type vessel employed in the tourist industry.

(3.) Shark Predation

Shark related injury and mortality has been documented in the NWHI at French Frigate Shoals. Although researchers had concluded shark predation was not the cause of the population decline at that location (Ragen, 1993), NMFS considers shark predation to be a significant factor in pup mortality at French Frigate Shoals. NMFS Honolulu Laboratory infers shark related mortality whenever a newborn to approximately three week old pup disappears at French Frigate Shoals, especially during periods when large sharks are observed patrolling near pupping beaches. Shark

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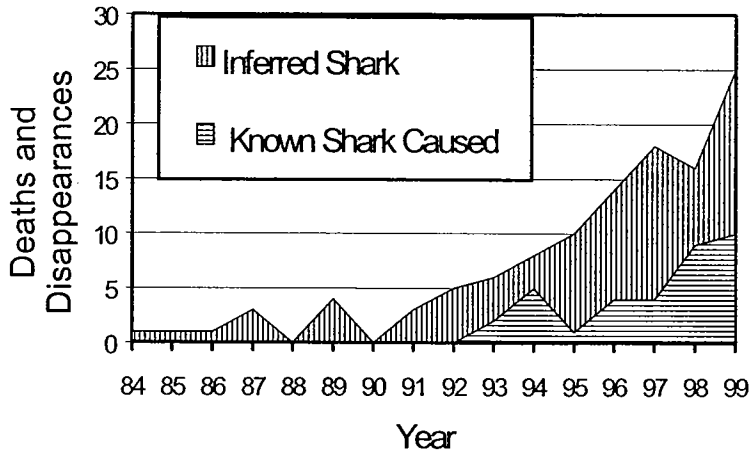
[21] One leatherback turtle interaction occurred during lobster fishing operations from a commercial vessel.

predation is inferred to be the primary cause of disappearance of these pups because attacks by male adults (the other possible primary cause of mortality) are unlikely because nursing pups are defended by their mothers. However, sharks have been observed killing pups in this age category despite their mother's defense tactics against shark predation. In 1999, shark predation was estimated to account for the deaths of 51.1 percent (23 out of 45) of the pups born at Trig Island, French Frigate Shoals. Overall, 9.4 percent (25 out of 244) of pups born in the NWHI were inferred or known to be preyed upon by sharks in 1999 (Figure 11). One shark was removed pursuant to a shark removal plan implemented in 2000 to improve pup survival and possibly slow the French Frigate Shoals population decline (thereby facilitating recovery).

Figure 11. Trends in number of known and inferred shark-caused deaths of Hawaiian monk seal pups at French Frigate Shoals. (Source: Laurs, 2000)



The dramatic increase in deaths and disappearances from shark attacks at French Frigate Shoals has been the result of an increased number of Galapagos sharks (*Carcharhinus galapagensis*) in the immediate vicinity of monk seal pupping areas. The occurrence and escalation of Galapagos shark predation on pups may be related to an episode of adult male monk seal aggression against pups, which resulted in pup deaths and the presence of carcasses remaining in the waters surrounding the pupping area. These carcasses may have attracted sharks to the new prey resource of nursing seal pups. Also, the disappearance of Whale-Skate Island, which had been a large pupping site, may have resulted in more pups being born at Trig Island where sharks can easily approach the shoreline.

(4.) Marine Debris and Contaminants

Marine Debris

Monk seal death and injury attributable to entanglement in marine debris has been documented in the NWHI. Lines, nets, and other debris have been removed from monk seals by government personnel. Although steps have been taken to reduce the debris load in the NWHI, the debris accumulation in these areas is incessant due to contributions from various sources (vessels of unknown origin) and currents to the NWHI. Much of this debris comes from north of the Hawaiian Archipelago (Kubota, 1999).

Information on marine debris entanglement and injuries, including mortalities, has been collected by NMFS since 1982. For the purposes of this biological opinion, NMFS reviewed documented entanglements of monk seals for the period 1982-2000 to determine the effects of marine debris. Entanglements in all debris types (fishery related debris and non-fishery related debris) were considered (Table 8). Fishery related gear was considered to comprise of nets, any net/line aggregate, "eel cones" (cones from hagfish traps), monofilament line, any line with attached floats, and lines with head/foot rope from a net. All other identified entangling items were considered non-fishery related. These items included unspecified lines (e.g. "ropes"), packing straps, plastic rings of unknown source, and assorted miscellaneous objects. Entanglements by unknown items, which were documented only by the presence of a recently acquired entanglement scar on a seal, were assigned to fishery or non-fishery items by multiplying the total unknowns times the ratio of known fishery items to all known items.

Table 8. Categories of Marine Debris that Entangle Monk Seals 1982-2000. (Source: NMFS, unpublished data, 2001; Henderson, 1990)

	category	description
	Nets	All nets or net fragments of fishery origin, including drift nets, trawl nets, or seines.
	Lines	All "ropes" or fishing line; lines are certainly of maritime origin, but are not necessarily of fishery origin.
	Net/Line Combination	Collection of nets and lines, probably aggregated at sea by ocean currents. Because nets are a part of the aggregate, the item is considered of fishery origin.
	Cone	Black plastic mesh cones which are part of traps used in the hagfish fishery.
	Rings	All rings other than the cones noted above. This category may include rims from plastic lids or other circular items; origin unknown.
	Straps	Plastic packing band used around boxes; origin fishery and non-fishery.

	category	description
	Other/Unknown	All items not in previous categories which have entangled monk seals; Monk seals with scars/wounds attributed to entanglement are considered to have been entangled by an unknown item.

The data were examined to determine which incidents resulted in "serious injuries", i.e. any injury that will likely result in mortality. The following were considered serious injuries:

1. Any entanglement which caused a wound, i.e. in which the seal's skin was broken. This definition includes seals observed with an entanglement scar, since the scar resulted from a wound.

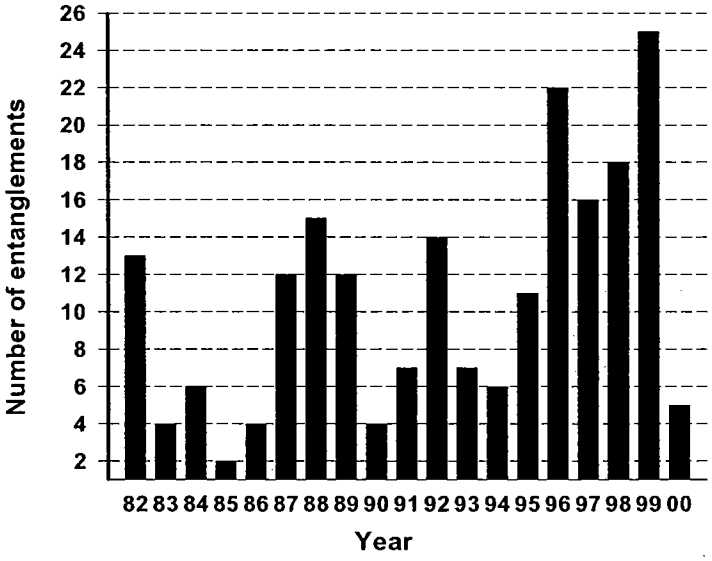
2. Any entanglement in which the seal was immobilized by entangling debris on an offshore reef, even if the seal was released by humans without having incurred a wound. Any seal so trapped would likely have died from drowning, predation, or starvation had it not been released.

