WESTERN
PACIFIC
REGIONAL
FISHERY
MANAGEMENT
COUNCIL

MAGNUSON-STEVENS ACT DEFINITIONS AND REQUIRED PROVISIONS

IDENTIFICATION OF FISHING COMMUNITIES

Amendment 6 (Supplement) to the Fishery Management Plan for the Bo ttomfish and Seamount Groundfish Fisheries of the Western Pacific Region

Amendment 8 (Supplement) to the Fishery Management Plan for the Pelagic Fisheries of the Western Pacific Region

Amendment 10 (Supplement) to the Fishery Management Plan for the Crustaceans Fisheries of the Western Pacific Region

Amendment 4 (Supplement) to the Fishery Management Plan for the Precious Corals Fisheries of the Western Pacific Region

Including an Environmental Assessment

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Cover Sheet

Summary

On October 11, 1996 the Magnuson-Stevens Fishery Conservation and Management Act (MSA) was re-authorized and amended by the Sustainable Fisheries Act. As a result, the MSA contains new requirements, making it necessary for Fishery Councils to amend all of their existing Fishery Management Plans (FMP) to incorporate these requirements. The Western Pacific Fishery Management Council (Council) developed amendments to its four FMPs to address these requirements, which were published in September 1998 and submitted to the National Marine Fisheries Service (NMFS) for review and approval. NMFS only partially approved the amendments, as described in a Federal Register notification published on April 19, 1999 (64 FR 19067). Among other elements, portions of the fishing community provisions (including portions of those required under MSA §301(a)(8) and §303(a)(9)) in Amendment 6 to the Bottomfish and Seamount Groundfish FMP, Amendment 8 to the Pelagics FMP, Amendment 10 to the Crustaceans FMP, and Amendment 4 to the Precious Corals FMP were disapproved.

This document addresses the disapproved portions of those four FMP amendments that pertained to the identification of fishing communities. It modifies Section 4.4.1 of the 1998 submission of those amendments by reconsidering the original identifications and identifying a new set of fishing communities within Hawaii. It modifies other subsections of Section 4.4 by providing additional background and analysis to justify those identifications. It does not modify the identification of American Samoa, the Northern Mariana Islands, and Guam as fishing communities, which was approved in the original amendments to the four FMPs.

In disapproving the identification of Hawaii as a fishing community in the 1998 submission of the amendments NMFS (64 FR 19067) cited the need to develop a narrower categorization and to provide additional background and analysis to justify the determinations.

The purpose of these supplementary amendments is to identify fishing communities in Hawaii that are potentially affected by management measures. These identifications have been made by examining the social and economic importance of fisheries to communities in Hawaii, as assessed and documented in a variety of publications and reviewed here.

Key findings with respect to the identification of fishing communities in Hawaii include the following: 1) Fishery resources have played a central role in shaping the social, cultural and economic fabric of Hawaii society. A large number of Hawaii's residents are substantially dependent on or substantially engaged in fishing or fishing-related activities and industries to meet social and economic needs. 2) Fishery participants tend to shift often among gear types and fisheries. Participation in multiple fisheries and the ability to switch gear types and fisheries are fundamental aspects of fisheries in Hawaii and are important to the viability of fishing operations and industries. 3) Fishery participants often reside in one area, moor or launch their vessels in other areas, fish offshore of other areas, and land their fish in yet other areas, and they tend to move among these areas according to the gear types used, weather conditions, and fishing conditions. 4) The shore-side activities associated with the large-vessel fisheries, particularly the longline fishery, are mostly concentrated in the vicinity of Honolulu. Although many people participate in those fisheries and related activities, Honolulu is a large city with a large economy so its dependency on those fisheries is relatively small. Activities associated with the small-

vessel fisheries, in contrast, are fairly widely dispersed within and among islands. Participants in these fisheries do not, generally, stand out geographically from the population as a whole, but there are certain locations in each of the seven inhabited islands in which relatively large concentrations of fishery participants reside or where there are relatively large concentrations of fishing activities or related services. 5) Because of the geographical barriers between Hawaii's islands, social and economic interactions among fishery participants occur primarily at the island level. For the same reason, fishery participants' engagement in fisheries management, such as through public meetings and outreach programs of state and federal agencies, occurs primarily at the island level. 6) The lowest level of government in Hawaii is the county. Each of Hawaii's major four counties includes one, two, or three inhabited islands.

These findings indicate that fishing and related services and industries are important to all of Hawaii's inhabited islands, that the social and economic cohesion of fishery participants is particularly strong at the island level, and that fishing communities are best not distinguished according to fishery or gear type. The most logical unit of analysis for describing the community setting and assessing community-level impacts is the island. In each of these four FMP amendments, each of the islands of Kauai, Niihau, Oahu, Maui, Molokai, Lanai, and Hawaii is identified as a fishing community for the purposes of assessing the effects of fishery conservation and management measures on fishing communities, providing for the sustained participation of such communities, minimizing adverse economic impacts on such communities, and for other purposes under the MSA.

The determinations made here used the best available information. If social or economic conditions change such that the locations of fishing communities change, or if more detailed information on economic dependence and other factors becomes available such that fishing communities can be more precisely identified, the determinations may be changed. The NMFS Honolulu Laboratory, the University of Hawaii and Western Pacific Council will collaborate to identify Hawaii fishing communities at a finer scale. This will include a follow up on the analyses made in these amendments by incorporating more recent as well as more historical data in the analysis of commercial marine license and federal permit holders. An additional component will provide a sociocultural profile of the Hawaii-based longline fishery. The longline industry has been heavily regulated with relatively little understanding of the sociocultural impacts of the regulations and even less awareness of impacts to any associated fishing communities.

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1. Introduction

1.1 Responsible Agencies

The Western Pacific Fishery Management Council (Council or WPFMC) was established by the Magnuson-Stevens Fishery Conservation and Management Act (MSA) to develop fishery management plans (FMPs) for fisheries operating in the US Exclusive Economic Zone (EEZ) around American Samoa, Guam, Hawaii, the Northern Mariana Islands and the Pacific Remote Island Areas (PRIAs).[1] Once an FMP is approved by the Secretary of Commerce (Secretary), it is implemented by federal regulations, which are enforced by the National Marine Fisheries Service (NMFS) and the US Coast Guard, in cooperation with state agencies.

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1.2 Public Review Process and Schedule

The original Comprehensive Amendment of all Council Fishery Management Plans (FMPs) was sent to NMFS for review and approval on September 18, 1998, and the partial approval notice was published in the Federal Register (FR 64, no. 74, 19067-19069) on April 19th 1999. The Council began revising the disapproved sections for bycatch (Pelagic and Bottomfish FMPs), fishing communities in Hawaii (all FMPs) and MSY/overfishing control rules (Crustacean, Pelagic and Bottomfish FMPs) in late 2001, and presented the revised drafts to its Scientific and Statistical Committee (SSC) on the 12th March 2002. The revisions were discussed at the Council's 112th meeting on March 19th 2002, at which time there was an opportunity for the public to comment on the revised sections of the Comprehensive Amendment. The Council voted to forward the revised sections on bycatch and fishing communities to NMFS for review and approval.

[1] Howland Island, Baker Island, Jarvis Island, Johnston Atoll, Midway Atoll, Kingman Reef, Palmyra Atoll, and Wake Island.

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2. Existing Management Measures

2.1 Bottomfish and Seamount Groundfish FMP

The FMP for Bottomfish and Seamount Groundfish Fisheries in the Western Pacific Region became effective by a final rule published on August 27, 1986 (51 FR 27413). The FMP prohibits certain destructive fishing techniques, including explosives, poisons, trawl nets, and bottom-set gillnets; establishes a moratorium on the commercial harvest of seamount groundfish stocks at the Hancock Seamounts, and implements a permit system for fishing for bottomfish in the EEZ around the Northwestern Hawaiian Islands (NWHI) (the current moratorium on the seamount groundfish fishery was published June 29, 1998 (63 FR 35162) and is in effect until 2004). The plan also establishes a management framework that provides for adjustments to be made, such as catch limits, size limits, area or seasonal closures, fishing effort limitation, fishing gear restrictions, access limitation, permit and/or catch reporting requirements, and a rules-related notice system.

Amendment 1 became effective on November 11, 1987 (52 FR 38102) and established limited access systems for bottomfish fisheries in the EEZ surrounding American Samoa and Guam within the framework measures of the FMP.

Amendment 2 became effective on September 6, 1988 (53 FR 299907). It was developed to reduce the risk of biological overfishing and improve the economic health and stability of the bottomfish fishery in the NWHI. The amendment divides the EEZ around the NWHI into two zones, the Hoomalu Zone and Mau Zone. A limited access system was established for the Hoomalu Zone, including landing requirements for permit renewal and for new entry into the fishery. One requirement for permit issuance is that the primary vessel operator must complete a protected species workshop. Access to the Mau Zone was left unrestricted, except for excluding vessel owners permitted to fish in the Hoomalu Zone. The Mau Zone is intended to serve as an area where fishermen can gain experience fishing in the NWHI, thereby enhancing their eligibility for subsequent entry into the Hoomalu Zone.

Amendment 3, which became effective on January 16, 1991 (56 FR 2503), defines recruitment overfishing as a condition in which the ratio of the spawning stock biomass per recruit at the current level of fishing to the spawning stock biomass per recruit that would occur in the absence of fishing is equal to or less than 20%. Amendment 3 also delineates the process by which overfishing is monitored and evaluated.

Amendment 4 became effective on May 26, 1991 (56 FR 24351). It requires vessel owners or operators to notify NMFS at least 72 hours before leaving port if they intend to fish in a protected species study zone that extends 50 nautical miles (nm) around the NWHI. This notification allows federal observers to be placed on board bottomfish vessels to record interactions with protected species if this action is deemed necessary.

Amendment 5 became effective on May 28, 1999 (64 FR 22810). It establishes a limited entry program for the Mau Zone in the NWHI, including landing requirements for permit renewal. One requirement for permit issuance is that the primary vessel operator must complete a protected species workshop.

Amendment 6 included new provisions required under the 1996 Sustainable Fisheries Act (SFA). Portions of the amendment that were approved included designations of essential fish habitat and descriptions of the various fishing sectors. Those provisions became effective on April 19, 1999 (64 FR 19067). Portions that were disapproved included provisions regarding fishing communities, overfishing definitions, and bycatch.

Of relevance to the management of the NWHI bottomfish fishery is the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve, established December 4, 2000 through Executive Order (EO) 13178 (65 FR 76903), as modified by EO 13196 on January 18, 2001 (66 FR 7395). The Reserve is managed by the Department of Commerce under the National Marine Sanctuaries Act. The EO includes prohibitions on commercial and recreational fishing, including the taking of living coral and dead coral, in certain “Reserve Preservation Areas” within the Reserve. It also includes provisions that cap the number of permits and the “annual aggregate take” for particular types of fishing based on historical levels of permit issuance and “take.” The intent and effects of the fishing-related provisions, however, are not entirely clear. The EO calls for the Secretary of Commerce to initiate the process to designate the Reserve as a National Marine Sanctuary. The public scoping associated with that process began in April 2002.

In June 1998 the State of Hawaii implemented several management measures for bottomfish in the state waters of the MHI (Hawaii Administrative Rule, Chapter 13-94). Because bottomfish are managed under the FMP on an archipelagic-wide basis and because there are bottomfishing grounds in federal waters that are adjacent to state waters, these measures directly impact the stocks managed under the Bottomfish FMP. The new rules apply to seven species of bottomfish and include gear restrictions, bag limits for non-commercial fishermen, areas closed to fishing and possession of fish, and a requirement that bottomfishing vessels be registered with the state (see Section 5.1.2 for further details).

A number of FMP amendments and framework adjustments are in various stages of preparation and approval. Although they have not been approved or implemented through regulations, the following descriptions give an indication of the actions being proposed and considered.

Amendment 7 was prepared and submitted in parallel with the FMP for Coral Reef Ecosystems of the Western Pacific Region. NMFS issued a Record of Decision on June 14, 2002 that partially approves the Coral Reef Ecosystems FMP and Amendment 7 to the Bottomfish FMP, but a proposed rule has yet to be published. The amendment would prohibit the harvest of Bottomfish and Seamount Groundfish Management Unit Species (BMUS) in the no-take marine protected areas established under the Coral Reef Ecosystems FMP. The Coral Reef Ecosystems FMP would establish such areas at Rose Atoll in American Samoa, Kingman Reef, Jarvis Island, Howland Island, and Baker Island. No-take areas were also proposed in the NWHI, but all proposed measures in the Coral Reef Ecosystems FMP that would have applied to the waters around the NWHI (including Midway) were disapproved in the Record of Decision because of possible conflict and duplication with the management regime of the NWHI Coral Reef Ecosystem Reserve.

A proposed regulatory adjustment to the FMP would establish provisions for allowing new entry into the Mau Zone, with eligibility criteria based on historical participation in the Hawaii bottomfish fishery. The proposed adjustment was transmitted to NMFS for review and approval on January 31, 2002.

A proposed regulatory adjustment to the FMP would suspend the minimum landing requirements for annual permit renewal in the NWHI Hoomalu and Mau Zone limited access programs. The proposed adjustment was transmitted to NMFS for review and approval on July 19, 2002.

Draft Amendment 8, currently under development, would include the federal waters around the Commonwealth of the Northern Mariana Islands (CNMI) and the Pacific Remote Island Areas (PRIA) under the FMP and designate 49 additional bottomfish species as BMUS.

Two draft supplements to Amendment 6 (in addition to this supplement), currently under development, would include measures to address SFA requirements having to do with the specification of overfishing criteria and the measurement and minimization of bycatch.

2.2 Pelagics FMP

The FMP for the Pelagic Fisheries of the Western Pacific Region became effective by a final rule published on March 23, 1987 (52 FR 5987). The FMP includes initial estimates of Maximum Sustainable Yields (MSY) and sets Optimum Yield (OY) for the stocks. The Pelagic Management Unit Species (PMUS) at that time were billfish, wahoo, mahimahi, and oceanic sharks. The FMP prohibits drift gillnet fishing within the region's EEZ and foreign longline fishing within certain areas of the EEZ.

Amendment 1 was drafted in response to the Secretary of Commerce MSA National Standard Guidelines (see 50 CFR 600) requiring a measurable definition of recruitment overfishing for each species or species complex in an FMP. It became effective on March 1, 1991 (56 FR 9686). The OY for PMUS was also defined as the amount of fish that can be harvested by domestic and foreign vessels in the EEZ without causing local overfishing or economic overfishing.

Amendment 2 became effective on May 26, 1991 (56 FR 24731). It requires domestic longline fishing and transport vessels to have Federal permits, to maintain Federal fishing logbooks, and, if wishing to fish within 50 nm of the NWHI, to have observers placed on board if directed by NMFS. Amendment 2 also requires longline gear to be marked with the official number of the permitted vessel. It also incorporated the waters of the EEZ around the CNMI into the area managed under the FMP.

Amendment 3, which became effective on October 14, 1991 (56 FR 52214), creates a 50 nm longline exclusion zone around the NWHI to protect endangered Hawaiian monk seals. As defined at 50 CFR 660.12, this is a contiguous area extending 50 nm from named features in the NWHI and connected by corridors between those areas where the 50-nm-radius circles do not intersect. The amendment also contains framework provisions for establishing a mandatory observer program to collect information on interactions between longline fishing and sea turtles.

Amendment 4 became effective on October 16, 1991 (56 FR 14866). It establishes a three-year moratorium on new entry into the Hawaii-based domestic longline fishery.[2] The final rule implementing the amendment establishes an expiration date for the moratorium of April 22, 1994. The amendment included provisions for establishing a mandatory vessel monitoring system for domestic longline vessels fishing in the Western Pacific Region. On November 15, 1994 Hawaii-based longline vessels were specifically required to carry a NMFS-owned vessel monitoring system transmitter (59 FR 58789).

Amendment 5 creates a domestic longline vessel exclusion zone around the Main Hawaiian Islands (MHI) ranging from 50 to 75 nm and a similar 50 nm exclusion zone around Guam and its offshore banks. It became effective on March 2, 1992 (57 FR 7661). The zones are primarily intended to prevent gear conflicts and vessel safety issues arising from interactions between longline vessels and smaller fishing boats. A seasonal reduction in the size of the closure was implemented in October 1992; between October and January, longline fishing is prohibited within 25 nm of the windward shores of all islands except Oahu, where longline fishing is prohibited within 50 nm from the shore.

Amendment 6, which became effective on November 27, 1992 (57 FR 48564) specifies that all tuna species are designated as fish under US management authority. It also applies the longline exclusion zones of 50 nm around the island of Guam and the 50–75 nm zone around the Main Hawaiian Islands (MHI) to foreign vessels.

Amendment 7 became effective on June 24, 1994 (59 FR 26979). It institutes a limited entry program for the Hawaii-based domestic longline fishery. The number of vessels allowed in the fishery is limited to 164, and the length of these vessels is limited to being no greater than 101 feet.

Amendment 8 included new provisions required under the 1996 Sustainable Fisheries Act (SFA). Portions of the amendment that were approved included designations of essential fish habitat and descriptions of the various fishing sectors. Those provisions became effective on April 19, 1999 (64 FR 19067). Portions that were disapproved included provisions regarding fishing communities, overfishing definitions, and bycatch.

In August 2000, the State of Hawaii enacted a law prohibiting the retention of shark fins separate

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[2] Throughout this document the term "Hawaii-based longline vessels" (or longliners) refers to vessels fishing under a Hawaii longline limited access permit as described at 50 CFR 660.21.

from the carcass (a practice called “finning”). In December 2000 the MSA was amended with a similar nation-wide prohibition.

In February 1999, the Earthjustice Legal Defense Fund filed a complaint on behalf of the Center for Marine Conservation and the Turtle Island Restoration Network in the U.S. District Court for the District of Hawaii. The complaint was centered on two issues involving the Endangered Species Act (ESA) and the National Environmental Policy Act (NEPA). First, the plaintiffs challenged NMFS’ determination under Section 7 of the ESA that continued conduct of the Hawaii-based longline fishery is not likely to jeopardize the existence of leatherback, loggerhead, olive ridley, or green turtles. Second, the Plaintiffs argued that an EIS should have been prepared before the issuance of a 1998 Biological Opinion (BO) and its Incidental Take Statement for sea turtles.

The U.S. District Court for the District of Hawaii upheld NMFS’ analyses and findings under the ESA that the fishery was not jeopardizing the existence of any protected species. However, the court determined that the agency had failed to prepare a comprehensive EIS for the fishery as required by NEPA. Subsequently, on November 23, 1999, the Court issued an injunction (entered on November 26, 1999, and amended by an order filed January 11, 2000) setting terms to apply during the period that NMFS prepares an EIS. This first injunction (64 FR 72290, December 23, 1999) led to the temporary closing of certain waters north of Hawaii to fishing by Hawaii-based pelagic longline vessels, as well as permanent requirements that all vessels follow prescribed techniques for handling and releasing turtles.[3]

While the EIS was being prepared NMFS re-initiated Section 7 consultations with respect to sea turtles and issued a new BO (NMFS 2001a). The terms and conditions of the BO were incorporated into the Final EIS (FEIS) as part of the preferred alternative, which was filed with the Environmental Protection Agency (EPA) on March 30, 2001. A concurrently issued court order made effective immediately those provisions in the preferred alternative meant to mitigate the Hawaii-based longline fishery’s interactions with sea turtles. An emergency interim rule putting the substance of the preferred alternative and Court Order into regulation was published on June 12, 2001 (66 FR 31561), and revised and extended December 10, 2001 (66 FR 63630), with an expiration date of June 8, 2002. This rule also implemented the seabird mitigation measures mandated by the short-tailed albatross BO issued by the US Fish and Wildlife Service (see below).

The major elements of the new sea turtle related rules were a prohibition on swordfish-directed longlining fishing north of the equator (including several specific restrictions on gear configuration), closure of the area bounded by the equator and 15° N latitude and 145° W and

[3] This Order was substantially modified and new emergency regulations were implemented in August 2000. Several other minor modifications and supplements occurred during and after this period. For a detailed description of the litigation history through March 2001, see the Pelagics FMP FEIS (NMFS 2001b) and the relevant Federal Register notices issued on December 27, 1999 (64 FR 72290), March 28, 2000 (65 FR 16346), June 19, 2000 (65 FR 37917), August 25, 2000 (65 FR 51992), November 3, 2000 (65 FR 66186), and February 22, 2001 (66 FR 11120). Federal Register notices on March 19, 2001 (66 FR 15358), June 12, 2001 (66 FR 31561), December 10, 2001 (67 FR 63630), and June 12, 2002 (67 FR 40232) provide additional information on the management regime implemented since completion of the FEIS.