3. Any entanglement in which the entangling item was removed without having inflicted an external wound, but for which the observer specifically stated that the item would not have come off without human assistance, or that the seal probably would have died.

Considering the information available, the above classification approach is consistent with the views expressed by researchers and veterinarians in a workshop held to discuss the serious injury guidelines.[22]

[22] In the discussion on the entanglement and injury of pinnipeds, one veterinarian noted that, "lesions from netting or packing bands are often infected and associated with necrotic tissue. If such an injury is in the neck region and if the infection surpasses the ability of the lymph system to control it, the lungs will often become infected, often leading to mortality. In addition, microbes that enter the blood stream can cause secondary infections in the heart (e.g. heart valves), brain, or other vital organs. . . ." (Differentiating Serious and Non-Serious Injury of Marine Mammals taken Incidental to Commercial Fishing Operations: Report of the Serious Injury Workshop held in Silver Spring, MD, April 1-2, 1997, p. 23).

Figure 12. Number of Hawaiian monk seal entanglements observed, 1982-2000. (Source: Laurs, 2000)



Injuries

A total of 204 entanglements were documented (see Figure 12), 96 by fishery items (5.05 per yr), 96 by non-fishery items (5.05 per yr), and 12 by unknown items (0.64 per yr). Assigning the unknowns to fishery or non-fishery according to the formula given above results in 102 entanglements by fishery items (5.37 per year) and 102 entanglements by non-fishery items (5.37 per yr).[23]

Serious Injuries

Of the total number of entanglements, a total of 47 serious injuries from entanglement were documented, including 27 by fishery items (1.42 per year), 8 by non-fishery items (0.42 per year), and 12 by unknown items (0.64 per year). Assigning the unknowns to fishery or non-fishery results in a total of 36 serious injuries from entanglements in fishery items (average of 1.91 per year) and total of 11 serious injuries from non-fishery items (average of 0.58 per year).

Mortalities

Mortalities from entanglement were also documented: 7 mortalities were documented (0.37 per year), 6 mortalities were from fishery items (0.32 per year) and 1 was from a non-fishery item

[23]The assignments of unknowns were allocated according to the ratio of known items causing serious injury (not merely entanglement) and known items causing nonserious injury.

(0.05 per year) (see Table 9).

Table 9. Known Marine Debris Related Mortalities 1982-2000. (Source: NMFS, unpublished data, 2001)

No.	Year and Location	Description
1	1986– French Frigate Shoals	Weaned male tangled in wire which was relic of USCG or Navy occupation; in water
2	1987–Lisianski Is.	Pup (uncertain if nursing or weaned) dead in aggregate of trawl net and line on shore
3	1987–French Frigate Shoals	Juvenile dead in aggregate of trawl net and line on shore
4	1988–Lisianski Is.	Weaned pup dead in large trawl net on shore
5	1995–Pearl and Hermes Reef	Bones of adult found scattered in line awash on shore
6	1997-French Frigate Shoals	Subadult dead in trawl net on reef
7	1998–Laysan Island	Weaned pup dead in trawl net on nearshore reef

As most of the monk seal population is located on uninhabited islands and atolls, observation and monitoring by NMFS and other agencies occurs during only part of each year. The serious injuries and mortalities documented above represent a minimum combined serious injury and mortality rate of 2.48 per year (1.91 serious injuries and 0.74 mortalities). It cannot be assumed that entanglements would be observed at a directly proportionally increased rate if year-round observations were made. For instance, NMFS biologists on site in the NWHI during pupping season have observed more weaned pups entangled in marine debris than other size classes of monk seals (Henderson 1990). At this time, the 2.48 rate of serious injury and mortality from fishery related marine debris should be considered a minimum serious injury and mortality rate.

(5.) Contaminants

Contaminants in the marine and terrestrial environment also pose a potential but unknown risk to monk seal recovery and survival. Effects on monk seals are unknown at this time. However, tissue samples from monk seals indicate that PCB levels are lower than other pinnipeds and the values at French Frigate Shoals are below similar samples obtained from monk seals at Midway Islands (NMFS unpub. preliminary data, 1999). The significance of these levels to monk seals health is unknown at this time. However, the ecological effects of clean-up and containment operations at Tern Island (French Frigate Shoals), Johnston Atoll, and Midway Island may have short-term adverse effects on the surrounding corals, fish and invertebrates. Reductions in prey abundance due to clean-up efforts could reduce foraging success and survival rates of monk seals

near these areas.

(6.) Tern Island Sea Wall Entrapment

Monk seals at Tern Island, French Frigate Shoals, have been entrapped behind a deteriorating sea wall. The seawall was built by the U.S. Navy when it converted the 11-acre sandbar into a 34 acre expanse with an airfield and area for support facilities. The U.S. Fish and Wildlife Service regained possession of Tern Island in 1979. Records from 1988 show that monk seals have been entrapped behind the seawall. Most of these monk seals have been redirected to the water by U.S. Fish and Wildlife Service (FWS) and NMFS personnel on site. Two subadult male monk seals have died as a result of becoming entrapped behind the sea wall. The numbers of entrapments and deaths (indicated by an asterisk) are listed below in Table 10. The restoration of the Tern Island sea wall is planned to take place in 2002 and is the subject of a separate section 7 consultation. The restoration should eliminate the entrapment hazard. (USFWS, 2001).

Table 10: Incidence of Monk Seal Entrapments and Deaths on Tern Island From 1988 - 2000 (Source: USFWS, 2000)

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
# of seals	1*	3	1	6 1*	4	2	3	3	0	0	5	4	4

(7.) **Human Interactions**

a. Disturbance at Haul-Out Sites

Some monks seals hauled-out on beaches are viewed by tourists and residents who are often unfamiliar with the take prohibitions and/or the normal behavior of monk seals. NMFS receives at least 2 reports per week of "stranded" monk seals. Some people attempt to haze the animal back into the water. Most often, the animal reported is exhibiting normal haul-out behavior. Another common harassment is people approaching too closely to take photographs of the seal on land or in the water. One female monk seal was intentionally harassed when a resident threw coconuts at it (Henderson, pers. comm., 2001). On Kauai, a monk seal was bitten by a pet dog (Honda., pers. comm., 2001). Disturbance to monk seals may result in modified behavior making them more susceptible to predators when forced to enter the water or causing an unnecessary expenditure of energy required for thermal homeostasis or catching prey. These incidents may increase as monk seal haul-outs increase in the MHI (Ragen, 1999).

b. Research in NWHI

Since 1982, Hawaiian monk seals have been removed from the wild or translocated between

locations by the Marine Mammal Research Program (MMRP) of the Honolulu Laboratory as part of research and management to facilitate recovery of the species. These removals and translocations are summarized below.

Selective criteria are used to identify monk seals for research, removal, and translocation. All criteria are designed to minimize risks to the monk seal population. For example, monk seals collected for rehabilitation were selected because of their low probability of survival in the wild. When these monk seals moved to Kure Atoll, some of them are known to have contributed to increased numbers of pups born into that population. Additionally, the removal of monk seals selected for translocation because of concerns for aggressive behavior resulted in fewer deaths at French Frigate Shoals and, probably at Laysan Island.

Rehabilitation-Release

Pups which wean prematurely from their mothers may be in poor condition, and are known to have a minimal probability of surviving their first year; some of these animals, as well as emaciated juvenile monk seals, have been collected for rehabilitation and release back into the wild. This project was initiated to salvage the reproductive potential of the females that would have otherwise been lost due to their high mortality rate. A total of 104 seals (mostly females) have been so taken; 68 were successfully rehabilitated and released into the wild, 22 died during rehabilitation, and 14 were judged to be unsuitable for release and were placed into public aquaria and oceanaria for research. Of the 68 monk seals which were rehabilitated and released from 1984 through 1993, 19 were alive as of 1999 (Johanos and Baker, in press, 1999). Some of the surviving 19, most of which are located at Kure Atoll, are pupping. However, a precise number of pups born to these released monk seals is unknown (NMFS unpub. data, 2001; Johanos and Baker, in press, 2001).

Of the remaining 49 monk seals that were rehabilitated and released, the following information has been gathered: 29 disappeared within one year of release; 15 disappeared from 2-11 years after release; and 5 were found dead within one year of release. Overall the mortality rate for all rehabilitated seals was lower than the rate if none of them had been rehabilitated. NMFS selected candidates for rehabilitation that were undersized at weaning, and NMFS had assessed that the mortality rates for these selectees in the wild would have been 100%. Regarding the expected success rate, the success of the program was somewhat lower than expectations, primarily because of very poor survival rate of 18 seals which were released at Midway rather than Kure Atoll.

Aggressive male translocation and removal

Adult male monk seals have been documented to injure and kill other monk seals, including adult females, immature monk seals of either sex, and weaned pups. Some of the attacks have been made by groups of adult males, while others were by individual males. To reduce injuries and mortalities, NMFS has removed aggressive adult males from some sites. A total of 40 adult male seals have been taken; 32 were translocated to locations distant from the site where the

attacks had occurred (21 were moved to the MHI in 1994 and 11 were moved to Johnston Atoll (9 in 1984 and 2 in 1998)); 5 were placed into permanent captivity; 2 died while being held in temporary pens for translocation, and 1 was euthanized. Although there is no systematic sighting effort for the 21 adult males translocated to the MHI, one sighting was made on Kauai in April, 2001.[24] The effects of male aggression are considered separately below. None of the adult monk seals translocated to Johnston Atoll have been resighted since the year in which they were translocated.

Other Translocations

Monk seals have been moved between populations for reasons other than mitigation of adult male attacks. A total of ten seals have been so taken; five healthy female weaned pups were translocated from French Frigate Shoals to Kure Atoll in an effort to bolster the population and increase the reproductive potential at Kure, and four healthy seals born in the main islands were translocated, after having weaned, to areas less utilized by humans to minimize the potential of human harassment.

Of the five monk seals translocated from French Frigate Shoals to Kure Atoll in 1990, two are known to remain alive at Kure as of 1999. Of the four monk seals relocated from sites in the MHI, one was observed alive at Kure Atoll in 1999, two were observed alive on Kauai in 2000, and one which was translocated to Niihau was reported to have been killed sometime after 1994 by a boat propellor, although this report is unconfirmed (Henderson, pers. comm., 2001).

Permanent Captivity

In addition to using unsuccessfully rehabilitated monk seals or aggressive males as captive research animals, some monk seals have been collected from the wild and placed directly into captivity. From 1983 to 1991 a total of 4 animals were taken; 2 monk seals were collected from the NWHI, and 2 monk seals found badly injured in the MHI, were treated and placed into permanent captivity (NMFS unpub. data, 2001).

In 1995, twelve monk seal pups were taken into captivity by NMFS for the purposes of rehabilitation and eventual return to the wild population. At the time of capture, some of the pups exhibited clinical signs associated with conjunctivitis, red eyes, blepharism, blepharospasm, and photosensitivity. Of the twelve monk seals pups, nine later developed corneal opacities and subsequent cataracts, and one developed cataracts (with no corneal opacities), and two of these total of ten monk seals later died (due to causes unrelated to blindness). (NMFS, 1997 - workshop report) The remaining 10 monk seals (eight blind and two sighted) were transferred to

[24]Salt Pond City and County Beach Park, Kauai. A monk seal with a red tag # 4A0 was reported acting aggressively toward another monk seal (Freeman, pers. comm., 2001). That tag number was confirmed by NMFS to be the tag number of an adult monk seal relocated from Laysan in 1994 (Henderson, pers. comm., 2001).

Sea World of Texas where they are research animals.

Research Handling

The MMRP handles monk seals in the wild as part NMFS' research to monitor the population and facilitate recovery. Takes have included tagging, instrumentation, and sampling for health assessment. MMRP has handled seals 3,343 times as part of its research activities since 1981. Three seals (3) died during research handling. All three individuals were adult male seals. Results of necropsies on these seals varied, but in general all three were older seals whose health had been compromised by chronic illness.

c. Intentional Injuries to Monk Seals

There is no recent evidence of intentional injuries from acts such as clubbing or shooting to monk seals in the NWHI. The NMFS Marine Mammal Research Program annually monitors all major breeding populations of monk seals, and collects data on any injuries or other events which could affect the survival of individual seals. The program has not documented any injuries or mortalities in the NWHI that could be attributed to clubbing, shooting, or other intentional wounding of monk seals since the establishment of the Protected Species Zone in 1991. (Johanos and Ragen, 1996a, 1996b,1997, 1999a, 1999b; Johanos and Baker, 2000). Although a Court Order[25] has found that intentional acts to monk seals occur, NMFS' monitoring of monk seal populations thus far indicates that intentional acts in the NWHI are not occurring.

(8.) Disease

Although some information concerning medical conditions affecting the Hawaiian monk seal is available, the etiology and impact of disease on wild animals at the population level is far from clear. There are substantial data gaps regarding the prevalence of disease conditions in populations of Hawaiian monk seals in the wild, and thus their potential impact on population dynamics is unknown. In the wild, even massive epizootics in remote locations may pass undetected (Aguirre, 2000).