180° longitude to longline fishing during the months of April and May, a restriction on re-registration of vessels to Hawaii longline limited access permits to the month of October, requirements for vessels that fish for pelagic fish with hook-and-line gear to carry line clippers and bolt or wire cutters and to employ a number of sea turtle handling and resuscitation measures, and requirements for longline vessel operators to annually complete protected species educational workshops conducted by NMFS. On April 5, 2002 (67 FR 16323) NMFS published additional interim rules, including a landing and possession limit of 10 swordfish per trip by longline vessels fishing north of the equator and a longline fishing closure north of 26° N latitude. These regulations expired June 8, 2002 and were replaced with permanent regulations implemented through the FMP amendment process, as described below.

An FMP regulatory amendment published June 12, 2002 (67 FR 40232) incorporates the reasonable and prudent alternative of the March 2001 BO on sea turtles, replacing the interim emergency regulations described above for sea turtles, with the exception of the prohibition on longline fishing north of 26° N latitude, which was not included and has now expired. While the emergency regulations applied only to Hawaii-based longline vessels, the regulatory amendment applies to all longline vessels and to all vessels fishing for pelagic species with hook-and-line gear throughout the Western Pacific Region.

The March 2001 BO was superceded by a BO published by NMFS on November 15, 2002 (NMFS 2002a). This new BO examined the impact of Western Pacific pelagic fisheries on marine mammals and sea turtles listed under the ESA in light of the changes to the Hawaii longline fishery in 2001. The new BO did not propose any significant changes in the management of the Hawaii longline fishery, implemented in the June 12, 2002 regulatory amendment. It did conclude, however, that with these measures in place the fishery was not likely to jeopardize the continued existence of Pacific sea turtles.

A BO for the endangered short-tailed albatross, issued by the US Fish and Wildlife Service (USFWS) on November 28, 2000, contains terms and conditions that would require longline fishermen to institute a variety of line and bait handling techniques and to employ specific methods of handling incidentally caught short-tailed albatrosses. These terms and conditions were implemented by the same set of emergency rules mentioned above for sea turtles and published on June 12, 2001 (66 FR 31561). The BO was amended on October 18, 2001 to allow the use of traditional basket-style longline gear as an alternative to monofilament gear set with a line-setting machine and weighted branch lines.

An FMP framework adjustment published May 14, 2002 (67 FR 34408) incorporates the terms and conditions of the November 2000 BO on seabirds, replacing the interim emergency regulations regarding seabirds. The regulations include requirements to use several seabird mitigation practices: Hawaii-based longline vessels fishing north of 23° N must use thawed blue-dyed bait and strategically discard offal to distract birds during the setting and hauling of longlines. Hawaii-based longline vessels fishing north of 23° N must, when making deep sets, use a line-setting machine with weighted branch lines or basket-style longline gear. Vessels making shallow-sets (if allowed in the future) must begin setting the longline at least one hour after local sunset and complete the setting process by local sunrise, using only the minimum vessels lights necessary. The use of additional mitigation practices, such as towed deterrents, is optional. If a short-tailed albatross is brought on board, the crew must notify NMFS and ensure that the bird displays four specific traits before being released. All seabirds brought on board alive must be handled using certain techniques in order to maximize the probability of their long-term survival once released. Owners and operators of Hawaii-based longline vessels must annually complete a protected species educational workshop conducted by NMFS.

The November 2000 short-tail albatross BO was superceded by a new BO published by USFWS on November 18, 2002 (USFWS 2002). This new BO examined the potential impact of Western Pacific pelagic fisheries in light of the changes to the Hawaii longline fishery in 2001. The new BO noted the changes in the management of the Hawaii longline fishery, implemented in the June 12, 2002 regulatory amendment, specifically the ban on swordfish fishing. It concluded that the fishery was not likely to jeopardize the continued existence of short-tail albatross, and reduced the allowable take of this species in line with the reduction of the threat posed by the Hawaii-based longline fishery.

A regulatory adjustment published January 30, 2002 (67 FR 4369) establishes an area seaward of 3 nm out to approximately 50 nm around the islands of American Samoa in which fishing for PMUS is prohibited by vessels greater than 50 feet in length that did not land PMUS in American Samoa under a federal longline general permit prior to November 13, 1997. The measure is intended to prevent gear conflicts and catch competition between large fishing vessels and locally based small fishing vessels.

In anticipation of the possibility of establishing a limited access program for the American Samoa longline fishery, on June 3, 2002 (67 FR 38245) a revised control date of March 21, 2002 was established to provide notice that vessels entering the American Samoa longline fishery after that date would not be guaranteed future participation in the fishery should a limited access program be established. The new control date replaces two dates previously established by the Council, November 13, 1997 and July 15, 2000.

Of relevance to the pelagic troll and handline fishery in the NWHI is the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve, established December 4, 2000 through Executive Order (EO) 13178 (65 FR 76903), as modified by EO 13196 on January 18, 2001 (66 FR 7395). The Reserve is managed by the Department of Commerce under the National Marine Sanctuaries Act. The EO includes prohibitions on commercial and recreational fishing in certain “Reserve Preservation Areas” within the Reserve. It also includes provisions that cap the number of permits and the “annual aggregate take” for particular types of fishing based on historical levels of permit issuance and “take.” The intent and effects of the fishing-related provisions, however, are not entirely clear. The EO calls for the Secretary of Commerce to initiate the process to designate the Reserve as a National Marine Sanctuary. The public scoping associated with that process began in April 2002.

A number of FMP amendments and framework adjustments are in various stages of preparation and approval. Although they have not been approved or implemented through regulations, the following descriptions give an indication of the actions being proposed and considered.

Amendment 10 was prepared and submitted in parallel with the FMP for Coral Reef Ecosystems of the Western Pacific Region. NMFS issued a Record of Decision on June 14, 2002 that partially approves the Coral Reef Ecosystems FMP and Amendment 10 to the Pelagics FMP, but a proposed rule has yet to be published. The amendment would remove all species of shark except nine pelagic species, as well as dogtooth tuna, from the Pelagic MUS list. Dogtooth tuna and coastal shark species would be managed under the Coral Reef Ecosystem FMP. The amendment would also prohibit the harvest of PMUS in the no-take marine protected areas established under the Coral Reef Ecosystems FMP. The Coral Reef Ecosystems FMP would establish such areas at Rose Atoll in American Samoa, Kingman Reef, Jarvis Island, Howland Island, and Baker Island. No-take areas were also proposed in the NWHI, but all proposed measures in the Coral Reef Ecosystems FMP that would have applied to the waters around the NWHI (including Midway) were disapproved in the Record of Decision because of possible conflict and duplication with the management regime of the NWHI Coral Reef Ecosystem Reserve.

An FMP framework adjustment published as a proposed rule May 6, 2002 (67 FR 30346) would establish permit and reporting requirements for any vessel using troll or handline gear to catch PMUS in the Pacific Remote Island Areas.

Draft Amendment 9, under development since early 2000, would put controls on the harvest and/or retention of sharks in the Hawaii-based longline fishery. A version of the amendment was submitted to NMFS prior to the national ban on shark finning. It is now being re-drafted in the context of that ban, and the draft preferred measure is to establish a retention limit of one non-blue shark per trip. The amendment would also define bottom-set longline gear as a fishing gear.

Draft Amendment 11, currently under development, would limit longline fishing participation and/or effort in the EEZ around American Samoa; the draft preferred measure would do so through a limited access program.

Two draft supplements to Amendment 8 (in addition to this supplement), currently under development, would include measures to address SFA requirements having to do with the specification of overfishing criteria and the measurement and minimization of bycatch.

2.3 Crustaceans FMP

Initial provisions of the FMP, which was initially for the "Spiny Lobster Fisheries of the Western Pacific Region," went into effect March 9, 1983 (48 FR 5560, 7 February 1983). It includes for a management area established in the NWHI: permit requirements, a minimum size limit for spiny lobsters, gear requirements (traps only, of certain dimensions), a ban on the harvest of egg-bearing female spiny lobsters, the closure of certain areas to fishing for spiny lobster (within 20 nm of Laysan Island, in all waters shallower than 10 fm, and within lagoon waters of the NWHI), a mandatory logbook program, and a requirement to take a vessel observer if directed by NMFS. For a management area established for MHI, American Samoa, and Guam, only the permit, data reporting, and observer requirements apply.

Amendment 1, made effective December 20, 1983, adopts the State of Hawaii's lobster fishing regulations for the federal waters around the MHI.

Amendment 2 modifies the allowable trap opening dimensions, with the intent of minimizing the risk of harm to the Hawaiian monk seal while allowing sufficient flexibility in trap design.

Amendment 3 revises the minimum spiny lobster size specifications for the NWHI management area, switching from a carapace length-based limit (7.7 cm) to a limit on tail width (5.0 cm). The amendment was made after the revisions were first made through emergency regulations, effective April 25, 1995.

Amendment 4, effective in March 1987, applies the existing closed areas (within 20-nm of Laysan Island, in waters shallower than 10 fm, within the lagoon waters of the NWHI) to slipper lobster.

Amendment 5 implements a minimum size for slipper lobster (5.6 cm tail width), requires the release of egg-bearing female slipper lobsters, requires escape vents in all lobster traps, and revises some of the permit application and reporting requirements. It also changes the FMP name from "Spiny Lobster Fisheries" to "Crustaceans Fisheries."

Amendment 6 defines recruitment overfishing for lobster stocks in terms of reference points that are expressed in terms of the spawning potential ratio (SPR), the ratio of the spawning potential per recruit in a given area at present to that in an unfished condition. The minimum SPR threshold, below which the stock would be considered recruitment overfished, is 20%. It is also specified that if the stock's SPR value is found to be between 20% and the optimum yield level of 50%, remedial management action would be considered.

An emergency action was taken on May 13, 1991 to close the fishery from May 8 through August 12, 1991 in response to indications of NWHI lobster stocks approaching an overfished condition (56 FR 21961). The closure was extended until November 12, 1991 through another emergency action on July 30, 1991 (56 FR 36912).

In response to the indications of stock decline in 1990 and 1991, Amendment 7 (1992) establishes a limited access program, an adjustable fleet-wide annual harvest, and a closed season in the NWHI fishery. Participation is limited to 15 permits/vessels, with permits issued according to criteria based on historical and current participation. Permits are freely transferable. Permit renewal is contingent on meeting minimum landings requirements over a two-year period. The program includes a maximum limit on the number of traps per vessel (1,100), revisions to reporting requirements, and certain other provisions. The fleet-wide annual harvest quota is set based on a target catch-per-unit-effort (CPUE) of 1.0 lobster/trap-haul, among other factors. The NWHI fishery is closed for the calendar year once the quota is reached. The closed season is January through June.

Amendment 8 eliminates the minimum landings requirements for permit renewal in the limited access program, allows the CPUE target that is used to set the harvest quota to be changed through the framework process, changes the term "initial quota" to "forecast quota" and provides a framework procedure to consider the allowance of fishing even when the forecast quota is zero, and modifies the reporting requirements.

Amendment 9 establishes an "annual harvest guideline" system in place of the annual harvest quota. The guideline is set based on a constant harvest rate of the population (i.e., it is proportional to the estimated exploitable population size) that is set based on a specified acceptable risk of overfishing. The acceptable risk of overfishing is specified at 10% (which was found through simulation results to be associated with a constant harvest rate of 13% per year). The annual harvest guideline for the NWHI permit area is published by NMFS no later than February 28 each year. The in-season quota adjustment procedures are also eliminated. The amendment also eliminates the minimum size limit and no-berried-lobster requirements, making it a "retain-all" fishery, and provides for certain regulatory adjustments to be made through framework procedures.

Amendment 10 includes new provisions required under the 1996 Sustainable Fisheries Act (SFA). Portions of the amendment that were approved included provisions regarding essential fish habitat, descriptions of the various fishing sectors, and bycatch. Those provisions became effective on April 19, 1999 (64 FR 19067). Portions that were disapproved included provisions regarding fishing communities and overfishing definitions.

A regulatory amendment published July 8, 1999 (64 FR 36820) establishes a framework procedure for setting bank-specific harvest guidelines in the NWHI. It divides the NWHI management area into four sub-areas: Necker Island, Gardner Pinnacles, Maro Reef, and all remaining NWHI lobster fishing grounds combined. The annual NHWI harvest guideline can be allocated among the four sub-areas, recognizing differences in fishing effort and recruitment in each area.

On June 26, 2000, NMFS made an emergency closure of the NWHI lobster fishery, effective July 1 through December 31, 2000 (65 FR 39314). The action was taken as a precautionary measure to protect lobster stocks because of shortcomings in understanding the dynamics of the NWHI lobster populations, the increasing uncertainty in population model parameter estimates, and the lack of appreciable rebuilding of the lobster population despite significant reductions in fishing effort throughout the NWHI. The closure was continued through the 2001 and 2002 seasons through announcements by NMFS on February 22, 2001 (66 FR 11156) and March 15, 2002 (67 FR 11678), respectively, that no annual harvest guidelines for the NWHI permit area would be issued. The actions were taken because of continuing uncertainty about the status and dynamics of the lobster populations and the models used to describe them, as well as because of a federal court order to keep the fishery closed until completion of an Environmental Impact Statement (under the National Environmental Policy Act) and a Biological Opinion (under the Endangered Species Act). Also taken into account were the apparent implications of the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve, established in December 2000 (see below).

Of relevance to the management of the NWHI crustaceans fishery is the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve, established December 4, 2000 through Executive Order (EO) 13178 (65 FR 76903), as modified by EO 13196 on January 18, 2001 (66 FR 7395). The Reserve is managed by the Department of Commerce under the National Marine Sanctuaries Act. The EO includes prohibitions on commercial and recreational fishing in certain "Reserve Preservation Areas" within the Reserve. It also includes provisions that cap the number of permits and the "annual aggregate take" for particular types of fishing based on historical levels of permit issuance and "take." Specifically, there is a provision stating that "the annual level of aggregate take under all permits of any particular type of fishing may not exceed the aggregate level of take under all permits of that type of fishing in the years preceding the date of this order…" (7)(a)(1)(C). The EO calls for the Secretary of Commerce to initiate the process to designate the Reserve as a National Marine Sanctuary. The public scoping associated with that process began in April 2002.

A number of FMP amendments and framework adjustments are in various stages of preparation and approval. Although they have not been approved or implemented through regulations, the following descriptions give an indication of the actions being proposed and considered.

Amendment 11 was prepared and submitted in parallel with the FMP for Coral Reef Ecosystems of the Western Pacific Region. NMFS issued a Record of Decision on June 14, 2002 that partially approves the Coral Reef Ecosystems FMP and Amendment 11 to the Crustaceans FMP, but a proposed rule has yet to be published. The amendment would prohibit the harvest of Crustacean MUS in the no-take marine protected areas established under the Coral Reef Ecosystems FMP. The Coral Reef Ecosystems FMP would establish such areas at Rose Atoll in American Samoa, Kingman Reef, Jarvis Island, Howland Island, and Baker Island. No-take areas were also proposed in the NWHI, but all proposed measures in the Coral Reef Ecosystem FMP that would have applied to the waters around the NWHI (including Midway) were disapproved in the Record of Decision because of possible conflict and duplication with the management regime of the NWHI Coral Reef Ecosystem Reserve.

Draft Amendment 12, currently under development, would include the federal waters around the Commonwealth of the Northern Mariana Islands (CNMI) and the PRIAs under the FMP.

2.4 Precious Corals FMP

The FMP for the precious corals fishery of the western Pacific region was implemented in September 1983 (48 FR 39229). In the FMP, precious coral beds are treated as distinct management units because of their widely separated, patchy distribution and the sessile nature of individual colonies. The beds are classified as Established, Conditional, Refugia, or Exploratory. Established Beds are ones for which appraisals of MSY are reasonably precise. To date, only the Makapu‘u bed has been studied adequately enough to be classified as Established. Conditional Beds are ones for which estimates of MSY have been calculated by comparing the size of the beds to that of the Makapu‘u bed and then multiplying the ratio by the yield from the Makapu‘u bed. It is assumed that ecological conditions at the Makapu‘u bed are representative of conditions at all other beds. Five beds of precious corals are classified as Conditional, all of which are located in the EEZ around Hawaii. Refugia Beds are areas set aside for baseline studies and possible reproductive reserves. No harvesting of any type is allowed in those areas. The single Refugia Bed that has been designated—the Westpac bed—is also located in the EEZ surrounding Hawaii. Exploratory Areas are the unexplored portions of the EEZ. Separate Exploratory Permit Areas are established for Hawaii, American Samoa, and Guam. The FMP permits the use of only selective gear in the EEZ around the MHI; that is, south and east of a line midway between Niihau and Nihoa Islands. Use of both selective and nonselective gear is permitted on the Conditional Beds of Brooks Bank and the 180-Fathom Bank and throughout the Exploratory Area of the NWHI. Quotas are established for pink, gold and bamboo coral populations in the Makapu‘u bed and in the Conditional Beds. Pink coral harvested from the Makapu‘u bed, the Ke‘ahole Point bed, and the Kaena Point bed must have attained a minimum height of 10 inches. If tangle net dredges are employed, the weight quota is only 20% of that allowed for selective harvesting. The FMP establishes a procedure for re-designating coral beds from Exploratory to Conditional and from Conditional to Established as new beds are located and more catch/effort data become available that will allow more precise determinations of sustainable yields.

Amendment 1 (effective date July 21, 1988; 50 FR 27519) applies the management measures of the FMP to U.S. Pacific Insular Areas other than Guam, American Samoa, and the Northern Mariana Islands by incorporating them into a single Exploratory Permit Area, expands the management unit species to include all species of the genus *Corallium*, and outlines provisions for the issuance of experimental fishing permits designed to stimulate the domestic fishery.

Amendment 2 (effective date January 28, 1991; 56 FR 3072) defines overfishing for Established Beds as follows: An Established Bed shall be deemed overfished with respect to recruitment when the total spawning biomass (all species combined) has been reduced to 20% of its unfished condition. This definition applies to all species of precious corals and is based on cohort analysis of the pink coral, *Corallium secundum*.

Amendment 3 (effective date October 19, 1998; 63 FR 55809) establishes a framework procedure for adjusting management measures in the fishery.

Amendment 4, implemented by rules published on April 19, 1999 (64 FR 19067) includes new provisions required under the 1996 Sustainable Fisheries Act. It provides descriptions of the various fishing sectors, discusses measures to minimize bycatch and bycatch mortality in the precious coral fishery, specifies criteria for identifying when overfishing has occurred in the fishery, identifies fishing communities, and identifies and describes essential fish habitat for managed species of precious corals. It designates the established bed of Makapu'u as a Habitat Area of Particular Concern because of the ecological function it provides, the rarity of the habitat type, and its sensitivity to human-induced environmental degradation. It designates Au'au Channel as a second Habitat Area of Particular Concern because of the ecological function it provides, the rarity of the habitat type, and its sensitivity to human-induced environmental degradation. Portions that were disapproved included provisions regarding the identification of fishing communities in Hawaii. This document is a supplement to Amendment 4.

A regulatory amendment published March 18, 2002 (67 FR 11941) revises the definitions of "live coral" and "dead coral," suspends the harvest of gold coral at Makapu'u Bed, applies minimum size restrictions only to live precious corals, prohibits the harvest of black coral with a stem diameter of less than one inch or a height of less than 48 inches (with certain exceptions), prohibits the use of non-selective fishing gear to harvest precious corals, and applies the minimum size restrictions for pink coral to all permit areas. The regulatory amendment included additional proposed measures that would have applied only to the NWHI, but they were not approved because they were determined to be inconsistent with the management regime of the NWHI Coral Reef Ecosystem Reserve (see below).