There have been periods of unusually high mortalities in subpopulations located in the NWHI. A die-off occurred in 1978 at Laysan Island (Johnson and Johnson, 1981). More than 50 seal carcasses were found in an advanced state of decomposition, and although the cause of the mortality was not identified, it may have been disease related. Also, survival of immature seals severely declined at French Frigate Shoals after 1987, and the reproductive potential of the

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[25]The Order Granting in Part and Denying In Part Plaintiffs' Motion for Summary Judgement, Granting in Part and Denying in Part Defendants' Cross-Motion for Summary Judgement, and Granting in Part Plaintiffs' Motion for a Permanent Injunction Motion for Summary Judgement in Greenpeace Foundation, *et. al.*, v. Norman Mineta, *et. al.* Civil No. 00-00068SPKFIY. U.S. District Court of Hawaii, November 15, 2000, p. 30.

species was being seriously compromised by the loss of young females. The cause has been attributed to emaciation/starvation; however, the role of endoparasites or disease is unknown. During 1992-93, undersized pup and juvenile seals from French Frigate Shoals were rehabilitated and released at Midway Atoll with poor success.

Health assessment and collection of baseline information on diseases is considered important to the recovery of the Hawaiian monk seal population (Gilmartin 1983, Aguirre et al., 1999). Banish and Gilmartin (1992) summarized pathological conditions found in 42 carcasses recovered from 1981 to 1985. Frequent findings included parasites, trauma, cardiovascular disease, and respiratory infections. Emaciation was a common condition. Banish and Gilmartin (1992) did not assess causes of death from any of their samples, but nonetheless concluded that there was no evidence of any disease phenomenon affecting the population in a manner which would significantly hinder recovery of the species. A series of examinations of 23 dead seals collected from 1989 to 1995 (T. Work, unpubl. data) ascribed causes of death as follows: emaciation (7); emaciation compounded by senescence (1); trauma (2); foreign body aspiration (1); and euthanasia(1) (see (g.) Male Aggression and Mobbing, below). Cause of death was not determined in 11 animals.

The relative significance of disease and related factors and their effect on population trends are poorly understood. Disease processes may be important determinants of population trends through long-term low levels of mortality, or through episodic die-offs. Table 11 describes the findings of health and disease studies on monk seals between 1925 and 1997.

Table 11. Health and disease studies in Hawaiian monk seals (*Monachus schauinslandi*), 1925-97. (Source: Aguirre, 1999)

1925	Internal parasites were first reported (Chapin, 1925).
1952	Diphyllobothriid cestodes were first reported (Markowski, 1952).
1959	The Acanthocephalan *Corynosoma* sp.was first reported (Golvan, 1959).
1969	Diphyllobothriid cestodes were reported (Rausch, 1969).
1978	Known as the Laysan epizootic, ≥50 monk seals were found dead. Specimens from 19 dead and 18 live seals were collected. All carcasses found with stomach ulceration and heavy parasite burdens and in severe state of emaciation. Livers from two carcasses tested positive to ciguatoxin and maitotoxin. There was serologic evidence to caliciviruses but serum specimens were negative for *Leptospira. Salmonella sieburg* was isolated from a rectal swab. Many parasite ova and products in coprologic exams were identified. Diagnosis was inconclusive (Johnson and Johnson, 1981; Gilmartin et al., 1980).
1979	*Contracecum* ulceration of a young seal was first reported (Whittow et al., 1979).
1980	Lung mites from the family Halarechnidae were first reported (Furman and Dailey, 1980).
1980	The Hawaiian monk seal die-off response plan was developed with the support of the Marine Mammal Commission (Gilmartin, 1987).
1983	The Recovery Plan for the Hawaiian monk seal addressed the importance of disease investigations (Gilmartin, 1983).

1988	A coprologic survey for parasites was performed from field scats collected in 1985 (Dailey et al., 1988).
1988	The hematology and serum biochemistry of 12 weaned pups collected between 1984 and 1987 for their rehabilitation in Oahu were reported (Banish and Gilmartin, 1988).
1992	Pathology of 42 seals collected between 1981-85 was summarized (Banish and Gilmartin, 1992).
1992	The French Frigate Shoals relocation project of 19 immature seals was initiated. Basic hematology, serum biochemistry, serology for leptospirosis and calicivirus infection, virus isolation, fecal culture for *Salmonella* and coproparasitoscopic examination were performed for their disease evaluation. Two of seven seals died of bacterial and aspiration pneumonia in *(sic)* Oahu, with positive titers to *Leptospira*. Detection of calicivirus by cDNA hybridization probe in 13 seals with viral particles seen by electron microscopy occurred in five seals. It was concluded that endemic disease agents identified in those seals were *Salmonella* and endoparasites (Gilmartin, 1993a; Poet et al., 1993).
1993	Inoculation of four monk seals with a killed virus distemper vaccine was experimentally performed on three seals at the Waikiki Aquarium (Gilmartin, 1993b; Osterhaus, unpubl. data 1997).
1995	An eye disease of unknown etiology was first diagnosed in 12 female monk seal pups that were transported to Oahu for rehabilitation. To date the cause remains unknown (NMFS files 1995-97, unpubl. data).
1996	Histopathology of selected tissues collected from 23 seals between 1989 and 1995 was performed by personnel of the National Wildlife Health Research Center, Honolulu Station (T. Work, unpubl. data, 1996).
1997	Two captive seals died of causes unrelated to the eye disease. One seal was diagnosed with *Clostridium* septicemia and another seal with hepatic sarcocystosis (Yantis et al., 1998).
1997	The Monk Seal Captive Care Review Panel developed recommendations to evaluate the health assessment and future disposition of 10 captive seals and the future of captive care and release efforts to enhance the recovery of the species (NMFS, unpubl. data, 1997).

2001 Unusual Mortality Event in the NWHI

In April, 2001, an "Unusual Mortality Event[26]" was declared on the basis of four juvenile monk seal deaths within nine days at Laysan Island, a death of a yearling at Midway, discovery of three decomposed carcasses (one subadult, one pup, and two juveniles) and one fresh dead carcass at Lisianski Island, a death of a yearling at French Frigate Shoals, and lethargic, thin juvenile monk seals observed at Laysan and Midway Islands. The relationship of these deaths and observed conditions of the seals is not known at this time. (NMFS unpub. data, 2001)

(9.) Male Aggression and Mobbing Behavior

Male aggression, including singular or multiple adult males attacking another seal (mobbing),

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[26]The MMPA defines an Unusual Mortality Event (UME) to be an occurrence which 1) is unexpected; 2) involves a significant die-off of a marine mammal population; and 3) demands an immediate response. In addition to the above conditions, an immediate response is warranted under two other circumstances: 1) mass stranding of an unusual species of cetacean; and 2) small numbers of a severely endangered species of marine mammal are affected.

can lead to monk seal injury and death. Removal of aggressive males has been undertaken to improve pup, juvenile and female survival rates. At French Frigate Shoals, individual adult males have presented more of a problem than groups of males. Individuals which were directly observed injuring or killing pups were removed, either by translocation or euthanasia. At Laysan Island, injuries and deaths have tended to result from massed attacks, or mobbings, by large numbers of adult males. The problem may be more related to an imbalanced adult sex ratio than to individual "rogue" males as evidenced by the decrease in mobbings and related injuries at sites where sex ratios were imbalanced but later came into balance (Johanos, et al., 1999). Males that were removed from Laysan Island included seals which had been observed participating in mobbings, as well as other animals whose behavioral profile matched that of known "mobbers". Removal was effected either by translocation or by transfer into permanent captivity. Ten males were removed in 1984, 5 in 1987, and 22 in 1994.

Removal of individual male seals from French Frigate Shoals markedly decreased the number of injuries and deaths attributable to adult male aggression (See Table 12 below). The results of removing adult males from Laysan Island are less clear (See Figure 13). Injuries and deaths from adult male aggression at Laysan Island have diminished, but it is not known how much male removal has contributed to this decline.

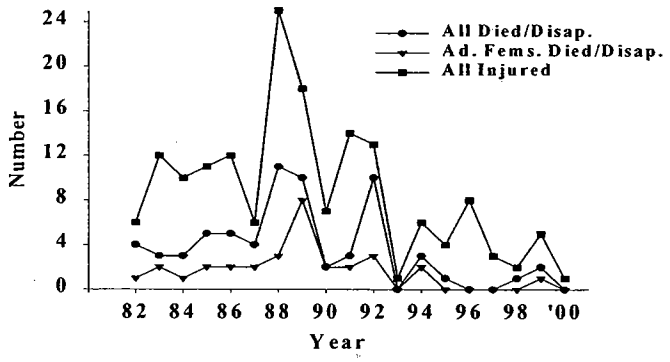
Table 12. Record of Monk Seal Removals and Pre and Post Removal Levels of Injuries and Mortalities caused by Adult Male Attacks. [27](Source: NMFS unpubl. data, 2001)

Location and Year of Removal and Location	No. of Injuries/Mortalities Caused by Adult Male Attacks in Year Prior to Removal	No. of Males Removed	No. Of Injuries/mortalities Caused by Adult Male Attacks in Year Subsequent to Removal
1984 Laysan	1983: 12 injuries; 3 mortalities	10 removed (9 translocated to Johnston, 1 died)	11 injuries; 5 mortalities
1984 Laysan	1983: 12 injuries; 3 mortalities	10 removed (9 translocated to Johnston, 1 died)	11 injuries; 5 mortalities

[27]NMFS is currently reviewing the data on injuries and mortalities caused by instances of male aggression.

Location and Year of Removal and Location	No. of Injuries/Mortalities Caused by Adult Male Attacks in Year Prior to Removal	No. of Males Removed	No. Of Injuries/mortalities Caused by Adult Male Attacks in Year Subsequent to Removal
1987 Laysan	1986: 12 injuries; 5 mortalities	5 removed (translocated to permanent captivity)	1988: 25 injuries; 11 mortalities
1991 French Frigate Shoals	9 injuries; 4 mortalities (all mortalities attributable to single male) (as tallied from 1991, prior to male removal)	1 (euthanized)	5 injuries; 1 mortality
1994 Laysan	1993: 1 injury; 0 mortalities , plus an undetermined number of injuries before removal in 1994 for a total preremoval: 6 injuries; 3 mortalities.	22 (21 translocated to MHI, 1 died)	1995: 3 injuries; 1 mortality
1998 French Frigate Shoals	6 injuries; 11 mortalities	2 (translocated to Johnston Atoll)	2 injuries; 1 mortality

Figure 13. Mortalities and Injuries to Monk Seals at Laysan Island from 1982 to 2000. (Source: NMFS unpub. data)



IV Effects

This section includes an analysis of the direct and indirect effects of the proposed action on the species and/or critical habitat and its interrelated and interdependent activities. The factors considered in this section include: 1) the status of the affected populations of species; 2) the level of removals attributed to the proposed action; and, 3) the impact of that removal on those populations in addition to all other direct and indirect human effects.

Information available for this Analysis

The State of Hawaii Division of Aquatic Resources does not systematically collect information regarding protected species interactions. NMFS PIAO Protected Species Program made available reporting cards to the fishery participants that could be used to anonymously report protected species interactions. To date, no cards have been returned to NMFS. In 2000, NMFS sent each bottomfish fishery permit holder marine mammal interaction reporting forms, but no reports of marine mammal injury or mortality have been received by NMFS. Therefore, the only information available to NMFS on monk seal interactions with the FMP bottomfish fishery is observer and other data discussed below.

Observer Data

NMFS observer data[28] collected from 1991- 1993 documented interactions of monk seals with bottomfish fishery operations. An interaction typically consists of monk seals approaching vessels and stealing fish either from hooks or from a competing predator (dolphins). Monk seals were not reported hooked or entangled, but were observed active in the "theft" of fish from handlines. Typically, they surfaced to consume the fish. Fish that were too large for consumption were abandoned. While some interactions involved a single fish, other interactions lasted as long as the retrieval of fish continued, with monk seals continually stealing fish. Some monk seals showed no fear of the vessels, approaching and remaining close to the vessels for long periods.

Some monk seals followed a vessel from station to station for several days. These monk seals could steal an average of 20 fish per day. Some seals, more wary of vessels, typically did not approach closely nor did they steal fish directly from handlines, but they did sometimes consume discarded fish. Monk seals also targeted shark-distracting lines baited with live bait.[29]

Reports of Hookings

There are several reports[30] of monk seals with hooks embedded either in their mouth or other various locations. All sightings to date are listed in Table 7. Some of these observations have been noted in past biological opinions for the bottomfish fishery and other reports as incidents of hookings in the bottomfish fishery. NMFS reviewed the existing data, including original reports (if available), and in some cases verbally confirmed the circumstances and identification of the hook type to assess identification of the hook as originating from the bottomfish fishery. The results of this data review (summarized in Table 12) revealed seven instances of hookings since 1982 that may be attributable to direct interactions with the bottomfish fishery. In 1982 an adult female monk seal was observed and photographed at French Frigate Shoals with a bottomfish hook in its mouth. That monk seal was later resighted without the hook. In 1990, NMFS researchers removed an *ulua* fishery or bottomfish fishery hook from a monk seal on the south shore of Kauai.[31] In 1991, NMFS researchers observed a monk seal with a hook at Kure Atoll, but the hook type could not be identified. In 1996 researchers removed a hook from an adult male at French Frigate Shoals. The hook was identified as a hook type used for *ulua* fishing and

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[28]NMFS observer data for the bottomfish fishery discussed *infra* p. 10.

[29]Shark distracting lines are usually baited with kahala or discard fish that are often associated with ciguatoxin or ciguatoxin-like condition (Nitta, 1993). However, it is unknown at this time whether monk seals are affected by this or other biotoxins.

[30]NMFS has received reports of hooks from a variety of sources, including the public, researchers in the field, and others.