Of relevance to the management of the NWHI precious corals fishery is the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve, established December 4, 2000 through Executive Order (EO) 13178 (65 FR 76903), as modified by EO 13196 on January 18, 2001 (66 FR 7395). The Reserve is managed by the Department of Commerce under the National Marine Sanctuaries Act. The EO includes prohibitions on commercial and recreational fishing, including the taking of living coral and dead coral, in certain "Reserve Preservation Areas" within the Reserve. It also includes provisions that cap the number of permits and the "annual aggregate take" for particular types of fishing based on historical levels of permit issuance and "take." The EO calls for the Secretary of Commerce to initiate the process to designate the Reserve as a National Marine Sanctuary. The public scoping associated with that process began in April 2002.

A number of FMP amendments and framework adjustments are in various stages of preparation and approval. Although they have not been approved or implemented through regulations, the following descriptions give an indication of the actions being proposed and considered.

Amendment 5 was prepared and submitted in parallel with the FMP for Coral Reef Ecosystems of the Western Pacific Region. NMFS issued a Record of Decision on June 14, 2002 that partially approves the Coral Reef Ecosystem FMP and Amendment 5 to the Precious Corals FMP, but a proposed rule has yet to be published. The amendment would prohibit the harvesting of Precious Coral MUS in the no-take marine protected areas established under the Coral Reef Ecosystem FMP. The Coral Reef Ecosystems FMP would establish such areas at Rose Atoll in American Samoa, Kingman Reef, Jarvis Island, Howland Island, and Baker Island. No-take areas were also proposed in the NWHI, but all proposed measures in the Coral Reef Ecosystems FMP that would have applied to the waters around the NWHI (including Midway) were disapproved in the Record of Decision because of possible conflict and duplication with the management regime of the NWHI Coral Reef Ecosystem Reserve.

Draft Amendment 6, currently under development, would include the federal waters around the Commonwealth of the Northern Mariana Islands (CNMI) under the FMP.

A framework adjustment, currently under development, would remove the quota of 1,000 kg for each Exploratory Area and replace that measure with a combination of restrictions on precious coral sizes that may harvested and areas that may be fished, with the intent of making it economically feasible to explore and gather information about precious coral resources outside of known beds. The adjustment would also establish a "mega-refugium" at the southern end of the NWHI with the intent of protecting what is a unique ecological area, providing valuable research data, and providing protection to gold coral beds that may be important foraging grounds for Hawaiian monk seals.

3. Purpose and Need for Action

On October 11, 1996 the Magnuson-Stevens Fishery Conservation and Management Act (MSA) was re-authorized and amended by enactment of the Sustainable Fisheries Act (SFA). As a result, the MSA contains new requirements, making it necessary for Fishery Councils to amend all of their existing FMPs to incorporate these requirements. The requirements pertain to bycatch, fishing sectors, essential fish habitat, fishing communities, and overfishing. To address the requirements of the SFA, the Council prepared a comprehensive document with amendments to all four of its FMPs. Amendment 6 to the Bottomfish FMP, Amendment 8 to the Pelagics FMP, Amendment 10 to the Crustaceans FMP, and Amendment 4 to the Precious Corals FMP were published in September 1998 and submitted to NMFS for review. NMFS only partially approved the amendments, as described in a Federal Register notification published on April 19, 1999 (64 FR 19067). Three components of the amendments were disapproved: the bycatch provisions (MSA §301(a)(9), §303(a)(11), and other sections) for the Bottomfish and Pelagics FMPs, the overfishing provisions (§303(a)(10) and other sections) for the Bottomfish, Pelagics, and Crustaceans FMPs, and for all four FMPs, the description of the State of Hawaii as a single fishing community (MSA §301(a)(8), §303(a)(9), and other sections).

This document addresses the disapproved sections of Bottomfish FMP Amendment 6, Pelagic FMP Amendment 8, Crustaceans FMP Amendment 10, and Precious Corals Amendment 4 regarding the identification of fishing communities. It modifies Section 4.4.1 of the 1998 submission of those amendments by reconsidering the original identifications and identifying a new set of fishing communities within Hawaii. It modifies other subsections of Section 4.4 by providing additional background and analysis to justify these new identifications. It does not modify the identification of American Samoa, the Northern Mariana Islands, and Guam as fishing communities. These new provisions are presented in Section 4 of this document.

In disapproving the identification of Hawaii as a fishing community in the 1998 amendments NMFS (64 FR 19067) cited the need to develop a narrower categorization and to provide additional background and analysis to justify the determinations.

The 1996 SFA amendments to the MSA added a definition of "fishing community" (MSA §3(16)) and required that fishing communities be considered in the fishery impact statement (§303(a)(9)) and in certain other contexts, such as any proposal for limited access to a fishery (§303(b)(6)) and any plan to ending overfishing (§304(e)(4)). The SFA also added National Standard 8 (§301(a)(8)), which states:

> *Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and the 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.*

As described in the NMFS Guidelines for Assessment of the Social Impact of Fishery Management Actions (3/19/2001 version), the SFA amendments have the effect of requiring three levels of assessment: First is the level of the fishery impact statement. One output of that level of assessment is the identification of both those communities involved in fisheries and those that meet the MSA definition of "fishing community." The second level would consider the impacts of management measures on fishing communities in the context of National Standard 8. The third level would take into account fishing communities, among other factors, when considering establishment of a limited access system.

The purpose of these amendments is to identify fishing communities in Hawaii so that, among other purposes under the MSA, appropriate analyses can be made – pursuant to National Standard 8 – of the potential effects of conservation and management measures on fishing communities, particularly through the preparation of fishery impact statements. These identifications are made by examining the social and economic importance of fisheries to communities in Hawaii.

This document is intended to fulfill NEPA requirements and is organized to incorporate an environmental assessment. Section 5 describes the affected environment. Section 6 presents the new fishing community provisions as the preferred alternative, along with the no-action alternative. Section 7 analyzes the environmental and socio-economic impacts of the two alternatives.

4. Identification of Fishing Communities in Hawaii

In order to describe what "fishing community" means in the context of the MSA and the determinations made in these amendments, provided in Section 4.1 is a brief background discussion of the general concept of community and the elements that define the narrower concept of fishing community – namely, that fishing communities are dependent on fisheries resources and they are defined by location. Background is also provided on the analytical approaches that have been used to identify and characterize both communities and fishing communities. In Section 4.2 the economic and social importance of fisheries to Hawaii's society as a whole and to particular groups are examined. In Section 4.3 are descriptions of the spatial distribution of fishery participants and fishing-related activities. Based on this information, determinations are made Section 4.4 on the identification of fishing communities in Hawaii. In Section 4.5 is an overview of the types of investigations that may be needed to characterize fishing communities in more detail in the future.

4.1 Background on the Identification of Communities

The identification of fishing communities in the context of the MSA is guided by the following definitions and specifications.

The MSA defines "fishing community" (§3(16)):

> *The term "fishing community" means a community which is substantially dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew and United States fish processors that are based in such community.*

The National Standard Guidelines further specify that (50 CFR 600.345):

> *A fishing community is a social or economic group whose members reside in a specific location and share a common dependency on commercial, recreational, or subsistence fishing or on directly related fisheries-dependent services and industries (for example, boatyards, ice suppliers, tackle shops).*

And further:

> *The term "sustained participation" means continued access to the fishery within the constraints of the condition of the resource.*

The National Standard Guidelines state that an appropriate vehicle for the analyses needed to ensure consistency with National Standard 8 is the fishery impact statement required by MSA §303(a)(9), which requires that any FMP:

> *include a fishery impact statement for the plan or amendment (in the case of a plan or amendment thereto submitted to or prepared by the Secretary after October 1, 1990) which shall assess, specify, and describe the likely effects, if any, of the conservation and management measures on--*
>
> > *(A) participants in the fisheries and fishing communities affected by the plan or amendment; and*
> >
> > *(B) participants in the fisheries conducted in adjacent areas under the authority of another Council, after consultation with such Council and representatives of those participants*

4.1.1 The Concept of Community

Community has been defined many ways but generally has two meanings. Communities can be groups of like-minded people who gain strength from their relationships and associations. Sometimes referred to as communities of interest (Sirmon et al. 1993), these groups can be people employed in a similar profession, who participate in the same activities, or who share a set of values. Members of these communities are linked by their interests and may live in a wide variety of locations. Examples in Hawaii may include the longline fishing community, the sport fishing community, or the environmental community.

The main other meaning of community is a spatially defined place such as a town or village – sometimes referred to as a community of place. The common link among members is their location. Community boundaries in the U.S. were once identified through observation of wagon wheel ruts indicating travel patterns between residences and settlements. Communities are the basic building blocks and foundation of our society, making critical contributions to the quality of our families, interpersonal relations, education, health, environment, food systems, economy, and overall well being (Lacy 1999). Communities can have an identity that adds considerably to residents' definition of themselves and their values.

Pivo (1992) characterized communities as consisting of a specific population of people living in a specific geographic area, with the presence of shared institutions and values, and social interactions. He then listed a variety of economic, demographic, physical, and social criteria that defined the character of Snoqualmie, Washington State. The 37 types of criteria included items such as occupation and percent of timber and agriculture, proportion of households with children, number of town centers and separation from suburbs, scenic beauty, level of agreement on community goals, and balance of old timers and newcomers.

It should not be surprising that communities have long been the subject of policy attention, especially when the issue is rural communities – America's small towns and the values with which they are associated. The goal of many policies, or at least a key mitigation consideration, is the desired presence of healthy, vital communities. Political support for thriving rural economies traces back to Jeffersonian ideals of a democracy based on the independence of "yeoman" farmers (McCool et al. 1997).

Rural communities in particular are of concern because they may not have the population, economic strength or diversity, or leadership to successfully cope with economic and social changes over which they have little control. Local infrastructure and human capital may be limited. The cumulative effects of sustained instability and accompanying transition can limit the capability of communities to react successfully to change (FEMAT 1993).

Burdge (1995) developed *A Community Guide to Social Impact Assessment* to enable community leaders and residents to conduct their own social impact assessments. He believed that doing so would not only help community members understand and deal with social impacts that result from projects or policy changes, but that the process of doing so collectively would lead to greater community cohesion and strengthen communities. Activities in the workbook included assessment of population impacts, community and institutional arrangements, conflicts between residents and newcomers, individual and family level impacts, and community infrastructure needs.

4.1.2 Communities and Resource Dependence

Whether the issue is timber, ranching, farming, fishing, or other type of resource use, special policies have been developed to protect the viability of small towns dependent on natural resources that are located on public lands or when their utilization is affected by public policy.

Forestry policy, for example, has considered the needs of rural communities located close to forests since establishment of the National Forests. The Forest Service gives special consideration to communities defined as timber dependent, based on employment level. Traditionally, if primary forest products manufacturing facilities provided 10 percent or more of total employment, the community was defined as timber-dependent (Haynes and Horne 1997).[4]

A variety of laws supported timber-dependent communities by trying to engineer community stability, defined as "a process of orderly change within those political and geographical areas that are significantly affected socially or economically by forest resources ... community stability concerns the prosperity, adaptability, and cohesiveness of people living in a common functional geographic area and their ability to absorb and cope with change" (Society of American Foresters 1989). Richardson (1993) listed a variety of socioeconomic factors thought to affect community stability: economic diversity, timber or forest dependency, economic stability, population stability, social cohesion or community solidarity, structural diversity (of community infrastructure and services), centrality (access to the region), quality of life, human capital, size, local leadership, and prosperity (income level and distribution).

Communities can have many types of relationships with various industries, and even dependence is not straightforward. Parkins (2001) identified four types of forest sector dependence (pulp and paper, logging, lumber, forest services) and linked each to measures of community well-being. There are likely different types of dependency on fishing present in communities as well, such as a cannery in town, a local culture's reliance on subsistence fishing, a community's link with

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[4] Similarly, farming-dependent counties are defined as nonmetropolitan counties in which 20 percent or more of the total labor and proprietors' income comes from farming (Cook and Mizer 1994).

sport fishing, the presence of a commercial fleet and/or shoreside support services, or a mix of those plus others.

In a study of the conditions of communities in the interior Columbia basin (ICBEMP 1998), a different approach to assessing natural resource dependency was taken. Communities were characterized based on three factors: geographic isolation from major population centers, employment specialization in 12 industry groups, and relationship to public lands administered by the Forest Service or Bureau of Land management. Industry specialization was calculated by dividing the percent employment for a particular industry in a community by the percent employment in the industry for the entire region (the Bureau of Economic Analysis region in which the community was located). This approach recognized that a community may be specialized in several different industries. Towns in the basin were categorized as having low to very high levels of specialization in each of the 12 industries based on the size of the specialization ratio.[5]

The authors of the interior Columbia basin communities study said that industry specialization – a measurement of a town's relationship to industries – should not be viewed as equivalent to resource dependence – a public policy choice. Showing a set of communities' specialization ratios allows policy makers to identify alternative levels of specialization as cut-off points for various purposes (such as defining "dependency") and to assess the sensitivity of the ratios under each policy alternative (which towns are included or dropped under each alternative). The authors also noted that the specialization analyses would not be used to address dependency unless the industries included are assumed to be "basic" or "export" industries. These industries add to the level of income and employment in a community by bringing outside money into the community through selling locally produced goods or services outside the area or to people who purchase them with outside income.

A policy concern associated with changes in management or output of resources affecting communities has been how well equipped communities are to deal with the new conditions.

The assessment of forest ecosystems conducted in the Pacific Northwest (FEMAT 1993) addressed impacts to forest-associated communities based on community capacity: "the ability of community residents and institutions to meet local needs and expectations, based on physical infrastructure, human capital, and civic responsiveness."

Harris et al. (1996) used a similar term, community resiliency, to refer to a community's ability to respond and adapt to change. Resiliency had many components, including community character, cohesiveness, services, and infrastructure, autonomy, economic diversity and/or strength, resource dependence, attractiveness to business, quality of life, leadership, effectiveness of community government, and preparedness for the future.

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[5] Community-level employment data is not routinely collected. For this study, Dr. Henry Robison of the University of Idaho used the phone book method to disaggregate county level employment data from the BEA Regional Economic Information System; this required analyzing business listings in local phone directories coupled with field verification (Robison and Peterson 1995).

4.1.3 Identification of Fishing Communities and Characterizing Dependence

Under National Standard 8, fishing communities must be geographic places rather than avocational groups (such as sport anglers) or occupational groups (such as longliners), unless they happen to live in the same place. There is no specific direction on the size or scale of such places. Researchers have taken a number of approaches to identifying appropriate scales for analysis.

Hall-Arber et al. (2001) used clusters of coastal counties, which led to definition of 11 sub-New England regions. An advantage of this approach was that it incorporated central place theory, which links smaller communities (hinterland) to larger ones (centers) to define local societies that meet diverse needs of residents. This approach also recognized that a group of communities often functions as a network for flow of social, cultural, and economic capital, consistent with the Natural Resource Region approach (Dyer and Poggie 2000). However, the authors said that counties are not necessarily socially meaningful units and that flow of capital may not be related to county boundaries (or may not just take place among coastal counties). Other studies of natural resource dependency have agreed, noting that a given county can contain a broad mix of towns having very different orientations toward natural resource industries.

The authors also briefly profiled counties within the sub-regions, and towns within the counties. Information reported at the town level included demographic characteristics, economic context, infrastructure, and a fisheries profile comprised of diverse information such as harvesting and processing, species and seasons, employment, cultural role of fishing, and fishing organizations. Fishing dependency was measured at the sub-regional level through a set of indices: percentage of labor force in fisheries, percentage of related occupations, and a summary measure of the impact of fishing on the region in relation to other occupations available to people who fish commercially.

Jacob et al. (2002) used aggregated zip code areas to identify fishing communities in Florida. This had the advantage of incorporating central place theory. The authors explained that zip code was also the only geographic identifier for many types of commercial and recreational fishing data and was a relatively small unit of measure. Their aggregation process produced 213 zip code communities, 81 of which were coastal (and therefore potential fishing communities), compared to 1,882 zip codes for all of Florida. Data used to identify proportions of fishing-related variables included federal and state commercial fishing permits, saltwater products licenses, seafood dealer permits, charter fishing permits, marinas, county business patterns, and demographic information from the census (all imported into Arcview GIS software). The initial findings from these analyses were verified through a rapid assessment and survey research to confirm that they were meaningful and relevant to community residents.

In their assessment of the Highly Migratory Species (HMS) Fisheries Management Plan and the Amendment to the Atlantic Billfish Fisheries Management Plan, Wilson and McCay (1998) identified communities by looking at landings data and other criteria, including the relationship between the communities and the fishing fleets and existing community studies, along with recommendations from the industry Advisory Panels for HMS and Billfish on which fishing communities the analysis should focus. They identified three main characteristics of fishing communities that would help to determine how the community would respond to changes in fisheries management: the existence of alternative activities – both fishing and non-fishing, economic vulnerability (the amount and sources of pressure and competition present for fishing related businesses), and community support (social capital available to people and fishing operations affected by regulations).

McCay and Cieri (2000) identified fishing communities by focusing on places identified as "ports" by the port agents of NMFS. They recognized that this may not capture "the full scope and nature of the communities in which vessels owners, operators, crew and processors work and live, and which are dependent on fisheries to meet their social and economic needs." Harvesters can be highly mobile, landing fish at distant and changing ports, and the costs of coastal property and other factors mean that people engaged in fishing may live and spend money away from the place where fish are landed or processed. Another complicating factor was that many coastal towns are increasingly dominated by tourism or suburbanized, making traditional fishing activities appear less important despite their longstanding and continuing social, cultural, and economic importance. One of the justifications for using county-level census and labor data was that people who worked out of a port were likely to live somewhere in the county, if not in the town or village identified with the port.

McCay and Cieri (2000) prepared their assessment with the goal of contributing to analyses by identifying vulnerability of fishing communities. Analyses of weigh-out data provided information on degrees of dependence on species or species complexes. Census and employment data described the socio-economic condition of the area, including the cost of living, the likelihood of finding other work, poverty levels, and education levels. Another factor affecting vulnerability was peoples' and governing bodies' level and type of support for the fishing industry and the land-use pressures against commercial and recreational fishing as expressed through land use planning, zoning, variances, and nuisance ordinances. Another key variable was seen as people's ability to organize and work together for common goals, as expressed by the availability of associations and other organizations to fishermen and their families, and places where fishermen hung out and communicated through social networks.

Aguirre International (1996) evaluated the dependency of five primary communities/ports involved in the multispecies groundfish fishery (MGF) by identifying seven indicators of dependence, assigning each a value, and summing them to provide an index. The criteria were number of repair/supply facilities, number of fish dealers/processors, the presence of religious art/architecture dedicated to fishing, the presence of secular art/architecture dedicated to fishing, number of MGF permits, and number of MGF vessels. The summed scores indicated the community's level of dependence on this specific fishery. The authors characterized the resulting index as a crude estimate only that should be verified through other information. They also described the considerable variation within each port; some fishers were much more dependent on the MGF than others due to degree of specialization, vessel size and ownership status, history of participating in other fisheries, and ethnic factors. The authors believed that five variables best predicted dependence on the MGF: relative isolation or integration of fishers into other economic sectors, the mix of vessel types and sizes in the port's fishery, degree of specialization (focus on one versus many fisheries), percentage of population involved in fishing or fishery-related industries, and level of competition and conflict within the port among different components of the MGF.

4.2 Economic and Social Importance of Fisheries in Hawaii

The importance of fisheries in Hawaii and the Western Pacific Region is recognized in the MSA ((§2(a)(10)), which states, "Pacific Island Areas contain unique historical, cultural, legal political and geographical circumstances which make fisheries resources important in sustaining their economic growth."

The Council has compiled extensive information on the economic and social importance of fisheries to Hawaii. Summaries of this material are presented in the Council's FMPs, FMP annual reports and annual "Value of the Fisheries" reports. Detailed information appears in a wide range of research reports that examine the history, extent and type of participation of island populations in the fisheries in Hawaii. For example, the Hawaii Fleet Industry and Vessel Economics project has produced cost-earnings studies of the Hawaii-based longline fleet (Hamilton et al. 1996) and Hawaii small-boat commercial fleet (Hamilton and Huffman 1997). A socio-cultural study of Hawaii's troll and handline fishery has been conducted by Miller (1996). Clarke and Pooley (1988) provide an economic analysis of the lobster fishery in the NWHI. Schug (2001) recounts the history of commercial fishing in Hawaii and its importance to particular social and ethnic groups. Additional descriptions of the fisheries in Hawaii may be found in volume 55, number 2, of *Marine Fisheries Review* (1993). The most recent comprehensive description and assessment of the pelagic fisheries is the Final Environmental Impact Statement completed in 2001 (NMFS 2001b) and incorporated by reference into this document. Much of the material presented in this section is taken from or adapted from that document, as well as from a Preliminary Draft Environmental Impact Statement for the bottomfish fisheries (WPRFMC 2001b).

4.2.1 Fishing in the Hawaiian Economy

4.2.1.1 Population and economy

The State of Hawaii lies 2,500 miles southwest of North America, the nearest continental land mass. The eight main islands are part of a 137-island archipelago stretching 1,523 miles from Kure Atoll in the northwest to the island of Hawaii in the southwest. The total land area of the archipelago is 6,423 square miles. The main islands include Oahu, Maui, Kauai, Niihau, Hawaii, Molokai, Kahoolawe, and Lanai. Hawaii was established as a territory of the United States in 1900 and became the 50th state in 1959.

The lowest level of government is the county, of which there are five. Kauai County includes the islands of Kauai and Niihau. Honolulu County includes the island of Oahu and the Northwestern Hawaiian Islands (excluding Midway, which is not part of the state). Maui County includes the islands of Maui, Molokai, Lanai, and Kahoolawe. Kalawao County includes a small part of Molokai, and its administration has been mostly merged with Maui County. Hawaii County includes the island of Hawaii. The state's population is distributed by county as shown in Table 1.

Table 1. Hawaii State population, by county

	1990	2000
Hawaii State	**1,108,229**	**1,211,537**
Kauai County	51,177	58,463
Honolulu County	836,231	876,156
Maui County	100,374	128,094
Kalawao County	130	147
Hawaii County	120,317	148,677

Source: U.S. Census Bureau.

Income generation in Hawaii is characterized by tourism, federal defense spending and, to a lesser extent, agriculture (Table 2). Tourism is by far the leading industry in Hawaii in terms of generating jobs and contributing to gross state product. The World Travel and Tourism Council (1999) estimates that tourism in Hawaii directly generated 134,300 jobs in 1999. This figure represents 22.6 percent of the total workforce. Agricultural products include sugarcane, pineapples (which together brought in $269.2 million in 1997), nursery stock, livestock, and macadamia nuts.

Table 2. Statistical summary of Hawaii's economy, 1994-1999

		1994	1995	1996	1997	1998	1999
Civilian Labor Force	Number	580,150	576,400	590,200	592,000	595,000	594,800
Unemployment	Percent	6.1	5.9	6.4	6.4	6.2	5.6
Gross state product in 1996 dollars	$ Millions	38,328	37,963	37,517	37,996	38,015	NA
Manufacturing Sales	$ Millions	2,026.1	2,045.0	1,724.1	1,468.8	NA	NA
Agriculture (all crops and livestock)	$ Millions	503.8	492.7	494.6	486.5	492.6	NA
Construction completed	$ Millions	3,317.3	3,153.3	3,196.4	2,864.9	NA	NA
Retail sales	$ Millions	15,237.7	15,693.3	16,565.0	16,426.0	NA	NA
Defense expenditures	$ Millions	3,876.8	3,782.5	3,883.5	4,074.9	4,103.7	4,174.2

Source: DBEDT 1999 and BOH 1999; reproduced from NMFS 2001b.

Median household income in Hawaii was calculated to be $40,827 in 1990, rising to $48,540 in 1998. Statewide per capita income in 1989 was calculated to be $15,770, rising to $25,684 in 1995 and $27,544 in 1999. The poverty rate in Hawaii grew more over the 1990s than in the nation as a whole. Despite this growth, Hawaii's poverty rate, which increased from 11.2 percent in 1988-89 to 12.4 percent in 1997-98, remained lower than the national rate (13.0 percent in 1997-98). Hawaii employment growth was virtually nil for most of the 1990s, continuing through to the end of 1998.

For several decades Hawaii benefited from the strength of regional economies around the Pacific that supported the state's dominant economic sector and principal source of external receipts – tourism (BOH 1999). In addition, industries of long-standing importance in Hawaii, such as the federal military sector and plantation agriculture, also experienced significant growth. However, Hawaii's economic situation changed dramatically in the 1990s. The state's main tourist market, Japan, entered a long period of economic malaise that caused the tourism industry in Hawaii to stagnate. The post-Cold War era brought military downsizing. Tens of thousands of acres of plantation lands, along with downstream processing facilities, were idled by the end of the decade due to high production costs. Employment in Hawaii sugar production fell by 20% between 1990 and 1993 and by an additional 50% from 1994 to 1995 (Yuen et al. 1997). Net out-migration became the norm in Hawaii, notwithstanding the state's appeal as a place to live. In 1998, the statewide unemployment rate was 6.2%, and unemployment on the island of Molokai reached 15% (DBEDT 1999).

As a consequence of the economic upheaval of the 1990s and the extensive bankruptcies, foreclosures and unemployment, Hawaii never entered the period of economic prosperity that many US mainland states experienced during the 1990s. Between 1998 and 2001 Hawaii's tourism industry recovered substantially, mainly because the strength of the national economy promoted growth in visitor arrivals from the continental US (Brewbaker 2000). However, efforts to diversify the economy and thereby make it less vulnerable to future economic downturns have met with little success, and the events of September 11, 2001 caused another strong downturn in tourism-associated activity from which the state has yet to recover. To date, economic development initiatives such as promoting Hawaii as a center for high-tech industry have attracted few investors. It is unlikely that any new major industry will develop in Hawaii in the near future to significantly increase employment opportunities and broaden the state's economy beyond tourism.

4.2.1.2 Fishing and fishing-related activities

The most recent estimate of the contribution of the commercial, charter and recreational fishing sectors to the state economy indicated that in 1992, these sectors contributed $118.79 million of output (production) and $34.29 million of household income and employed 1,469 people (Sharma et al. 1999). These contributions accounted for 0.25% of total state output ($47.4 billion), 0.17% of household income ($20.2 billion) and 0.19% of employment (757,132 jobs). However, in contrast to the sharp decline in some traditional mainstays of Hawaii's economy such as large-scale agriculture, the fishing industry has been fairly stable during the past decade. Total revenues in Hawaii's pelagic, bottomfish and lobster fisheries in 1998 were about 10% higher than revenues in 1988 (adjusted for inflation) in those fisheries.

Hawaii's fisheries include commercial, recreational, and charter sectors. Hawaii's commercial fishing sector includes a number of distinct fisheries. As shown in Table 3, the Hawaii longline fishery is by far the most important economically, accounting for 73 percent of the total estimated ex-vessel value of commercial fish landings in the state in 1999. The other components of the pelagics fisheries and the bottomfish, crustaceans, and precious corals fisheries accounted for relatively small shares of the landings and value of the state's commercial fisheries.

Table 3. Volume and value of commercial fish landings in Hawaii, by fishery, 1999

Fishery	Pounds landed (1,000s)	Percent of total pounds landed	Ex-vessel value ($1,000s)	Percent of total ex-vessel value
Pelagics				
Pelagic longline	28,300	75%	47,400	73%
Troll	2,960	8%	4,550	7%
Pelagic handline	2,340	6%	3,950	6%
Aku pole and line	1,450	4%	1,850	3%
MHI bottomfish handline	420	1%	1,300	2%
NWHI bottomfish handline	370	1%	1,210	2%
NWHI lobster trap	260	1%	1,040	2%
All other fisheries	1,650	4%	3,330	5%
Total	**37,750**	**100%**	**64,630**	**100%**

Source: Preliminary data compiled by NMFS Southwest Fisheries Science Center Honolulu Laboratory.

Small-boat fishermen can be categorized as being full-time commercial, part-time commercial, expense (selling fish only to try to cover trip expenses), and recreational. The contribution of expense and recreational fishing to the economy can be described in part by fishing-related expenditures. Total annual expenditures by recreational vessels were found to average about $6,000 per vessel in 1995-1996 (Hamilton and Huffman 1997). The direct economic effect of the recreational and expense fleets (sales plus direct expenditures) was estimated at about $18.4 million per year for 1995-1996 (NMFS 2001b). The majority was generated by pelagic fishing but bottomfishing was also important. Recreational and expense fishermen can be presumed to accrue enjoyment benefits over and above what they spend on fishing. For example, a study by Meyer Resources (1987) asked fishermen what their recreational fishing experience was worth to them in dollar terms; the study estimated the annual value of fishing trips to Hawaii recreational fishermen to be $347 million (in 1995 dollars).

Total gross revenues in the pelagics charter fishery, including charter fees and fish sales, were estimated in 1996-1997 at about $15 million per year (NMFS 2001b). Gross earnings for bottomfish trips were estimated to be about $340,000 per year (Hamilton 1998).

In addition to the values associated with direct revenues and expenditures, Hawaii’s fisheries also generate employment and income indirectly. The fisheries have economic impacts on businesses whose goods and services are used as inputs in the fisheries, such as fuel suppliers, chandlers, gear manufacturers, boatyards, tackle shops, ice plants, bait shops and insurance brokers. In addition, the fisheries have impacts on businesses that use fishery products as inputs for their own production of goods and services. Firms that buy, process or distribute fishery products include seafood wholesale and retail dealers, restaurants, hotels and retail markets. Both the restaurant and hotel trade and the charter fishing industry are closely linked to the tourism base that is so important to Hawaii’s economy. Finally, people earning incomes directly or indirectly from the fisheries make expenditures within the economy as well, generating additional jobs and income.

A more complete assessment of the contributions of the various fisheries to Hawaii's economy can be obtained by combining in-out multipliers and other coefficients (e.g., as estimated by Sharma et al. 1999) with estimates of total sales in order to estimate total output and jobs generated. These and related estimates are provided for the pelagic fisheries in NMFS (2001b). The multipliers and coefficients that can be applied to other fisheries are available in Sharma et al. (1999). A subsequent study (Leung & Pooley 2000) examines an alternative approach to the use of multipliers and presents revised estimates on the contributions of these results to Hawaii's economy.

4.2.2 Fishing in Hawaiian Society

This section describes the sociocultural setting of the fisheries in Hawaii, with the aim of tracing the history of fishing and describing some of the social and cultural factors that contribute to strong social and economic cohesion among people involved in fisheries – that is, factors that help make fishing communities.

The sociocultural aspects of a fishery include the shared technology, customs, terminology, attitudes and values related to fishing. While it is the fishermen that benefit directly from the fishing lifestyle, individuals who participate in the marketing or consumption of fish or in the provision of fishing supplies may also share in the fishing culture. An integral part of this framework is the broad network of inter-personal social and economic relations through which the cultural attributes of a fishery are transmitted and perpetuated. The relations that originate from a shared dependence on fishing and fishing-related activities to meet economic and social needs can have far-reaching effects in the daily lives of those involved. For example, they may constitute important forms of social capital – that is, social resources that individuals and families can draw on to help them achieve desired goals.

The products of fishing supplied to the community may also have sociocultural significance. For instance, beyond their dietary importance fish may be important items of exchange and gift giving that also help develop and maintain social relationships within the community. Alternatively, at certain celebratory meals various types of seafood may become imbued with specific symbolic meanings.

Finally, the sociocultural context of fishing may include the contribution fishing makes to the cultural identity and continuity of the broader community or region. As a result of this contribution the activity of fishing may have existence value for some members of the general public. Individuals who do not fish themselves and are never likely to may derive satisfaction and enjoyment from knowing that this activity continues to exist. They may value the knowledge that the traditions, customs and life ways of fishing are being preserved.

Over the past 125 years the sociocultural context of fishing in Hawaii has been shaped by the multi-ethnicity of local fisheries. Although certain ethnic groups have predominated in Hawaii's fisheries in the past and ethnic enclaves continue to exist within certain fisheries, the fishing tradition in Hawaii is generally characterized by a partial amalgamation of multi-cultural attributes. An examination of the way in which the people of Hawaii harvest, distribute and consume seafood reveals remnants of the varied technology, customs and values of Native

Hawaiians and immigrant groups from Japan, China, Europe, America, the Philippines and elsewhere.

4.2.2.1 Social aspects of fish harvest

Commercial fishing first became important in the Hawaiian Islands with the arrival of the British and American whaling fleets during the early nineteenth century. The whalers made the islands their provisioning and trading headquarters because of their central location in the Pacific (Nakayama 1987). This trade reached its zenith in the 1850s when more than 400 whaling vessels arrived in Honolulu annually (Shoemaker 1948). European- and American-owned trading concerns, called "factors," were established to service the whalers and gradually became the dominant enterprises in Honolulu. The significance of whaling to Hawaii's economy waned considerably during the late-nineteenth century by which time plantation agriculture centered on sugar and pineapple production had grown in importance. A number of the trading companies that supported the whaling industry, however, adjusted to these economic changes and remained at the heart of Hawaii's industrial and financial structure (Shoemaker 1948).

The introduction of a cash economy into Hawaii and the establishment of communities of foreigners in the islands also led to the development of a local commercial fishery. As early as 1832, it was the custom for fish and other commodities to be sold in a large square near the waterfront in Honolulu (Reynolds 1835). In 1851, the first regular market house for the sale of fishery products was erected (Cobb 1902). The territorial government replaced this market in 1890 with an elaborate structure that Cobb (1902:435) referred to as "one of the best [market houses] in the United States." Other fish markets were established on the islands of Maui and Hawaii.

Initially, commercial fishing in Hawaii was monopolized by Native Hawaiians, who supplied the local market with fish using canoes, nets, traps, spears and other traditional fishing devices (Jordan and Evermann 1902; Cobb 1902; Konishi 1930). However, the role that Native Hawaiians played in Hawaii's fishing industry gradually diminished through the latter half of the nineteenth century. During this period successive waves of immigrants of various races and nationalities arrived in Hawaii increasing the non-indigenous population from 5,366 in 1872 to 114,345 in 1900 (OHA 1998). The new arrivals included Americans, Chinese, Portuguese and Filipinos, but particularly significant in terms of having a long-term impact on the fishing industry was the arrival of a large number of Japanese. The Japanese, like the majority of the early immigrants, were contracted to work on Hawaii's sugar cane plantations. When contract terms expired on the plantations many of the Japanese immigrants who had been skilled commercial fishermen from the coastal areas of Wakayama, Shizuoka and Yamaguchi Prefectures in Japan turned to the sea for a living (Okahata 1971). Later, experienced fishermen came from Japan to Hawaii for the specific purpose of engaging in commercial fishing.

During much of the twentieth century Japanese immigrants to Hawaii and their descendants were preeminent in Hawaii's commercial fishing industry. The tightly knit communities that the first Japanese immigrants formed both helped ease the transition to American society and retarded the process of acculturation (Tamura, 1994). The Japanese were able to maintain their separate communities in Hawaii more effectively than any other immigrant group. Among those Japanese communities of particular significance were the settlements of commercial fishermen and their families in the Palama, River Street and Kākāʻāko areas of Honolulu adjacent to the harbor (Lind 1980).

The adherence of Japanese immigrants to traditional cultural practices included Japanese religious observances, and many of the religious activities of communities such as Kākāʻāko were centered on fishing (Miyasaki 1973). Various traditional Japanese taboos and rituals directed how a new fishing boat was to be launched, when a vessel could leave or return to port, what items could be brought on board a boat, and many other aspects of fishing behavior (Hamamoto 1928; Katamoto 1984). Over the years, succeeding generations of fishermen of Japanese ancestry in Hawaii became more "Americanized," but many Japanese fishing traditions persisted. For example, Japanese immigrant fishermen brought from Japan the Shinto practice of building a *jinsha* (shrine) dedicated to a deity such as *Konpira-sama* or *Ebisu-sama* (Kubota 1984; Miyasaki 1973). Today, an *Ebisu jinsha* constructed at Maʻalaea on the island of Maui during the early 1900s still stands, and fishermen of Japanese ancestry as well as others who share a common bond in fishing continue each year to ceremonially bless individual fishing vessels (Kubota 1984; T. Arine, Maui *Jinsha*, pers. comm. 2000).[6]

In addition to ethnic and community ties, the physical danger of fishing as an occupation also engendered a sense of commonality among fishermen. Describing the captains and crews of the early sampan fleet in Hawaii, Okahata (1971:208) wrote: "It is said that the fishermen were in a clan by themselves and were imbued with a typical seaman's reckless daring spirit of 'death lies only a floor board away.'" The extreme isolation of the NWHI and the limited shelter they offered during rough weather made fishing trips to these islands particularly hazardous.

As late as the 1970s, the full-time professional fishermen in Hawaii were predominately of Japanese descent (Garrod and Chong 1978). However, by that period hundreds of local residents of various ethnicities were also participating in Hawaii's offshore fisheries as part-time commercial and recreational fishermen. In addition, a growing number of fishermen from the continental U.S. began relocating to Hawaii. Many of the new arrivals came to the islands because declining catch rates in some mainland fisheries had led to increasingly restrictive management regimes. For example, many of the participants in the NWHI lobster fishery that was just starting to be developed in the late 1970s came from areas such as the Pacific Northwest where crustacean fisheries were experiencing declining catches (Clarke and Pooley 1988; Pooley 1993a).

The arrival of newcomers from outside the state and increasing ethnic diversity within Hawaii's commercial fishing industry diminished some of the social cohesiveness that existed among Hawaii's early commercial fishermen. Nevertheless, networks of relations among fishery participants are still present and have a significant effect on fishing activity. For example, various groups of fishermen are still represented by a *hui* or organization, and these voluntary associations continue to play an important role in Hawaii's fishing industry.

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[6] In some communities in Japan *Ebisu* is regarded specifically as the god of fishing, farming and commerce (Tokihiko 1983). He is depicted holding a fishing rod in his right hand and a sea bream under his left arm.

4.2.2.2 Motivations for fishing

The motivations for fishing among contemporary Hawaii fishermen tend to be mixed even for a given individual (Glazier 1999a). In the small boat fishery around the MHI the distinction between “recreational” and “commercial” fishermen is extremely tenuous (Pooley 1993a). Hawaii’s seafood market is not as centralized and industrialized as US mainland fisheries, so that it has always been feasible for small-scale fishermen to sell any or all of their catch for a respectable price. Money earned from part-time commercial fishing is an important supplement to the basic incomes of many Hawaii families.

It is also important to note that many people in Hawaii who might be considered “commercial” fishermen hold non-fishing jobs that contribute more to their household income than does fishing (Pooley 1993a). For some fishermen non-fishing jobs are not a choice, but a necessity due to the inability to earn an adequate return from fishing. Many participants in Hawaii’s offshore fisheries often catch insufficient fish to cover even fuel, bait and ice expenses, but they continue fishing simply for the pleasure of it. Some go so far as to pursue non-fishing occupations that allow them to maximize the time they can spend fishing regardless if it is profitable or not (Glazier 1999a).

Even those fishermen who rely on fishing as their primary source of income have other reasons for their occupational choice besides financial gain. For example, fishermen may enjoy the independent lifestyle. Fulfillment of social obligations may also at times be an important reason for fishing. Fish are an important food item among many of the ethnic groups represented in Hawaii, especially during various social events. Fishermen are expected to provide fish during these occasions and may make a fishing trip especially for that purpose (Glazier 1999a).

Finally, some Hawaii fishermen feel a sense of continuity with previous generations of fishermen and want to perpetuate the fishing life style. This sense of tradition is reflected in the importance placed on the process of learning about fishing from “old timers” and transmitting that knowledge to the next generation. A recent sociocultural survey of small trolling vessel captains in Hawaii found that many of those interviewed either descend from long time fishing families or have worked in fishing or fishing-related work since they were in their teens (Glazier 1999a). The average captain had almost 18 years of offshore fishing experience. The survey found that 35% of boat captains were taught how to fish by their fathers, grandfathers or uncles, while 32% reported being taught by friends (Glazier 1999a). Only 14% indicated that they taught themselves. Most Hawaii fishermen consider knowledge and experience to be more important factors in determining fishing success than “high-tech” gear. An example of the value placed on information passed down from previous generations of fishermen is the monument that one town on Oahu has recently proposed to commemorate the *kūpuna* (elders) of that area who are recognized for their fishing skills and knowledge (Ramirez 2000).