[31]The hook was reported as recurved and measured about two inches from the eye to the bottom of the hook, and had no attached gear (wire line, weights, etc.) that could be used to further identify the type of fishing activity involved.

bottomfish fishing. Additionally, there have been two hookings of monk seals reported which could not be confirmed and are included in tally for hooks that may be attributable to the bottomfish fishery. In 2000, a hooked monk seal was observed on Molokai with two hooks embedded in its chest. NMFS responded by sending a team and a veterinarian to find, dehook, and treat the monk seal. The veterinary exam showed no hooks, but evidence of slight, nonserious injury where, presumably, the hooks had been embedded. In 2001, an adult male monk seal was observed with a hook and line on Kaho'olawe. Again NMFS responded by sending a team to dehook the monk seal. However, efforts to locate this animal to date have been unsuccessful. An additional report may be found in the Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region 1994 Annual Report (WPRFMC, 1995) which describes the hooking of a monk seal during bottomfish fishing operations in the Ho'omalu Zone in 1994. The monk seal reportedly took an uku and was hooked in the lower jaw. The line was cut so that 12-18 inches of line remained attached to the hook. Should fishers, remove hooks and/or disentangle monk seals that become hooked/entangled with bottomfish gear, the injuries associated with hooking and/or entanglement may be reduced. Although the rate of reduction of injury (reduction of risk of post-release entanglement) may not be quantified, there is the potential for the reduction of effects of the take.

Table 13. Hookings of monk seals since 1982 that may be attributable to the Bottomfish Fishery (Source: NMFS, unpubl. data 2001)

	Date and Location	Description	Outcome	Report Confirmation Status
1	1982 French Frigate Shoals (AR[32]-1129)	Adult female was observed with bottomfish hook in mouth.	Resighted alive without hook at French Frigate Shoals	Photograph of hooked seal reviewed by NMFS to identify type of hook
2	1990 MHI - Kauai (AR-1129)	Juvenile observed with hook Serious Injury	NMFS response included capture and hook removal. Monk seal was released alive. Hook identified as type used in the *ulua* shore-based fishery.	NMFS researchers identified hook as *ulua* or bottomfish hook. No identifying gear attached to hook.

[32]Administrative Record for Greenpeace Foundation, et al. v. Norman Mineta, et al. Civil No. 00-00068SPKFIY. U.S. District Court of Hawaii.

	Date and Location	Description	Outcome	Report Confirmation Status
3	1991 NWHI - Kure Atoll	Subadult female observed with hook in corner of mouth	Seal subsequently seen without hook.	Hook never recovered or identified.
4	1994 NWHI - Ho'omalu Zone (AR-1289)	Monk seal hooked in lower jaw while stealing fish from line. Serious Injury	Line cut leaving 12-18 inch tailing line	NMFS received a call from the fisherman.
5	1996 NWHI - French Frigate Shoals (AR-1996)	Adult male observed with hook in mouth Serious Injury	Hook removed by researchers. Monk seal released alive. Hook identified as type used in the *ulua* shore-based fishery and bottomfish fishery.	Independent researchers identified hook as *ulua* or bottomfish hook. No identifying gear attached to hook.
6	2000 MHI - Molokai	Juvenile male observed with 2 hooks and line embedded in chest (ventral) area.	NMFS response included capture and physical exam of seal. No hooks or line present, but slight injury was documented by veterinarian.	Fishery type unknown.
7	2001 MHI - Kaho'olawe	Adult male with hook in abdomen or front flipper	Hook not removed as of July, 2001.	Fishery type unknown.

Positive attribution of these observed hooks embedded in monk seals to a particular fishery is difficult. However, since the hooks may have originated from the bottomfish fishery, and given the observed behavior of monk seals around bottomfish fishing vessels, NMFS conservatively assumes that the bottomfish fishery incidentally hooks monk seals during fishing operations. Therefore, hooks of unknown type and origin are included in Table 13. The level of hooking in the bottomfish fishery appears low, as there are few confirmed incidents of hookings, including a lack of observation of injured monk seals at locations where researchers routinely monitor the populations in the NWHI.

Interaction Estimates Based on Observer Data

One study (Kobayashi and Kawamoto, 1995) compared the existing NMFS observer data[33] (1990-1993) with data collected by the Hawaii Department of Aquatic Resources (HDAR) aboard chartered vessels during 1981-1982, for evaluation and estimation of economic impacts associated with shark, dolphin, and monk seal interactions. The study estimated a damaged fish ratio of 8.71 fish per 1000 fish attributable to shark damage, 2.67 fish per 1000 fish attributable to dolphin damage, and 0.45 fish per 1000 fish attributable to monk seal damage. The study also theorized that some of the unseen losses may be estimated using data on the hook loss rate using the assumption that hooks are lost primarily when a hooked fish is stolen by a predator. Based on the assumption that lost hooks are primarily attributable to sharks, the authors of the study estimated a ratio of stolen fish to damaged fish at 27:1 for sharks for the limited period of the study. However, the study recognized that one difficulty with an approach of estimating the relationship of fish loss to gear loss is that not all thefts of fish result in gear loss because dolphins and seals appear to be adept at pulling fish from the hook without breaking the line. Therefore due to the low incidence rate (0.45/1000 fish) of monk seal damaged fish one assumption may be that the monk seal ratio of stolen fish to hook loss is magnitudes lower than that for sharks which would indicate that gear is not usually lost during a monk seal interaction. There needs to be a better method to model dolphin and monk seal thefts independent of hook losses. The findings of this report provide some evidence for an increasing trend in these fishery interaction rates over time. The authors also state that "It cannot be ruled out that the samples used in this analysis may have, by chance, involved the extreme bounds of a natural cycle in activity or abundance". They also advocate that further study is needed to understand the temporal and spatial dynamics of shark, dolphin, and monk seal populations and their foraging behavior.

1. Analysis of the Effects on the Species

Hookings

As discussed in the previous section, NMFS assumes that a low level of hooking of monk seals may persist in the bottomfish fishery. From the data presented in Tables 7 and 13, an estimate of hooking that may be attributable to the bottomfish fishery may be calculated by taking the number of hooks observed in monk seals that are potentially attributable to the bottomfish fishery (7) and calculating the rate of hooking occurrence over the number of years since the first hook was observed (20 (from 1982 through 2001)). The resulting rate of hooking occurrence is 0.35 monk seals hooked per year, or one monk seal hooking every 2.9 years. NMFS expects that 57 percent of the monk seals incidentally hooked will survive the interaction essentially unharmed (nonserious injury) as based on the classification of past hooking incidents into the categories of serious injury and nonserious injury (Table 13). That results in a serious injury rate of 43 percent or one monk seal every 6.7 years. However, it should be recognized that the actual rate is

[33]NMFS observer data for the bottomfish fishery discussed *infra* p. 10.

dependent upon fishing effort and location. This figure represents the rate given the data available. Future hooking rates may be lower than the historical rate if the bottomfish fishing activities decrease in areas utilized by monk seals. Two monk seals were observed with hooks at French Frigate Shoals, where 5.6 percent of the total bottomfish catch reportedly occurs (WPRFMC, 2000a). More bottomfish fishing occurs at other areas in the NWHI (Lisianski Island 6.8 percent, Laysan Island 13.6 percent, Necker Island 13.0 percent). Although monk seals also utilize these areas, there have been no observed hooks in monk seals at these locations which are frequented by NMFS and contract research personnel who actively observe the monk seal populations at these locations. However, the WPRFMC reports that relatively shallow waters 11 - 92 meters (10-50 fm) were fished around French Frigate Shoals, and this may account for the higher level of observed monk seals with hooks at French Frigate Shoals. Monk seals have wide home ranges, and occasionally travel between the MHI and the NWHI. Thus, whenever a hooked monk seal is observed, identifying with certainty where a hooking took place is difficult as a seal observed in the MHI may have been hooked in the NWHI and vice versa. Without human intervention, a seriously injured monk seal may die. If the hook and associated gear is not removed from the monk seal during the interaction, there is a chance that the animal will become fouled in the line attached to the hook, possibly causing additional injuries after the initial hooking incident.