Whatever the motivations for fishing, the contributions of friends and family members to these efforts are often substantial. Small boat fishing in Hawaii is almost always a cooperative venture involving friends or relatives as crew members (Glazier 1999a). In addition, wives, in particular, often play an essential role in shore-side activities such as the transport of fish to markets, purchase of ice, vessel maintenance, bookkeeping and so forth (Glazier 1999a).

In Hawaii during the past several years there have been a number of highly publicized clashes between the owners of large and small fishing boats and between fishermen who are newcomers and those who are established residents (Glazier 1999a). The reasons for these conflicts are complex, but the perception that the state's marine resources are being damaged and depleted by certain groups of fishermen is a central factor. Fish landing statistics support the notion that catch rates in some fisheries are on the decline. Many fishermen have found that fishing is no longer a profitable enterprise and have dropped out of the industry (Glazier 1999a). The situation is aggravated by a depressed state economy that has made it more difficult for many fishermen to find the financial resources to support marginal fishing operations.

In some cases, government regulations have helped alleviate competition among fishermen. In 1991, for example, a longline vessel exclusion zone ranging from 50 to 75 nm was established around the MHI to prevent gear conflicts between large longline vessels and small troll and handline boats. However, government regulations have also added to the level of tension and feelings of frustration among fishermen. For instance, many fishermen in Hawaii have adjusted to natural variations in the availability of various types of fish by adopting a multi-species, multi-gear, highly flexible fishing strategy. However, this strategy is increasingly constrained by the implementation of limited access programs in Hawaii's major commercial fisheries (Pooley 1993a).

Despite this highly competitive and divisive environment fishermen have been able to develop and maintain networks of social relations that foster collaboration and mutual support. For example, fishermen's attempts at organizing to promote their shared interests, whether in the market or lobbying government for changes in policy, have generally been fragmented. Nevertheless, some fishermen in Hawaii are represented by a *hui* or organization, and these voluntary associations often facilitate coordination and cooperation for the mutual benefit of their members. One example is the Maui Cooperative Fishermen's Association, which is comprised of bottomfish fishermen, many of whom are part-timers. Another example is the Hawaii Longline Association, which was organized in 1999 to promote the interests of longline vessel owners, captains and deckhands. The association has 600 members, and all ethnic groups that participate in the longline fishery are represented (NMFS 2001b). Another is the *hui* that permit holders in the NWHI lobster fishery formed in 1998. The members of the association negotiated an agreement whereby some permit holders consented to forego the 1998 season in exchange for a share of the revenues earned by those who would participate in the fishery (WPRFMC 2001d).

Glazier (1999a) observed that membership in a Hawaii fishing *hui* can instill a strong feeling of camaraderie and solidarity among fishermen. The cohesion within these organizations constitutes available social capital for both their members and the broader community. For example, fishing clubs often organize or participate in community service projects (Glazier 1999a). Examples of more ad hoc forms of cooperation among fishermen are also common. For instance, fishermen may take turns trucking each other's fish from distant landing sites to the central fish auction in Honolulu, thereby reducing transportation costs (Glazier 1999a).

Close social relationships also continue to be maintained between some fishermen and fish buyers. For example, small boat fishermen on Kauai and the Kona side of the island of Hawaii tend to sell their catch directly to local buyers who, in turn, sell it to restaurants or retail markets

(Glazier 1999a). By sending their fish directly to dealers fishermen not only avoid the commission charged by the auction but also enjoy the price stability over the long-term that comes with an established reciprocal relationship. As Peterson (1973:59) noted, "A fisherman feels that if he is 'good to the dealer' in supplying him with fish that he needs to fill his order, 'the dealer will be good to him' and give him a consistently fair price for his fish."

4.2.2.3 Social aspects of fish distribution and consumption

Archaeological evidence indicates that seafood was part of the customary diet of the earliest human inhabitants of the Hawaiian Islands (Goto 1986). An early European visitor to Hawaii observed that, "There is no animal food which a Sandwich Islander esteems so much as fish" (Bennett 1840:214). Nineteenth century immigrants to Hawaii from Asia also possessed a culture in which fish was an integral part of the diet. Despite the "exorbitant" fish prices that Hawaii residents have often encountered in the markets, the level of consumption of seafood in the islands has historically been very high. One early commentator noted:

> *In the Honolulu market 2,000,000 pounds of fresh salt water fish valued at $5,000,000 are sold annually. These figures represent a high price for a food that abounds in the waters all around the Islands, yet the people of this community, who are great lovers of the products of the sea, will gratify their tastes even at this expense* (Anon. 1907:17).

Today, per capita seafood consumption in Hawaii is approximately 41.2 pounds per year, or nearly three times higher than the national average of 15 pounds per year (Shomura 1987; USDA 2000).

Because seafood was such a significant item in the diets of local residents, the fish markets themselves became important institutions in Hawaii society. Dole (1920:20) noted that the fish market located in the busiest section of Honolulu was more than a commercial establishment, it was also "…Honolulu's political center where impromptu mass meetings were held …; it was, in a way, a social center also, especially on Saturdays for then business was at its height." Much of the retailing of fish now occurs through self-service supermarkets, but Honolulu's fish markets have endured and continue to be centers of social interaction for some island residents.

The fish markets are comprised of retail units the, majority of which are single proprietorship-family type operations. Close social connections have developed between retailers and consumers, as the success of the dealers is largely a function of their ability to maintain good relations with their customers and maintain a stable clientele (Garrod and Chong 1978). One journalist wrote of the Oahu Market, where fresh fish and produce have been sold for nearly a century: "In the hustle and bustle of daily life in downtown Honolulu, many people are drawn to Oʻahu Market because of its informal charm and the feeling of family one gets while shopping there" (Chinen 1984:9).

Early in the last century Bryan (1915) developed a list of the various fish purchased in the Honolulu market by each of Hawaii's principal "nationalities." The ethnic identification of Hawaii's *kamaʻāina* (long-time residents) with particular species has continued to the present day. The large variety of fish typically offered in Hawaii's seafood markets reflects the diversity of ethnic groups in Hawaii and their individual preferences, traditions, holidays and celebrations.

Many of the immigrant groups that came to Hawaii brought with them cultures in which fish are not only an integral part of the diet but given symbolic and even transformative connotations. Certain fish communicate messages of solidarity, favor, opulence and the like, or are believed to impart specific desirable traits to the diners (Anderson 1988; Baer-Stein 1999). For example, some types of fish that are red in color have found acceptance within the Japanese community in Hawaii as a substitute for red *tai* (sea bream, *Pagrus major*) – a traditional Japanese symbol of good luck and, therefore, an auspicious fish to be served on festive occasions (HDAR 1979; Shoji 1983). The red color of these fish also symbolizes prosperity and happiness.[7] The December peak in landings of certain species reflects the demand for them as an important dish in feasts celebrating *Oshogatsu* (Japanese New Year's), considered the most important cultural celebration for people of Japanese ancestry in Hawaii. Serving these fish is also important during non-seasonal events such as wedding and birthday banquets. For Hawaii residents of Chinese descent fish or "*yu*" is an important item during feasts celebrating *Tin nien* (Chinese lunar New Year) and other ritual observances, as it is a homophone for abundance (Choy 1989). Fish also symbolize regeneration and freedom because of their rapid ability to propagate as well as their speed and unconfined lifestyle (Baer-Stein 1999). Fish with white, delicately flavored flesh are in particularly high demand by the Chinese community during New Year celebrations and other festive occasions (Peterson 1973).

An insistence on quality, as well as quantity and variety, has also long been a hallmark of Hawaii's seafood markets. For example, the Japanese immigrants to Hawaii came from a society in which fishermen, fish dealers and even cooks typically handle prized fish with considerable care (Joya 1985). Hawaii seafood consumers continue to demand fresh fish. Both the discriminating tastes of local residents and the symbolic meaning with which some fish are imbued are linked to the importance of fish as gifts from one person or family to another. In Hawaii various types of high-priced fish such as red snapper are highly regarded as gifts (Peterson 1973). Such sharing and gift giving may play an important role in maintaining social relations, as exemplified by the traditional Japanese obligation to engage in reciprocal exchanges of gifts according to an intricate pattern of established norms and procedures (Ogawa 1973). Those who neglect the obligation to reciprocate risk losing the trust of others and eventually their support.

The sharing of fish among members of the extended family and community is also an early tradition of the indigenous people of Hawaii. The social responsibility to distribute fish and other resources among relatives and friends remains a salient feature of the lives of many Native Hawaiians that is enacted on both a regular basis and during special occasions (Glazier 1999a). Among Native Hawaiians fish is considered a customary food item for social events such as a wedding, communion, school graduation, funeral or child's first birthday (baby *lū'au*) (Glazier 1999a).

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[7] The reason *tai* is regarded as a celebratory fish among Japanese is thought to be due not only to its beauty of form and color but also because "*tai*" suggests the word "*medetai*," meaning auspicious (Shoji 1983).

4.2.2.4 Social significance of fishing to the broader community

Commercial fishing has been part of Hawaii's economy for nearly two centuries. Long-established fishing-related infrastructure in Honolulu such as the fish markets and Kewalo Basin mooring area has helped define the character of the city. Moreover, for some major ethnic groups in Hawaii such as the Japanese and Native Hawaiians the role that their forebears played in the development of commercial fisheries in the islands remains an important part of their collective memory. In 1999, for example, the Japanese Cultural Center of Honolulu organized an exhibition commemorating the past involvement of Japanese in Hawaii's commercial fishing industry.

Given the historical significance of commercial fishing in Hawaii, it likely that some local residents consider the fishing industry to be important in the cultural identity and heritage of the islands. Individuals who have never fished and do not intend to may nonetheless value the knowledge that others are fishing and that this activity is continuing to contribute to Hawaii's social, cultural and economic diversity. This existence value may be expressed in various ways. For example, some individuals may engage in vicarious fishing through the consumption of books, magazines and television programs describing the fishing activities that others are pursuing in the waters around Hawaii.

Just as Hawaii's fishing tradition is an integral part of the islands' heritage and character, the image of Hawaii has become linked with some types of locally caught seafood, such as the bottomfish species ō*pakapaka* and *onaga*. The continued availability of these seafoods in Hawaii has important implications for the mainstay of the state economy - tourism.[8] Many Japanese tourists visiting Hawaii want to enjoy the traditional foods and symbols of prosperity of Japan while they vacation in Hawaii, including various types of high quality fresh fish (Peterson, 1973). Hawaii tourists from the US mainland and other areas where fish is not an integral part of the customary diet typically want to eat seafood because it is perceived as part of the unique experience of a Hawaii vacation. For both Japanese and US mainland tourists, the experience of consuming fish in Hawaii may be enriched if the fish eaten is actually caught in the waters around Hawaii. Suryanata (2000) observes that markets within the state for "grown in Hawaii" products have expanded in the past decade through the proliferation of gourmet restaurants that feature "Pacific Rim" and "Hawai'i Regional Cuisine." This marketing strategy eschews traditional symbols constructed by the tourism industry in favor of inciting an appreciation of the social relationships and physical environment that make Hawaii a unique place.

Suryanata (2000) also notes that place-based specialty food can retain its appeal to buyers beyond a vacation period or even attract buyers who have never been to the place in question. Just as a consumption of organic food may signify a commitment to a certain environmental and

[8] Suryanata (2000) notes that many attributes of Hawaii have been constructed in the marketing of Hawaii by the tourist industry, and unusual or exotic food complements the marketed image. In describing the current initiative to revive Hawaii's agricultural sector by diversifying into high-value non-traditional export crops, such as tropical flowers, gourmet coffee and tropical specialty fruits, she writes "None of these products is unique to Hawai'i in a true sense to merit a higher price, but marketing strategies seek to define a strong place-association of these products with Hawai'i, to capitalize on Hawai'i's exotic image and to develop niche markets for specialty products from paradise." This statement is equally true for locally produced seafood sold in Hawaii.

social value, a consumption of products from Hawaii can symbolize a partial fulfillment of a desire to experience or relive a Hawaii vacation. According to a national seafood marketing publication, the power of this constructed value to influence prospective buyers has not been lost on Hawaii's seafood dealers:

> *When it comes to selling seafood the Hawaiians have a distinct advantage. Their product comes with built-in aloha mystique, and while they've emphasized the high quality of the fish taken from their waters, they've also taken full advantage of the aura of exotic Hawaii itself in promotion on the mainland and, now, in Europe* (Marris 1992:75).

Local production of food as opposed to a reliance on imports also creates opportunities to foster social connections between consumers and their food producers. As noted above, much of the retailing of fish in Hawaii now occurs through supermarkets, and a large quantity of the seafood sold is imported. However, there still exists in Hawaii personal connections between consumers and the individuals who harvest and retail fish. Such connections may have broad public value. For example, a recent article by agricultural researchers identified proximity as one of the key attributes of a sustainable food system:

> *A sustainable food system is one in which "food is grown, harvested, processed, marketed, sold, [and] consumed as close to home as possible." An emphasis on locally grown food, regional trading associations, locally owned processing, local currency, and local control over politics and regulation is found within a proximate system. A proximate food system will have "grocery stores close to home which carry local items with little or no corporately owned products to compete," and would provide "specialty items that characterize the bioregion"* (Kloppenburg et al. 2000:182).

Today, the people who participate in fishing and fishing-related services and industries in Hawaii comprise an ethnically mixed and spatially dispersed group numbering thousands of individuals, although actual numbers are difficult to ascertain. Most are year-round residents of Hawaii, but some maintain principal residences elsewhere.

4.3 Geographical Aspects of Communities in Hawaii

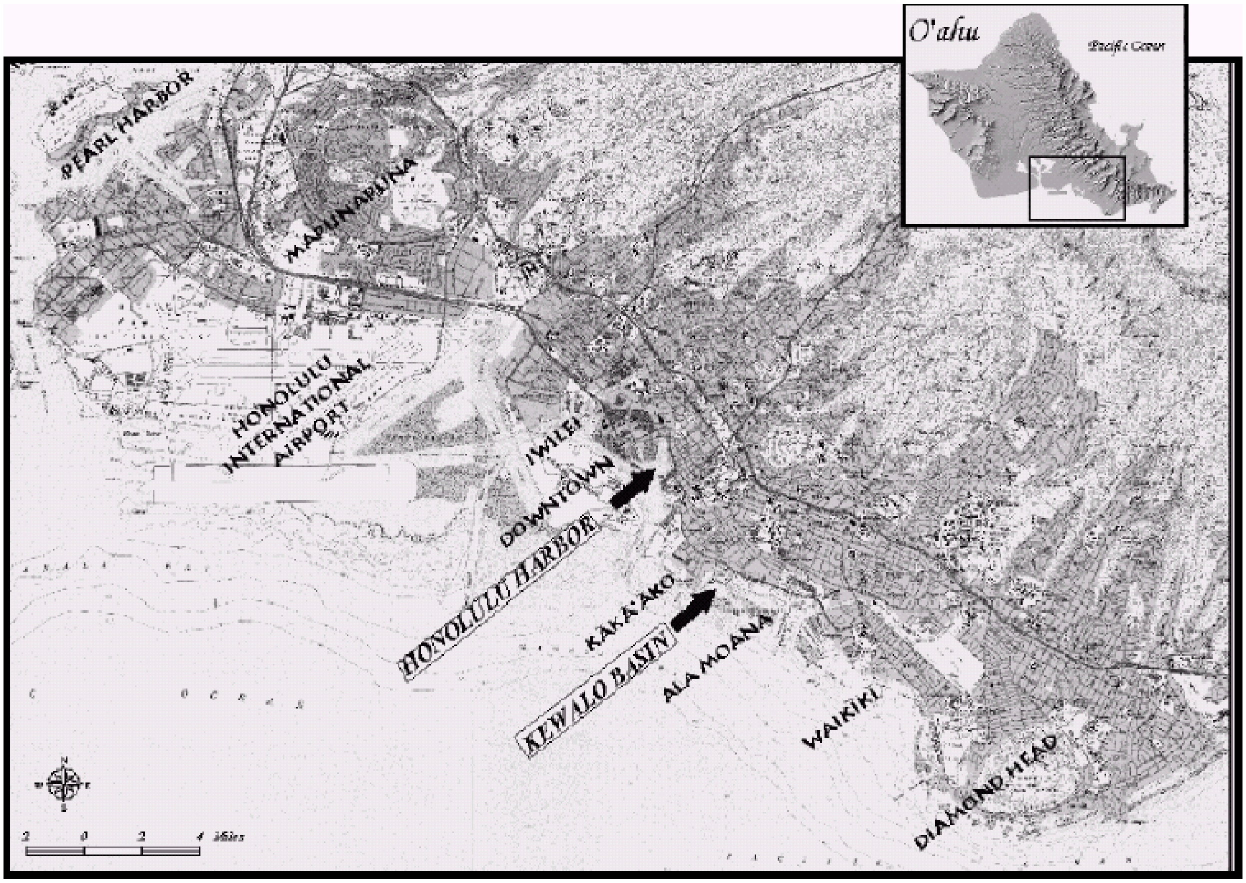
As defined under the MSA, a fishing community occupies a specific geographic location. In this section is an examination of the geographical distribution of fishery participants and fishing-related activities in Hawaii. Examined is the distribution of vessel departure sites, fish landing sites, residences of permit and license holders, and locations of fish processing facilities and markets. Other factors that contribute to social cohesiveness, or "community-making," at specific geographic scales are also discussed.

4.3.1 Vessel Departure Sites

Prior to World War II the bulk of Hawaii's commercial fishing fleet was found on Oahu, moored at Kewalo Basin in Honolulu. After the war, fishermen had to increasingly compete with the tourism industry for shoreline space and facilities. By the 1970s, Kewalo Basin still provided berthing for about 150 vessels, but that included many boats engaged in tourist-oriented water activities such as charter fishing, dinner cruises, and whale-watching. As new longline boats arrived from the US mainland during the fishing industry expansion of the 1980s, the majority of vessels were relegated to a portion of Honolulu Harbor, the largest and most important of the state's commercial harbors.

New piers were designed and constructed in the harbor to accommodate the growing fishing fleet. At present, however, the majority of longline vessels continue to offload their catch at Kewalo Basin because it is closer to the fish auction, United Fishing Agency, Ltd. Honolulu Harbor lies about a mile west of Kewalo Basin along the same stretch of waterfront abutting the city of Honolulu's central business district. While Kewalo Basin is designed to accommodate fishing and pleasure vessels, the main purpose of Honolulu Harbor is to service large container vessels transporting goods to and from Hawaii. Nevertheless, NMFS treats Honolulu Harbor and Kewalo Basin as the same "port" for the purpose of compiling fishery statistics for the annual publication, "Fisheries of the United States." Figure 1 illustrates the location of Honolulu Harbor and Kewalo Basin with respect to the greater Honolulu area.

Figure 1. Kewalo Basin and Honolulu Harbor and the greater Honolulu area



There exists little documentation on which harbors are considered by participants in Hawaii's commercial fisheries to be their "home ports." In the case of large vessels, US Coast Guard records are used by NMFS to derive home port data. Until recently, the place of vessel construction was listed as the home port. Within the past few years, a "hailing port" designation has been added for new vessels, but this information is not available for the older portion of the fleet.

Discussions with fishing industry representatives indicate that the shore-side base of the Hawaii-based longline fishery continues to be primarily situated in Honolulu. During the past few years twenty or so longline vessels that targeted swordfish regularly shifted to California during the fall months, and occasionally longliners targeting tuna offload in Hilo. However, the bulk of the longline fleet is based in Honolulu year round. Honolulu is also the most important base for most of the other large-vessel fleets, including the NWHI bottomfishing and lobster fishing fleets. It appears that all but three of the NWHI bottomfish vessels are based at Kewalo Basin; the other three operate out of Port Allen Harbor on Kauai. Although not based in the Hawaii State, 10 to 15 albacore trollers periodically use the facilities in Honolulu Harbor. Five of the seven vessels participating in Hawaii's *aku* pole-and-line fishery are berthed in Kewalo Basin. In addition, a substantial number of foreign fishing vessels find Honolulu Harbor an attractive and convenient location for port calls. These vessels are prohibited under the Nicholson Act from off-loading fish in Honolulu, but they often purchase fuel, provisions and other goods and services. It is estimated that foreign fishing vessels made 316 port calls in Honolulu in 1998. In the mid and late 1990s, these vessels also were involved in the transshipment through Honolulu each year of an estimated 120 metric tons (mt) of shark fins worth $2.6 million. The fins were transferred at sea from the fishing boats to foreign tankers, which also re-supplied the fishing boats with fuel and provisions purchased in Honolulu. US-flag vessels, including some Hawaii-based longline boats, were then contracted on a casual basis to transport the shark fins from the tankers to shore-side facilities. Typically, the contracted vessels met the tankers as they were heading into Honolulu and received the cargo of fins in international waters (McCoy and Ishihara, 1999).

Charter fishing vessels, which primarily engage in pelagic trolling but also do bottomfishing, are based in a relatively small number of harbors convenient for tourists and other patrons. The geographic distribution of moored-vessel respondents to a 1996-1997 survey of charter vessels (Hamilton 1998) is shown in Table 4. Honokohau on the island of Hawaii appears to be the base for the largest number of moored charter vessels, followed by Kewalo Basin on Oahu and Lahaina on Maui. In addition to moored vessels, about 27 trailered vessels are used for charter fishing.

Table 4. Distribution of moored charter vessels in Hawaii, 1996-1997

Island	Boat harbor	Number of vessels
Hawai‘i	Honokohau	28
O‘ahu	Kewalo Basin	13
Maui	Lahaina	11
	Ma‘alaea	4
Kaua‘i	Nawiliwili	4
	Port Allen	1
Moloka‘i	Kaunakakai	1

Source: Hamilton (1998); reproduced from NMFS (2001b).
Includes only the respondents to a 1996-1997 cost-earnings survey.

The pelagic troll and handline fleets and the portion of the bottomfishing fleet that confines itself mostly to the MHI are made up of relatively small vessels, most of which are trailered rather than moored. One reason is that harbor mooring facilities tend to be expensive. But also important is the advantage of being able to utilize different launching ramps in different parts of a given island (Hamilton and Huffman 1997). This mobility significantly increases the fishing ranges of small boats (Glazier, 1999). For example, a “run” of *ahi* on another side of an island can be much more easily accessed by launching a trailered vessel from the other side than by running the boat all the way around the island. Although the shore-side facilities may be limited at many ramps and harbors, the extensive network of launching sites provides fishermen living anywhere on a given island ready access to multiple fishing grounds. Glazier (1999a) identified 55 ramps and harbors used by fishing boats in Hawaii (listed in Table 5 and illustrated in Figures 2 through 6). This number does not include numerous other private boat mooring and launching facilities. Many of these facilities consist of simple boat ramps in relatively isolated locations. Even some of the large, well-developed harbors, such as Honokohau, are remote from any central business district or residential area. However, fishermen find these facilities to be attractive launching sites because of their proximity to fishing grounds. The relative attractiveness of the facilities typically changes throughout the year as weather and sea conditions and other factors change.

Table 5. State- and county-owned harbors and boat ramps, by island

Facility	Location	Description
O‘ahu		
Ala Wai	Honolulu (Waikiki)	The state-owned Ala Wai has 699 berths and 63 moorings mostly for sailboats, motor yachts and charter fishing-sized vessels. There is one launch ramp.
Kewalo Basin	Honolulu	Kewalo is home to O‘ahu’s primary charter fleet. The fleet shares the harbor with various longline vessels, O‘ahu’s *aku* pole and line fleet, other commercial fishing vessels, and tour and parasailing boats.
Ke‘ehi Harbor and Lagoon	Honolulu (near airport)	State-owned Keehi Harbor and Lagoon has 355 berths and 360 moorings. Three launch ramps make the harbor a favored point of south shore ocean access for small trolling vessels.
Waianae	Waianae, Leeward Coast	The state-owned Waianae Boat Harbor is one of the island’s primary small vessel harbor and ramp access points. The harbor has berthing spaces for 146 vessels.
Hale‘iwa	North Shore	Haleiwa Boat Harbor is a state-owned harbor and anchorage in Waialua District on O‘ahu’s North Shore. The harbor has some 85 berthing and mooring spaces.
Kahana Bay	Windward (central)	Kahana Bay facility consists of a single launch ramp.
He‘eia Kea	Windward O‘ahu, just N of Kane‘ohe	The harbor is home to some 40 small vessels. The three-lane ramp facility attracts fishers from many points on O‘ahu’s Windward coast.
Kailua	Windward O‘ahu, between Kailua and Lanikai	Kailua Ramp is a county-owned, single lane launch ramp.
Maunalua Bay	Southeast coast at Hawai‘i Kai	Maunalua has two launch ramps.
Hawai‘i		
Mahukona	North Kohala	This county-owned facility consists of a one-lane launch ramp providing access to the nearshore waters of North Kohala and Alenuihaha Channel.
Kawaihae	Kohala Coast	Kawalhae is a state-owned harbor facility situated near the intersection of Queen Kaahumanu Highway and Kawaihae Road. There are 52 mooring spaces here, and one single-lane launch ramp.
Puako	Kohala Coast	The facility at Puako is a state-owned single-lane launch ramp. It is situated within Puako Bay along Queen Kaahumanu Highway.
Honokohau	Kailua-Kona	Honokohau is a large state-owned harbor facility in North Kona. Charter operations dominate the 155 mooring spaces here, though some small troll vessels are also moored. There is a high volume of small troll vessel usage at the four-lane launch ramp here.
Kailua-Kona	North Kona	This state-owned facility is located in the heart of Kailua-Kona. There is one single-lane launch ramp and nine berthing spaces.
Keauhou	Central Kona	Keahou Harbor facility is a two-lane state-owned launch ramp located about six miles south of Kailua-Kona. There is a two-lane launch ramp, four berthing spaces, and 24 mooring spaces.
Honaunau	South Kona	There is a single-lane county-owned launch ramp at Honaunau in South Kona.
Ho‘okena	South Kona	This is a single-lane ramp.
Milol‘ii	South Kona	This launch ramp is actually a natural feature of the shoreline.
Kaulana Bay (Ka Lae or South Point)	Kau	This is a state-owned launching area.

Facility	Location	Description
Punalu‘u	Kau	This is a privately owned ramp.
Poihiki	Puna	A high percentage of vessels participating in Hawai‘i’s ika-shibi fishery operate from the harbor at Isaac Hale State Park.
Radio Bay	South Hilo	This state-owned anchorage in South Hilo has 12 mooring spaces.
Reed’s Bay	South Hilo	The state-owned anchorage here has 25 mooring spaces but no launch ramp.
Wailoa Sampan Basin	South Hilo	This state-owned facility has 12 berthing spaces.
Wailoa	South Hilo	Wailoa is a state-owned harbor facility that has a two-lane launch ramp and 42 mooring spaces.
Waiakea	South Hilo	This is a single-lane launch ramp.
Lapahoehoe	North Hilo	There is a county-owned ramp facility.
Kaua‘i		
Hanalei Bay	Hanalei Valley, North Shore	Trailered boats may be put in at a one-lane county-maintained launch ramp along the river.
‘Anini	North Shore	A one-lane county-maintained launch ramp allows ocean access to small vessels.
Waiakaea Channel	Windward (east)	This state-owned two-lane launch ramp is located in Kapaa.
Wailua Marina	Windward (east)	Boat tour companies lease land from the state to operate a small ramp and private marina at the eastern terminus of Wailua River in Wailua.
Kaumuali‘i	Windward (east)	This state-owned area is located in Kawaihua Judicial District.
Wailua	Windward (east)	This one-lane state-owned launch ramp is located across the river from the Wailua Marina.
Hanamaulu	Windward (east)	This country-owned single-lane launch ramp affords access to the ocean near Hanamaulu Stream.
Niumalu	Windward (southeast)	Niumalu access launch ramp is county owned.
Nawiliwili	Windward (southeast)	The state-owned facility has a two-lane launch ramp, 20 berthing spaces and 15 mooring spaces. A small charter fleet, numerous sailing vessels, and a few small vessel commercial troll and bottomfish fishing operations moor here.
Koloa	South	Koloa Landing is a county-owned single-lane launch ramp facility situated at the terminus of Waikomo Stream.
Kukui‘ula	South	Kukui‘ula facility is state-owned, single-lane launch ramp and nine mooring spaces.
Port Allen	South (central)	This state-owned boat harbor is located in a commercial area in Koloa District. There is a two-lane launch ramp facility here, and 34 berthing spaces. Two charter vessels operate regularly from the harbor, as do some small commercial fishing operations.
Makaweli	South (westerly reach)	This small private launch ramp with anchorage is located at the terminus of Makaweli River at Waimea.
Kiki a Ola	South (westerly reach)	Kiki a oOa is a state-owned facility at Waimea. There is a single-lane launch ramp and eight mooring spaces.
Maui		
Mala Wharf	West Maui (central northern)	Mala is a small facility just north of Lahaina, regularly used by the small vessel troll fleet and increasingly by tour boat operations. The state-owned facility has 2 launch ramps and anchorage.
Lahaina Anchorage	West Maui (central northern)	Lahaina Harbor is a state-owned facility situated in the midst of the tourist district in Lahaina. Consequently, the many tour and charter boats based here benefit from considerable walk-up traffic. There is relatively little small troll vessel usage of the harbor. The facility has 21 berthing spaces and 78 moorings.
Ma‘alaea	Wailuku (southwest)	The facility has 31 berthing spaces and 66 mooring spaces.

Facility	Location	Description
Kalama	Wailukua	This is a one-lane ramp facility located in Wailuku District.
Kihei	Wailuku (south shore)	The state-owned facility at Kihei is a two lane launch ramp that provides assess to areas around Molokini Island and ‘Alalakeiki Channel.
Hana Bay	Hana (central)	Hana Bay is a natural harbor located just south of Nanu‘alele Point, the easternmost tip of Maui. This state-owned facility is a one-lane launch ramp that allows access to waters along the rugged coastline.
Ke‘anae	Hana (north shore)	Ke‘anae is a county-owned one lane launch ramp located near Ke‘anae Point.
Maliko	Makawao (north shore)	Maliko is a state-owned one-lane ramp facility at Maliko Bay in Makawao District.
Kahului	Wailuku (western, north shore)	Kahului is the primary commercial harbor serving Maui. One small troll vessel regularly uses dockage here to sell its catch to local restaurants. In-transit and emergency mooring is offered to small vessels.
Moloka‘i		
Kaunakakai Harbor	South Shore (central)	This state-owned harbor has one launch ramp, 3 berthing spaces, and 29 moorings. A number of small pelagic troll vessels and one charter boat are moored here.
Hale o Lono	South Shore (western)	Small vessels launch here despite the absence of structural launching facilities.
Kalaupapa	North Shore (central)	Use of this harbor and anchorage facility is restricted to operations associated with Kalaupapa National Historic Park.
Lana‘i		
Manele	South Shore (southeast)	This state-owned facility has one launch ramp and 28 berthing spaces.
Kaumalapau	West Coast (southwest)	This privately-owned facility has a small harbor and anchorage.

Source: Glazier (1999a); reproduced from NMFS (2001b).