NMFS finds that the bottomfish fishery as managed under the FMP may incidentally hook monk seals. However, based on available information and the fishing participation and landing caps and current Reserve closed areas (all areas of critical habitat around areas where monk seals have been observed with hooks potentially attributable to the bottomfish fishery in the past), NMFS expects that the rate of incidental hookings will be very low, notably less than one monk seal per year. Consequently, the estimated rate of serious injury leading to mortality will be substantially lower. Based on the foregoing, it is reasonable to expect that few monk seals will be hooked and/or die as a result of interactions with the bottomfish fishery. The rate of serious injury leading to mortality of monk seals may be reduced if fishers remove hooks and/or disentangle monk seals from bottomfish gear coincident to the gear interaction. This rate of take is unlikely to reduce the numbers, reproduction, or distribution of the monk seal population.

Behavioral Modification

Hooking rates appear to be low; however, interaction rates could be much higher if monk seals are stealing large numbers of fish from the bottomfish fishery vessels. Although observer data have not been collected since 1993, and no reports have been submitted or collected from fishery participants, NMFS assumes an undetermined level of interaction persists, albeit at an unknown level. The distribution of these interactions is within both zones of the management area of the NWHI bottomfish fishery.

The effects of these interactions (monk seals stealing fish) on monk seal populations are unclear. Individual monk seals may habituate to the presence of fishing operations. The report, "Summary Report: Bottomfish Observer Trips in the Northwestern Hawaiian Islands October 1990 to December 1993 states that "(g)iven the artificial availability of these Bottomfish species

to seals and dolphins as a result of the fishing gear and technique, the proximity of populations of seals and dolphins to the fishing grounds, and the practice of discarding unwanted fish, it is likely that predation of catch by seals and dolphins will continue in the NWHI (Nitta, 1993)."

These interactions (monk seals stealing fish) may modify monk seal feeding behavior. Individual monk seals may associate vessels with a source of food and develop preferences for vessel catch. Observer records of monk seals indicate that some monk seals followed fishing vessels for several days and stole fish or consumed discards. Some monk seals could expend considerable energy searching for and/or following vessels in lieu of normal foraging behavior.

Traveling with the vessel may displace effort on the part of monk seals to locate more permanent foraging locations. Monk seals tracked by Abernathy and Siniff (1998) showed site fidelity to foraging locations. Finding suitable foraging locations may be a product of exploration, and may suggest that time spent following vessels that visit the same location intermittently may displace natural foraging habitat exploration and identification.

Observations of monk seals, and data from foraging behavior studies indicate that younger monk seals tend to forage nearer to shore, and adults, especially males, will forage at farther locations and deeper depths (Abernathy and Siniff, 1998). This may suggest that juveniles are more susceptible than adults to fishery interactions in shallow water. However, more information is needed in order to determine which component of the monk seal population interacts with the fishery.

Because direct information is scarce, the possible effects of individual monk seals following bottomfish fishing vessels and consuming catch or discards on the monk seal population are difficult to determine. Individual seals could have better growth rates and reproductive success when they rely upon the easy prey of hooked fish. On the other hand, reliance on fishing vessels for food could hinder the growth and reproductive success of individual seals when vessels move out of an area and seals must learn to forage on their own, or if the prey they obtain from the vessels is inadequate for the monk seal's dietary needs. In addition, use of the vessels as a food source increases the likelihood that an individual seal will become hooked or entangled in fishing gear. If juvenile seals are the primary component of the population that modifies normal behaviors to prey off of bottomfish fishing vessels, and if the low survival rates of this stage are affected more by starvation than shark predation, it is possible that these behavioral changes are having adverse effects on population survival.

Discard Consumption

Monk seals may feed on discards, including fish species associated with ciguatoxin, because fishery participants feed the monk seals and/or dump discards in the presence of monk seals. NMFS observers reported that fishery participants illegally fed discards to monk seals during hand line retrieval in order to distract the monk seals from stealing valuable catch. The prevalence of feeding discards as a means of distracting seals is unknown, but is not believed to be practiced routinely throughout the fishery (Katekaru, pers. comm., 2001). Feeding of discards

to monk seals is prohibited under both the ESA and the MMPA.

Discard availability may affect monk seals in several ways. As discussed above, the availability of discards to monk seals may modify normal monk seal foraging behaviors. Also, monk seals that forage on vessel discards or catch may not obtain the nutritional variety available in their natural diet.

Although a Court Order[34] concluded that illegal discard practices in the bottomfish fishery are poisoning monk seals, NMFS' monitoring of monk seal populations, health and disease studies, and diet studies indicate that monk seals, even if consuming ciguatoxins, are not considered to be adversely affected by the consumption (Work, 1999). NMFS believes that it is unlikely that monk seals are or would be poisoned by consuming lost (fish that inadvertently come off gear while fishing) discarded fish which are ciguatoxic. Monk seals are known to commonly consume other species (e.g. moray eels) that contain high levels of ciguatoxin (Hokama, 1980), and no monk seal sickness or death has been attributed to ciguatoxin poisoning (Work, 1999; NMFS, 2000; Gilmartin et al., 1980; Nitta, 1993). The investigation of the mass die-off at Laysan Island in 1978 included necropsy and analysis of 18 monk seals. Of the 18 monk seals tested, only two tested positive for ciguatoxin and maitotoxin; reaction to these toxins was not proven to be the cause of death (Work, 1999).

Reduction of Prey Available to Monk Seals

Available data on monk seal prey indicate that there is little overlap of the bottomfish management unit and bycatch species and the known prey items of monk seals. Tables 5 and 6 indicate that there is no evidence that monk seals depend on the species targeted in the fishery, although some overlap between bycatch families and monk seal prey families are evidenced by reports of monk seals stealing catch and discard fish from bottomfish fishing vessels. However, this overlap may be indicative of opportunistic feeding on bottomfish target/bycatch/incidental catch species and not evidence that these species are a component of the normal monk seal diet. Available information indicates that monk seals are not foraging on identifiable teleost prey at deep water in lieu of shallow water teleosts. Therefore, it seems unlikely that the bottomfish fishery is competing directly or indirectly with monk seals for the same fish species.