Figure 2. Locations of harbors, boat ramps, and anchorages on Oahu

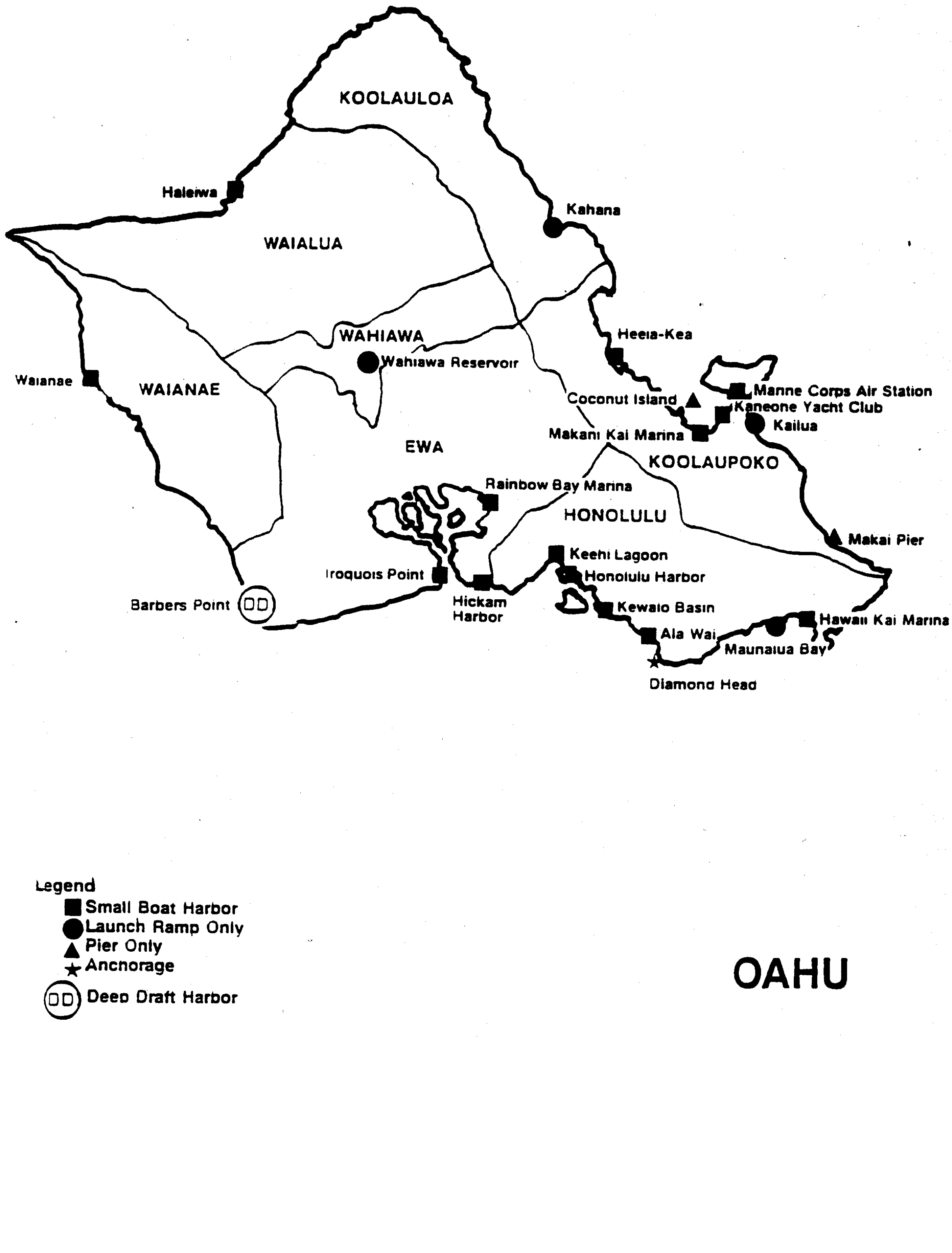


Figure 3. Locations of harbors, boat ramps, and anchorages on Hawaii

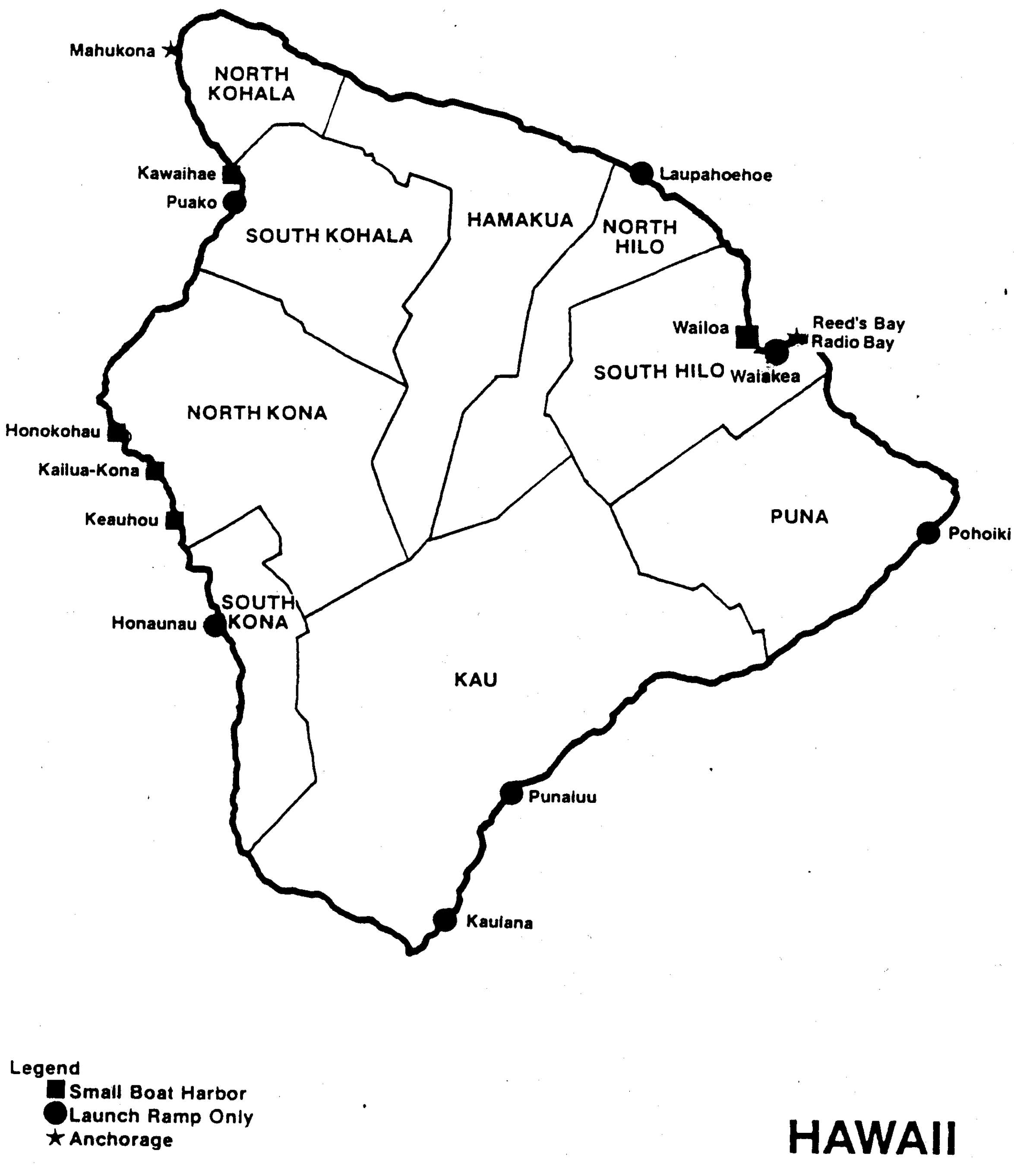


Figure 4. Locations of harbors, boat ramps, and anchorages on Kauai

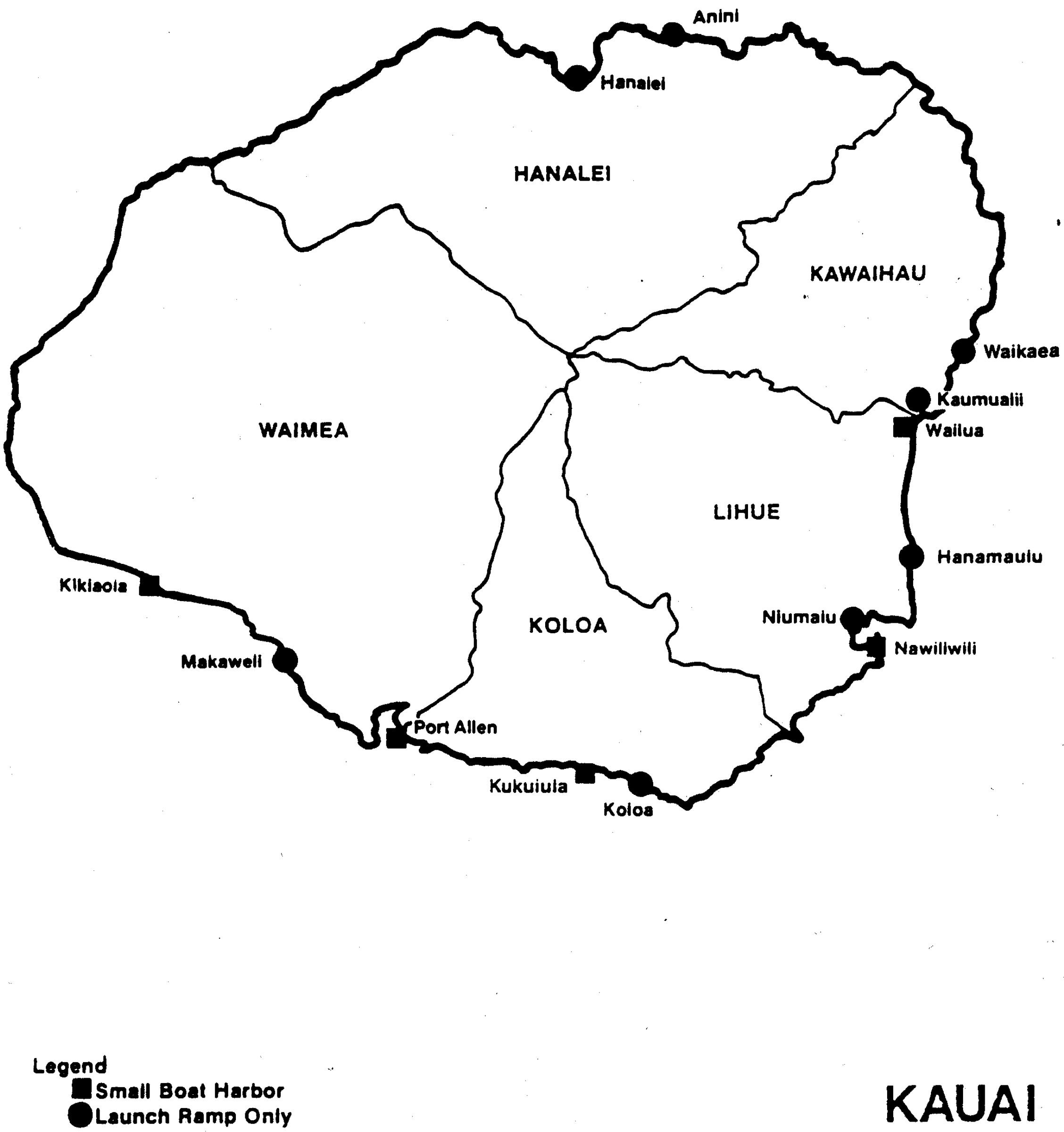


Figure 5. Locations of harbors, boat ramps, and anchorages on Maui

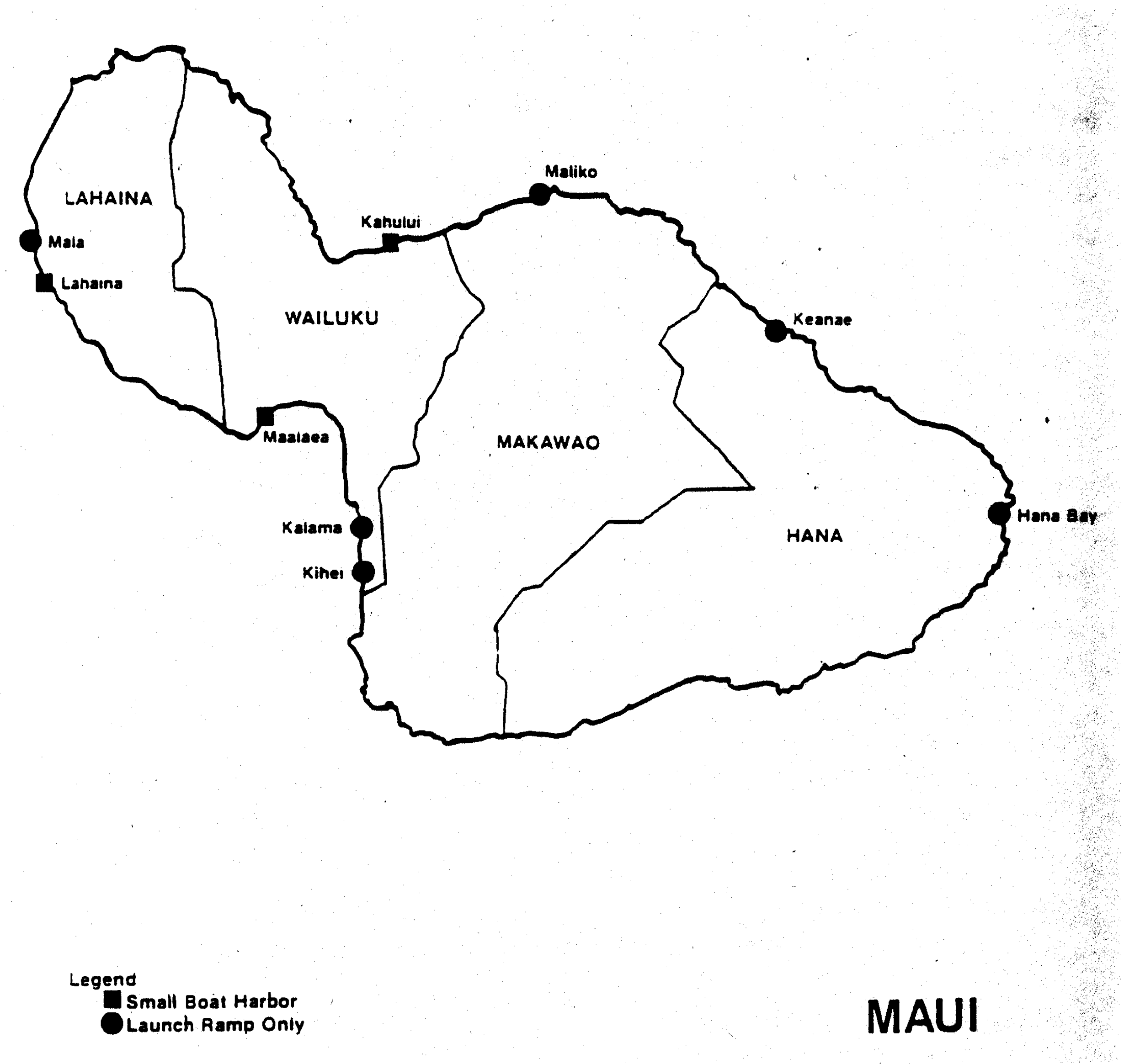
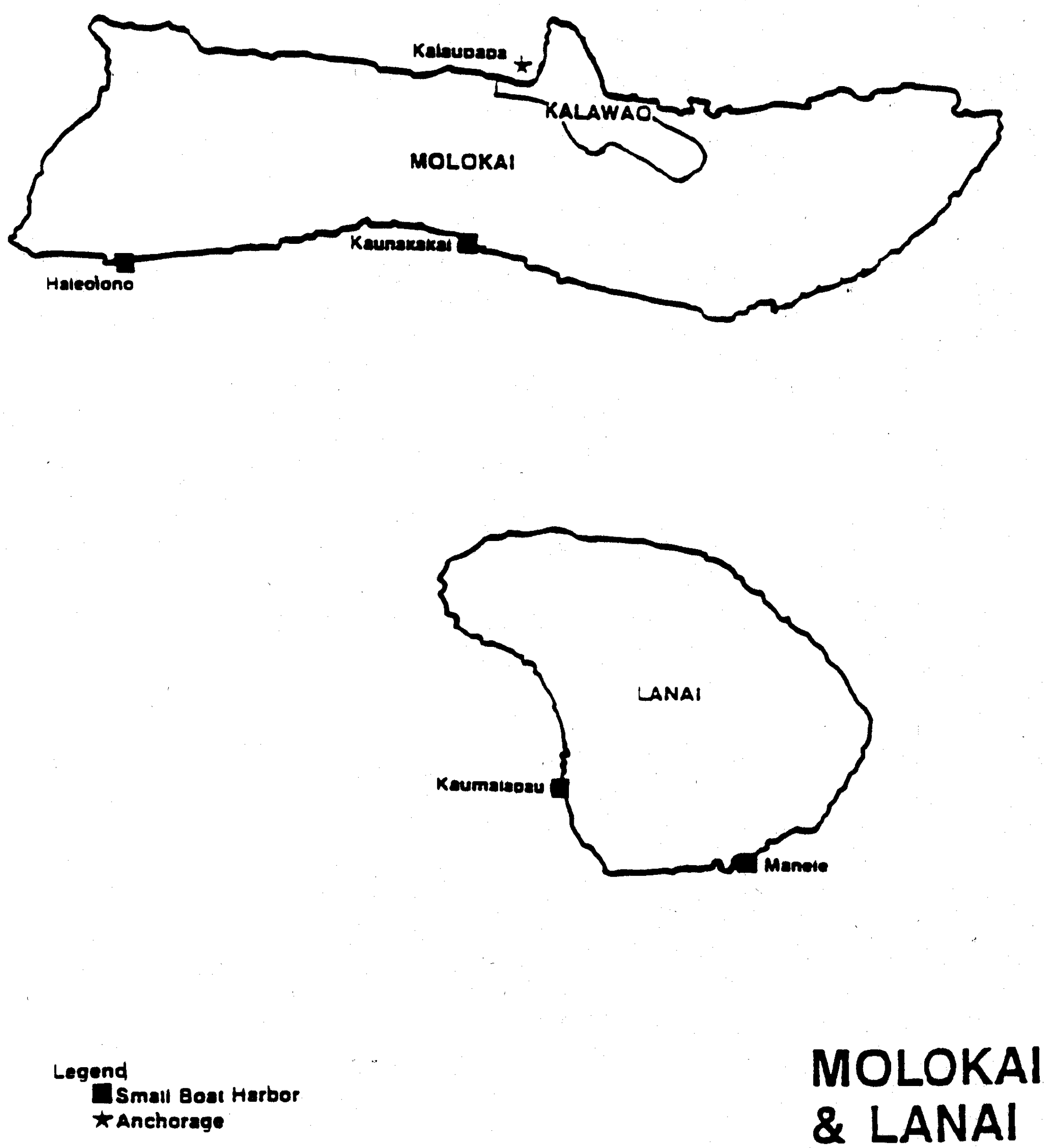


Figure 6. Locations of harbors, boat ramps, and anchorages on Molokai and Lanai



4.3.2 Fish Landing Areas

Another way to identify possible links between the fisheries and specific communities or locales is to examine fish landings data on a geographic basis. Table 6 presents the total volume and ex-vessel value of landings for six of the main Hawaiian Islands. As shown, Oahu accounts for slightly more than 84 percent of the total ex-vessel value of landings.

Table 6. Volume and value of commercial fish landings in Hawaii, by island, 1998

Island	Pounds Landed	Ex-Vessel Value	Percent of Total Ex-Vessel Value
Hawai‘i	3,362,372	$5,658,269	10.18%
Kaua‘i	803,897	$1,539,492	2.77%
Lana‘i	23,725	$36,115	0.07%
Maui	706,903	$1,379,553	2.48%
Moloka‘i	42,685	$142,684	0.26%
O‘ahu	22,274,538	$46,810,884	84.24%
Total	**27,214,120**	**$55,566,997**	**100.00%**

Source: Hawaii Division of Aquatic Resources commercial landings data compiled by NMFS Southwest Fisheries Science Center – Honolulu; reproduced from NMFS (2001b).

There are numerous areas on each of the main islands where fish catches are landed, as shown in Table 7. Some of these overlap with the departure sites noted in the previous discussion, but the match is not uniform.

Table 7. Volume and value of commercial fish landings in Hawaii, by landing area, 1998

Landing Area	Pounds Landed	Ex-Vessel Value	Percentage of Total Island Ex-Vessel Value
Hawaiʻi			
Hilo, Papaʻikou, Waiakea, Wailoa	727,802	$1,357,985	24.00%
Honaunau	116,601	$203,614	3.60%
Honokaʻa	245	$421	0.01%
Honokohau, Kailua, Kailua-Kona	1,295,350	$1,755,028	31.02%
Hoʻokena, Kohala	1,711	$2,707	0.05%
Kau Desert	3,407	$4,754	0.08%
Kawaihae, Puako	104,046	$206,174	3.64%
Keahou, Kahaluʻu	228,730	$373,572	6.60%
Kealakekua, Keʻei, Napoʻopoʻo	56,882	$75,778	1.34%
Kona	131,751	$156,965	2.77%
Mahukona	406	$1579	0.03%
Miloliʻi	45,028	$78,397	1.39%
Naʻalehu, Ka Lae, Kaulana, Kaʻaluʻalu	10,635	$26,861	0.47%
Other	131,712	$219,212	3.87%
Pahoa	250	$210	0.00%
Pohoiki, Kalapana, Kapoho Point, Puna	400,342	$945,669	16.71%
Punaluʻu	69,804	$163,659	2.89%
South Point	37,300	$83,898	1.48%
ʻUpolu	370	$1,777	0.03%
Hawaiʻi Total	**3,362,372**	**$5,658,269**	**100.00%**
Kauaʻi			
Anahola	148	$286	0.02%
ʻAnini, Kalihiwai, Moloaʻa	27,625	$31,952	2.08%
Haʻena	26	$0	0.00%
Hanalei, Wainiha	9,825	$9,338	0.61%
Hanamaʻulu	11,026	$7,478	0.49%
Kapaʻa, Wailua	49,990	$97,290	6.32%
Kekaha, Kiki a Ola, Mana	130,011	$294,000	19.10%
Koloa	3,022	$4,302	0.28%
Kukuiʻula, Makahuʻena Pt.	12,249	$20,852	1.35%
Lihuʻe, Ahukuni	26,067	$56,693	3.68%
Nawiliwili, Niumalu	206,872	$315,751	20.51%
Other	37,002	$94,866	6.16%
Port Allen	289,965	$606,452	39.39%
Waimea	69	$226	0.01%
Kauaʻi Total	**803,897**	**$1,539,492**	**100.00%**

Landing Area	Pounds Landed	Ex-Vessel Value	Percentage of Total Island Ex-Vessel Value
Lana‘i			
Manele Beach	19,625	$33,068	91.56%
Other	4,100	$3,047	8.44%
Lana‘i Total	**23,725**	**$36,115**	**100.00%**
Maui			
Hana	9,535	$26,393	1.91%
Honokowai, Ka‘anapali	4,506	$7,004	0.51%
Honolua	31	$0	0.00%
Kahului, Naska	69,067	$207,947	15.07%
Kihei	55,186	$144,607	10.48%
Lahaina	154,764	$176,266	12.78%
Ma‘alaea	157,910	$358,662	26.00%
Makena, Keone‘oi‘o	1,556	$4,099	0.30%
Mala Wharf, Kahana	55,708	$125,555	9.10%
Maliko, Ha‘iku, Pa‘uwela	32,390	$85,868	6.22%
Nahiku, Ke‘anae, Peahi	269	$1,209	0.09%
Olowalu	6	$0	0.00%
Other	165,975	$241,938	17.54%
Maui Total	**706,903**	**$1,379,553**	**100.00%**
Moloka‘i			
Halawa	495	$2,144	1.50%
Kamalo Harbor	756	$1,327	0.93%
Kaunakakai	31,120	$115,492	80.94%
Other	10,255	$23,663	16.58%
Puko‘o Harbor	59	$57	0.04%
Moloka‘i Total	**42,685**	**$142,684**	**100.00%**
O‘ahu			
Awa Wai, Diamond Head, Waikiki	2,814	$7,049	0.02%
Campbell Park, Pearl Harbor, Hickam, Other	173,402	$269,379	0.58%
Ewa	921	$2,575	0.01%
Hale‘iwa	326,579	$672,914	1.44%
Hau‘ula, La‘ie, Punalu‘u	1,577	$2,195	0.00%
He‘eia, He‘eia Kea	48,271	$104,684	0.22%
Honolulu, Ke‘ehi, Sand Island	9,746,154	$21,355,245	45.62%
Honouliuli, Hoaeae	613	$1,181	0.00%
Kahalu‘u	185	$268	0.00%
Kahana Bay	1,099	$394	0.00%
Kahuku	628	$2,452	0.01%
Kailua Bay	2,783	$5,609	0.01%
Kane‘ohe Bay	60,145	$88,126	0.19%

Landing Area	Pounds Landed	Ex-Vessel Value	Percentage of Total Island Ex-Vessel Value
Kaneohe, Mikiola	103,515	$240,039	0.51%
Kewalo Basin	10,957,172	$22,340,779	47.73%
Koko Head, Hawai'i Kai, Maunalua Bay, Portlock	93,746	$243,640	0.52%
Nanakuli	124,485	$510,163	1.09%
Pearl City, Waipio, Waipahu	1,649	$3,446	0.01%
Waiahole	457	$481	0.00%
Waianae, Pokai Bay	627,887	$959,554	2.05%
Waikane	179	$400	0.00%
Waimanalo	277	$300	0.00%
O'ahu Total	**22,274,538**	**$46,810,884**	**100.00%**

Source: Hawaii Division of Aquatic Resources commercial landings data compiled by NMFS Southwest Fisheries Science Center – Honolulu; reproduced from NMFS (2001b).

Several points are evident in Table 7. For the island of Hawaii, commercial fish landings were reported at 19 locales. The Hilo-Papaikou-Waiakea-Wailoa area accounts for about a quarter of the total value of the landings for the island, the Honokohau-Kailua-Kailua-Kona area accounts for nearly a third, and the Pohoiki-Kalapana-Kapoho Point-Puna area accounts for about 17 percent. Several landing facilities may be located within each of these areas. For the island of Kauai and its 14 reported landing sites, two areas (Kekaha-Kikiaiola-Mana and Nawiliwili-Niumalu) each account for about 20 percent of the total value of island landings, while Port Allen accounts for about 40 percent. The volume of fish landed on Lanai and Molokai is relatively small and concentrated in a few areas. Maui has a relatively even distribution of landings across 13 locales, with six of the 13 each accounting for between about one-tenth to one-quarter of the total value of landings. The pattern of landings for Oahu differs markedly from that of other islands in that there are many landing sites, but a few locales in the same general area account for nearly all the landings. Honolulu-Keehi-Sand Island and Kewalo Basin together account for slightly more than 93 percent of the total value of the landings for the island, due primarily to the concentration of the longline fleet and other large-vessel fleets in these areas. The next most prominent landing site on Oahu is Waianae-Pokai Bay, which only accounts for two percent of the island total. However, the value of the landings at this site exceeds that for any non-Oahu locale with the exception of the two highest volume areas on the island of Hawaii.

No recreational landings data are available, but landing site patterns can be assumed to be similar to those for the small-boat portion of the commercial fleet, much of which is composed of expense fishermen. The ongoing Hawaii Marine Recreational Fishery Survey, which relies on interviews with fishermen by telephone and at launching and landing points, will reveal geographical landing patterns. The survey is being performed by HDAR and NMFS. The first results are anticipated to be available in late 2002.

Although the data in Table 7 reveal the relative importance of different landing sites in terms of commercial fish volume, they fail to give any indication of the fidelity of individual fishermen to particular landing sites. As described above in terms of points of departure, fishermen – particularly those with trailered boats – are known to shift considerably among landing points (within a given island) according to market, fishing, and weather conditions.

4.3.3 License Holder Residences

The spatial distribution of fishery participants can be examined by mapping the residences of fishery license and permit holders. The two relevant permit types are the federal permits issued under the FMPs and the Commercial Marine Licenses issued by the Hawaii Division of Aquatic Resources (HDAR). State law requires that any person who "takes marine life for commercial purposes" and lands it in Hawaii, whether from within or outside of the state, first obtain a Commercial Marine License from HDAR. Each person on a vessel engaged in fishing is required to obtain a license, however, to avoid double counting, only vessel captains. Thus there may be more than one license issued for each vessel that fishes commercially. Because Hawaii's licensing requirement applies to people that sell even a single fish in a given year, many fishermen that fish primarily for recreational purposes hold licenses. The state license data examined here therefore include not only full-time and part-time commercial fishermen but also "expense" fishermen (fishermen that fish primarily for recreational purposes but sell their catch to help cover trip costs).

It should be noted that the addresses examined here are actually the mailing addresses indicated on the application forms and not necessarily residence addresses. Some of the addresses are known to be in industrial waterfront areas – that is, they are business addresses. The addresses are examined by zip code, which appears to be the most useful and convenient spatial scale.