Summary of Effects

It appears that the population size of Hawaiian monk seals has remained stable over the last 8 years, although their total abundance is still to small to protect this species from extinction in the foreseeable future. Population trends in this species are determined by the highly-variable dynamics of the six main reproductive subpopulations. At the species level, demographic trends

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[34]In Judgement, and Granting in Part Plaintiffs' Motion for a Permanent Injunction Motion for Summary Judgement in Greenpeace Foundation, et al. v. Norman Mineta, et al. Civil No. 00-00068SPKFIY. U.S. District Court of Hawaii, November 15, 2000, p. 30.

over the past decade have been driven primarily by the dynamics of the French Frigate Shoals subpopulation, where an increasingly inverted age structure indicates that recruitment of adult females and pup production may soon decrease. At French Frigate Shoals, the count of animals older than pups is now less than half the count in 1989. Poor survival of pups has resulted in a relative paucity of young seals, so that this population of monk seals is expected to experience further population declines as adults die and there are few juveniles to replace them. Because this subpopulation has the largest number of animals, declines in this subpopulation would cause the species' total abundance to decline (unless other subpopulations experience increases that are large enough to offset decreases at French Frigate Shoals).

Over the last decade, the causes of the poor survival for these age classes at French Frigate Shoals have been related to poor condition from starvation, shark predation, male aggression, habitat loss, and entanglement in marine debris. A decrease in prey availability may be the result of decadal scale fluctuations in productivity or other changes in local carrying capacity for seals at French Frigate Shoals or a combination of factors (Craig and Ragen, 1999; Polovina, et al., 1994; Polovina and Haight, 1999). At this point it is speculative to indicate whether or not fishing effort in these areas has been intense enough to change the forage base.

Therefore, NMFS anticipates that changes in feeding behavior in response to fishing vessel activity may have negative consequences for individual seals, but these behavioral changes do not appear to affect the survival of seal populations. Population survival may be more affected by changes in forage base that are associated with phenomena like decadal shifts in productivity.

Given the expected low rates of hooking and the seemingly low level of competition for fishery resources from the bottomfish fishery, the bottomfish fishery is unlikely to have direct or indirect effects that would diminish the value of foraging areas within monk seal critical habitat. Nor is the bottomfish fishery likely to reduce appreciably the likelihood of both the survival and recovery of the Hawaiian monk seal in the wild by reducing the reproduction, numbers, or distribution of the species.

V Cumulative Effects

Cumulative effects include the effects of future state, local, and private actions that are reasonably likely to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. NMFS has no information about cumulative effects that are reasonably certain to occur in the action area, other than the ongoing impacts of activities identified in the *Environmental Baseline* section above. Therefore, there are no new cumulative effects anticipated.

VI Conclusion

After reviewing the current status of monk seals, the environmental baseline for the action area,

the effects of the proposed fishery, and the cumulative effects, it is NMFS' biological opinion that the proposed bottomfish fishery as described is not likely to jeopardize the continued existence of the Hawaiian monk seal or result in the destruction or adverse modification of its critical habitat.

VII Incidental Take Statement

Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in such conduct of listed species of fish or wildlife without a special exemption. Harm is further defined to include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior. Incidental take is any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or the applicant.

By definition, a species or population stock which is listed as threatened or endangered under the Endangered Species Act (ESA) is also considered depleted under the Marine Mammal Protection Act of 1972, as amended (MMPA). Accordingly, before the agency can provide NMFS Sustainable Fisheries Division with a written statement regarding incidental take of marine mammals, any incidental take must be authorized pursuant to section 101(a)(5)(E) of the MMPA, 16 U.S.C. § 1371(a)(5)(E). Section 101(a)(5)(E) provides that the Secretary shall allow the incidental taking of individuals from marine mammal stocks listed as threatened or endangered under the ESA in the course of commercial fishing operations falling under category (c)(1)(A)(iii) of section 118[35] if the Secretary determines that the incidental mortality and serious injury will have a negligible impact on the affected species or stock and that a recovery plan has been developed or is being developed for such species or stock under the ESA.

NMFS is not including an incidental take authorization for the Hawaiian monk seal at this time because the incidental take of marine mammals has not been authorized under section 101(a)(5) of the Marine Mammal Protection Act and/or its 1994 Amendments. Following issuance of such regulations or authorizations, the Service may amend this biological opinion to include an incidental take statement for monk seals, as appropriate.

VIII Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the

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[35]One in which there is a remote likelihood of or no known incidental mortality or serious injury of marine mammals. The bottomfish fishery is classified as a Category III fishery (66 FR 6545, January 22, 2001).

purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

The conservation recommendations for this action are:

1. Reactivation of the NMFS observer program in the bottomfish fishery in the NWHI. Data collected by the observer program should include the number of interactions and the circumstances of each interaction, information regarding the size/age class of animal and the type of fish taken by the animals, photographs of any protected species hooked or entangled in gear (if available), and other items of information which are deemed necessary for formulating plans for minimizing the interactions.

2. Exploration and implementation of monitoring programs for the bottomfish fishery.

In order for NMFS to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, NMFS Protected Resources Division requests notification of the implementation of any conservation recommendations.

IX Reinitiation of Consultation

This concludes formal consultation on the bottomfish fishery as conducted under the Bottomfish FMP. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) The amount or extent of incidental take is exceeded; (2) new information reveals the effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this biological opinion; (4) if a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, formal consultation shall be reinitiated immediately.

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Appendix H-1

Summary Data
Northwestern Hawaiian Islands Bottomfish Fishing Caps

(I) Average annual fishing caps (all species); (II) Annual fleet totals (all species); (III) Historical percent of harvest which is bottomfish; (IV) Likely annual fleet totals of bottomfish to be harvested.

Scenario (ranked as low to high fishing caps)	I Fishing Cap Average pounds allowed per permit holder per year **(all species combined)**	II Fleet total pounds allowed per year **(all species combined)***	III Historic percent of harvest which is bottomfish in NWHI	IV Likely fleet total pounds per year of bottomfish to be harvested*
Baseline	34,252	479,529	82%	394,609
E	48,068	672,952	84%	567,379
B	50,934	713,071	84%	601,687
D	51,803	725,239	84%	610,221
A	51,888	726,436	84%	611,185
C	58,633	820,859	83%	679,863

* Note: Sixteen permit holders appear to qualify for fishing caps (they held NWHI bottomfishing permits as of 12/4/00), however the fleet totals shown here are based on 14 vessels as two of the 16 permit holders have no catch history based on the NWHI Reserve EO requirements on which to derive the caps.

Key to scenarios:

Baseline= total fleet catch over the past five years, average catch per vessel is this number divided by 14. This row includes active and non-active fishing years.

E = Set each permit holder's cap to equal their average catch over those years (of the past five) in which they were active. "Active" is defined as a year in which a vessel met the minimum landing requirements applicable as of 12/4/00.

B = Set each permit holder's cap to equal to their average catch in the those active years (of the past five) in which their catch was a certain percent of their average catch in their best three

active years out of the last five years. 75% was used as the applicable percent, years were again ranked based on total catch of all species combined.

D = Set each permit holder's cap to equal the catch resulting from multiplying their average number of trips during their three busiest active years (those with the most trips) times their average catch per trip from all five years.

A = Set each permit holder's cap to equal to their average catch from their best three active years out of the last five years. Years were ranked based on the permit holder's total catch of all species combined.

C = Set each permit holder's cap to equal to their catch in their best year (of the past five). Years were again ranked based on total catch of all species combined.

cleared: September 5, 2001