Figures 7 through 14 show the distribution in 2001 of the business or home mailing addresses, by zip code, of commercial marine license holders and federal fishery permit holders. In the case of the Hawaii State licenses, each license holder indicates a single "primary" gear type on his or her license application. Only that primary gear type is accounted for in these state license distribution maps, so each license holder is associated with only one gear type and included in only one of the state license maps. The distribution maps of federal permits are treated separately from the state license maps, so a given person may be included in both the federal permit map and the state license map for a given gear type (e.g., longline).

4.3.3.1 Pelagics fisheries

Figure 7. Distribution of federal Hawaii longline limited access permit holders, by mailing address zip code, Oahu only, 2001 (N=153)

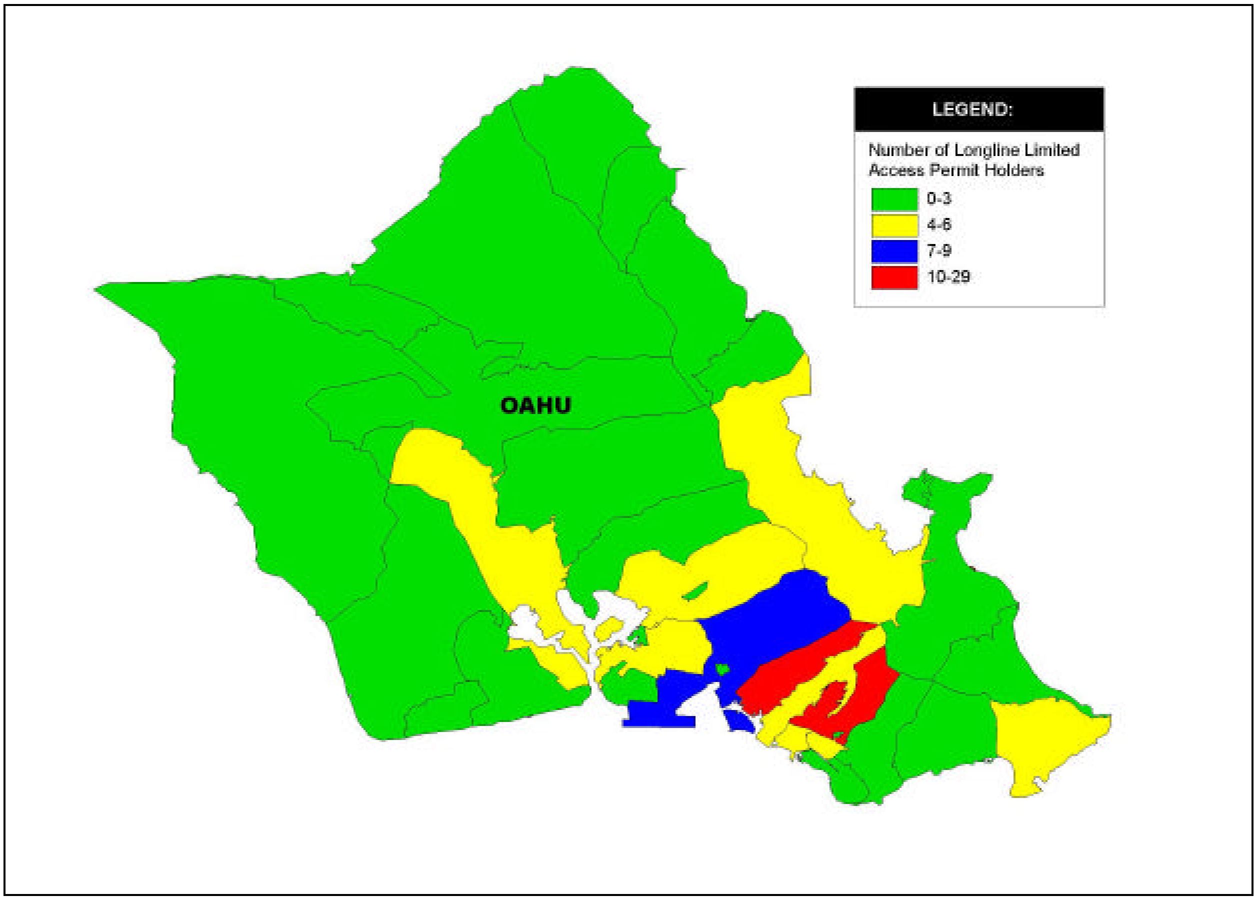


Figure 8. Distribution of HDAR Commercial Marine License holders that participated in the Hawaii-based longline fishery, by mailing address zip code, 2001 (N=830)

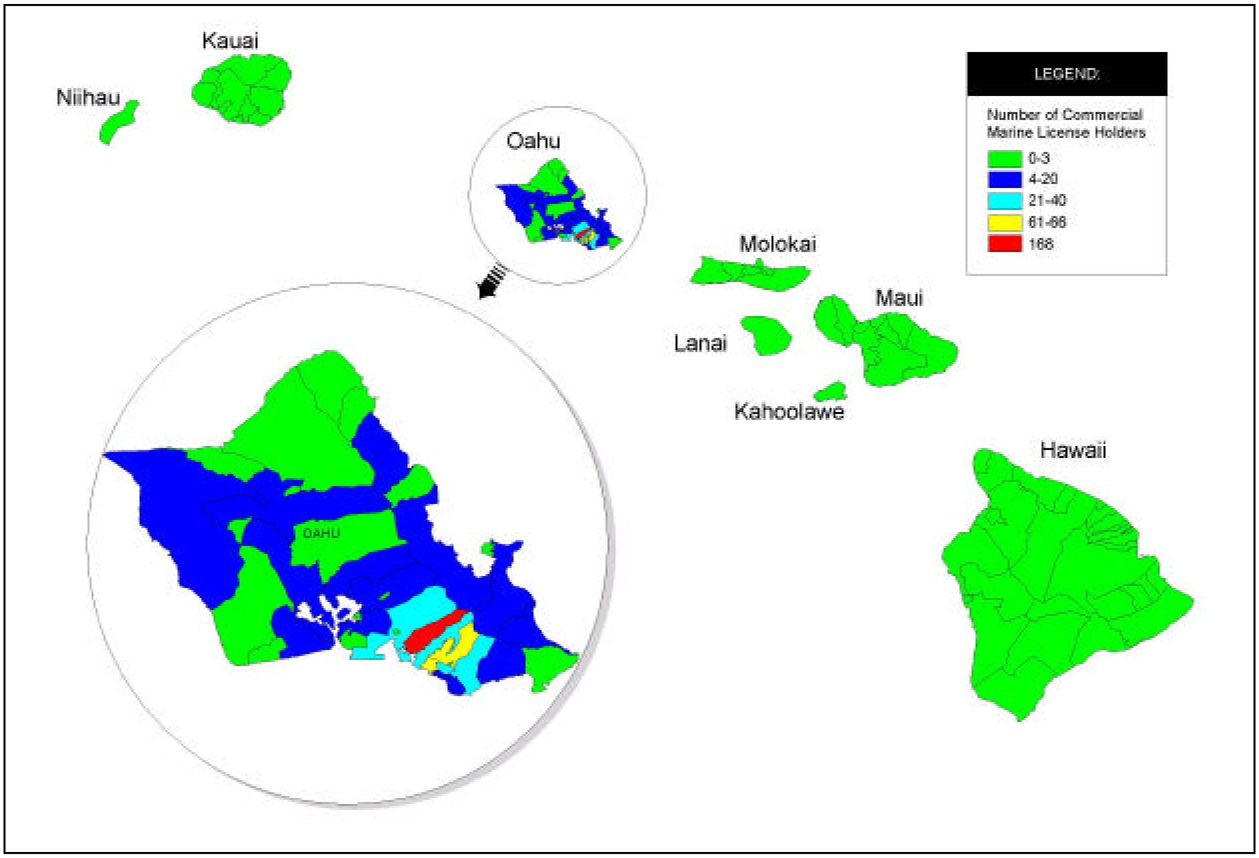


Figure 9. Distribution of HDAR Commercial Marine License holders that participated in the Hawaii-based troll fishery, by mailing address zip code, 2001 (N=1,772)

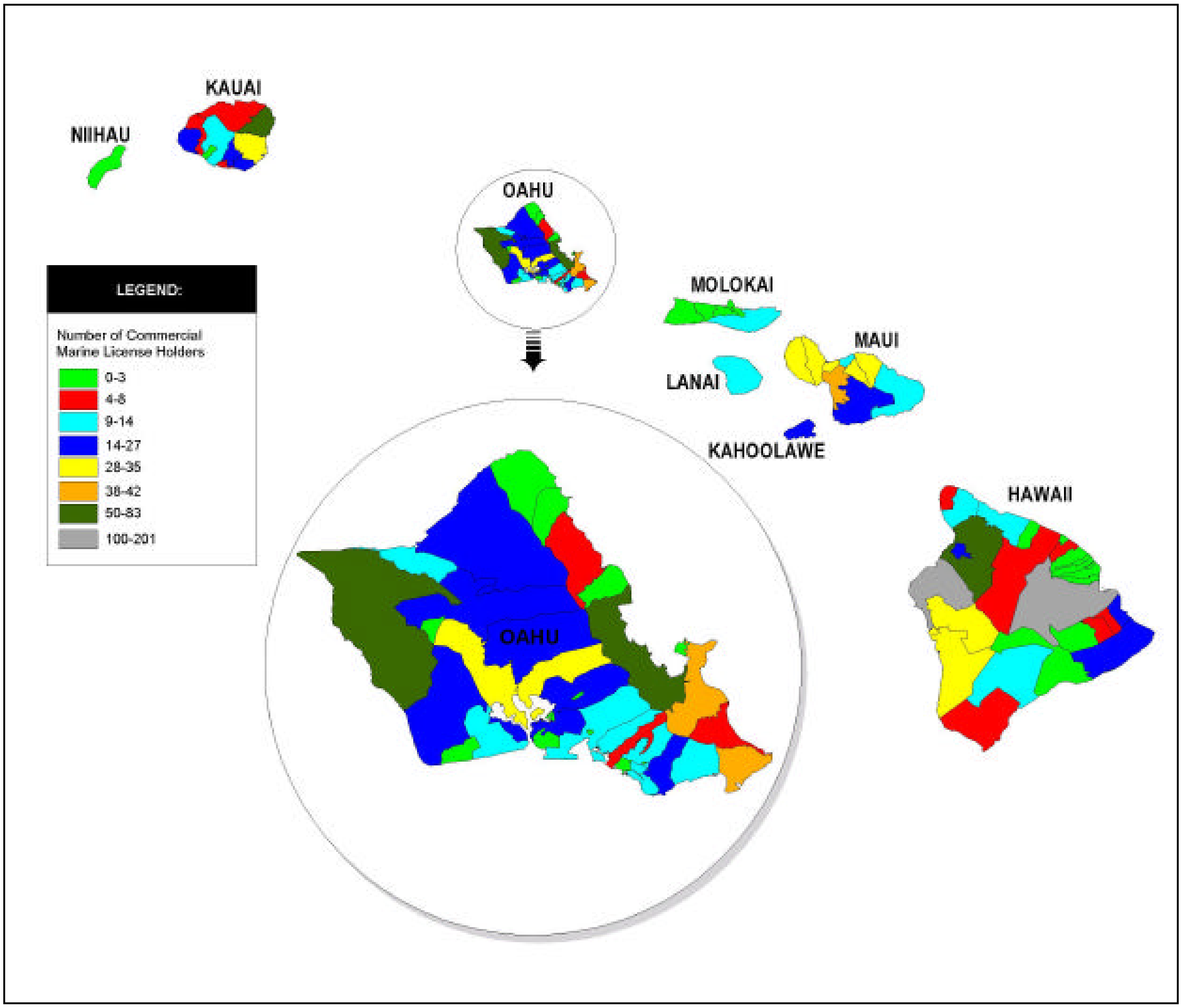
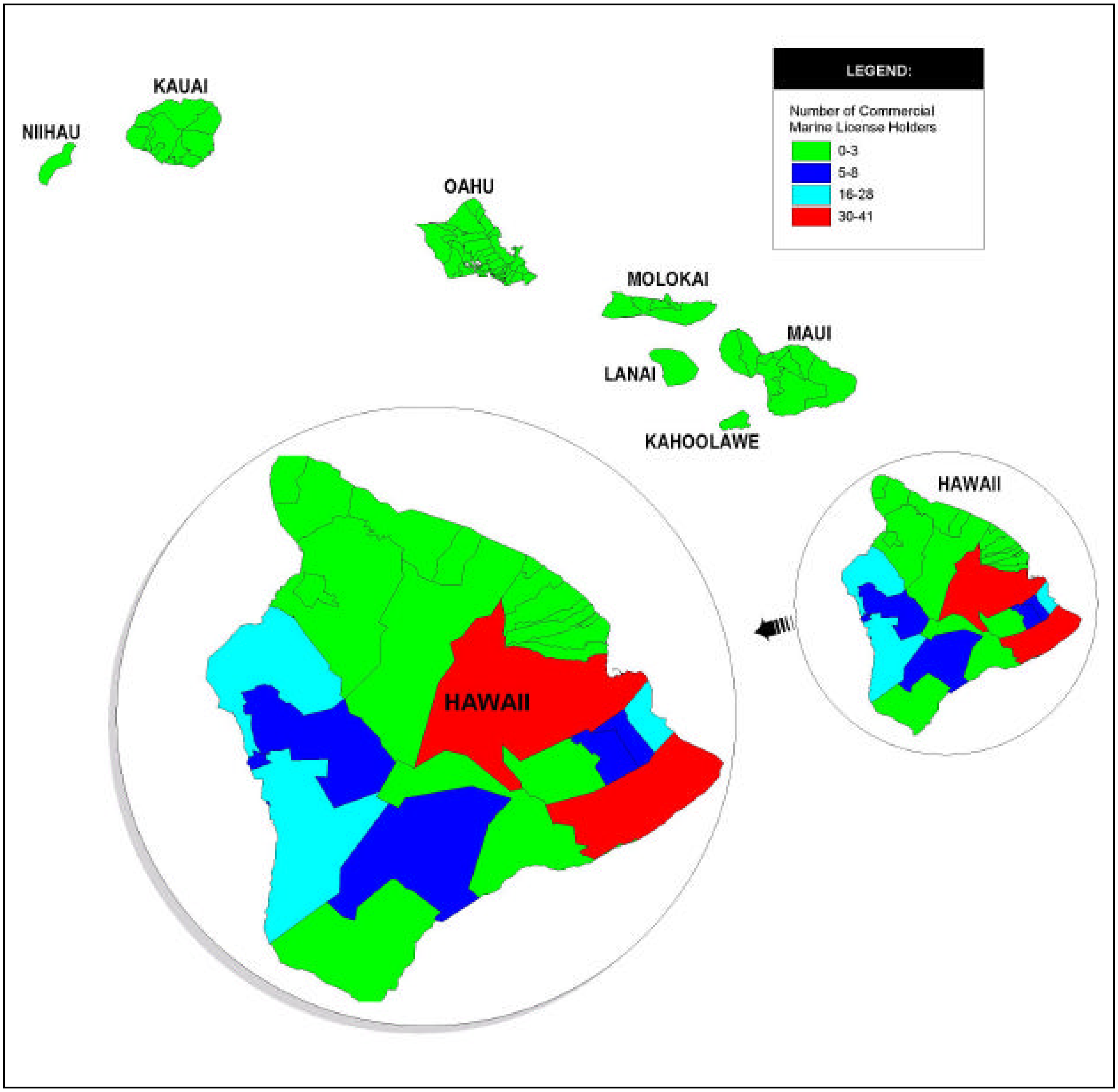


Figure 10. Distribution of HDAR Commercial Marine License holders that participated in the Hawaii-based pelagic handline fishery, by mailing address zip code, 2001 (N=220)



The mailing addresses of most federal Hawaii limited access longline permit holders are on Oahu (107) particularly in the vicinity of Honolulu (Figure 7). Four permit holders had addresses on Hawaii , and 42 (Washington 10 permits, California 9 permits, New Jersey 8 permits, Florida 6 permits, Oregon 6 permits, Mississippi 2 permits, Louisiana 1 permit).

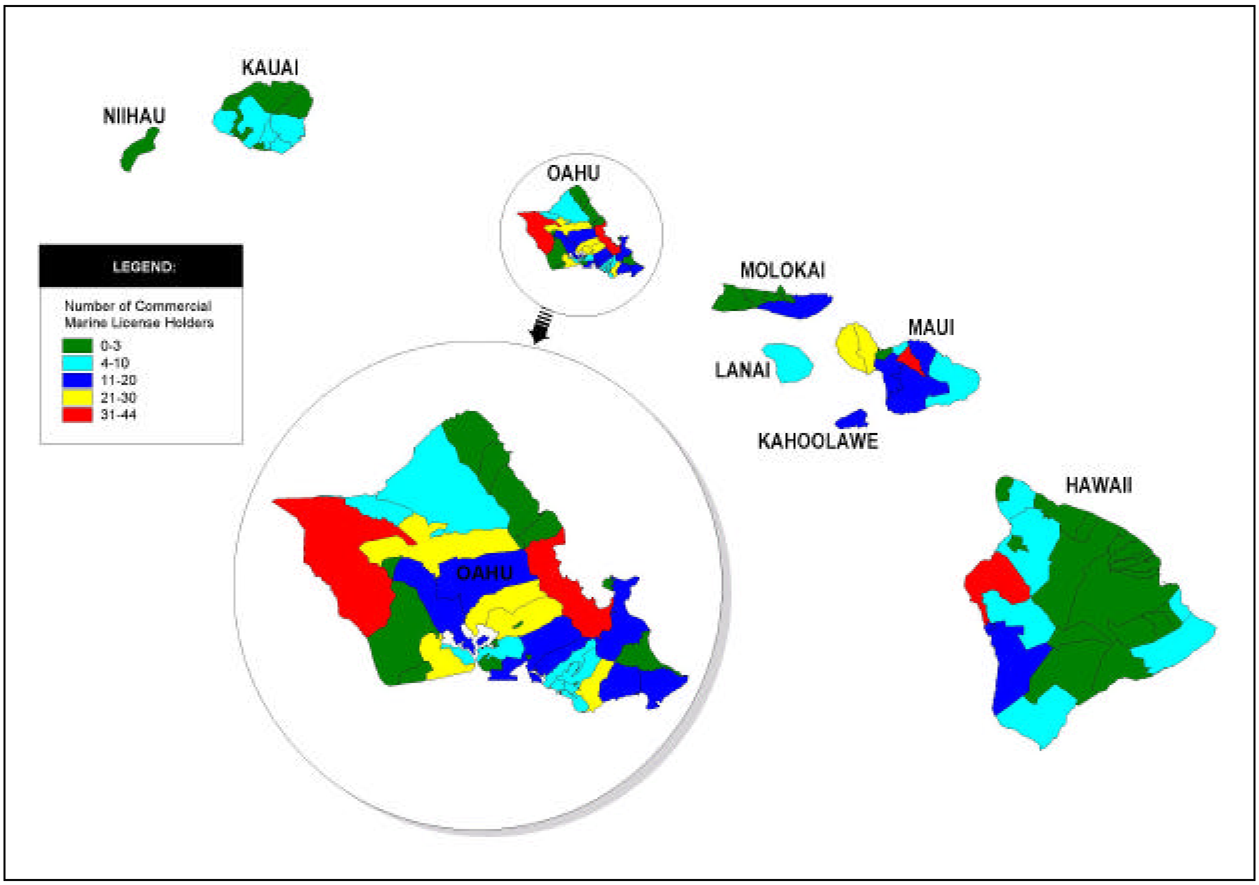
The distribution of HDAR license holders shown in Figure 8 includes all license holders that indicated longline as their primary gear type, so each federally permitted vessel may be represented by more than one crew member. Although the number of participants included in Figure 8 (state license holders) is substantially greater than the number included in Figure 7 (federal permit holders), the geographical distributions of the two are similar, with a concentration on Oahu, particularly in the vicinity of Honolulu.

The distribution of troll fishery participants includes substantial numbers on each of the five larger main islands (Figure 9). The distribution of pelagic fishery participants, which were much fewer in number than the troll participants, was markedly different, with a substantial clustering on the island of Hawaii (Figure 10).

The residences of license holders whose primary gear type was *aku* pole-and-line are not mapped because the number of participants was so small.

4.3.3.2 Bottomfish fisheries

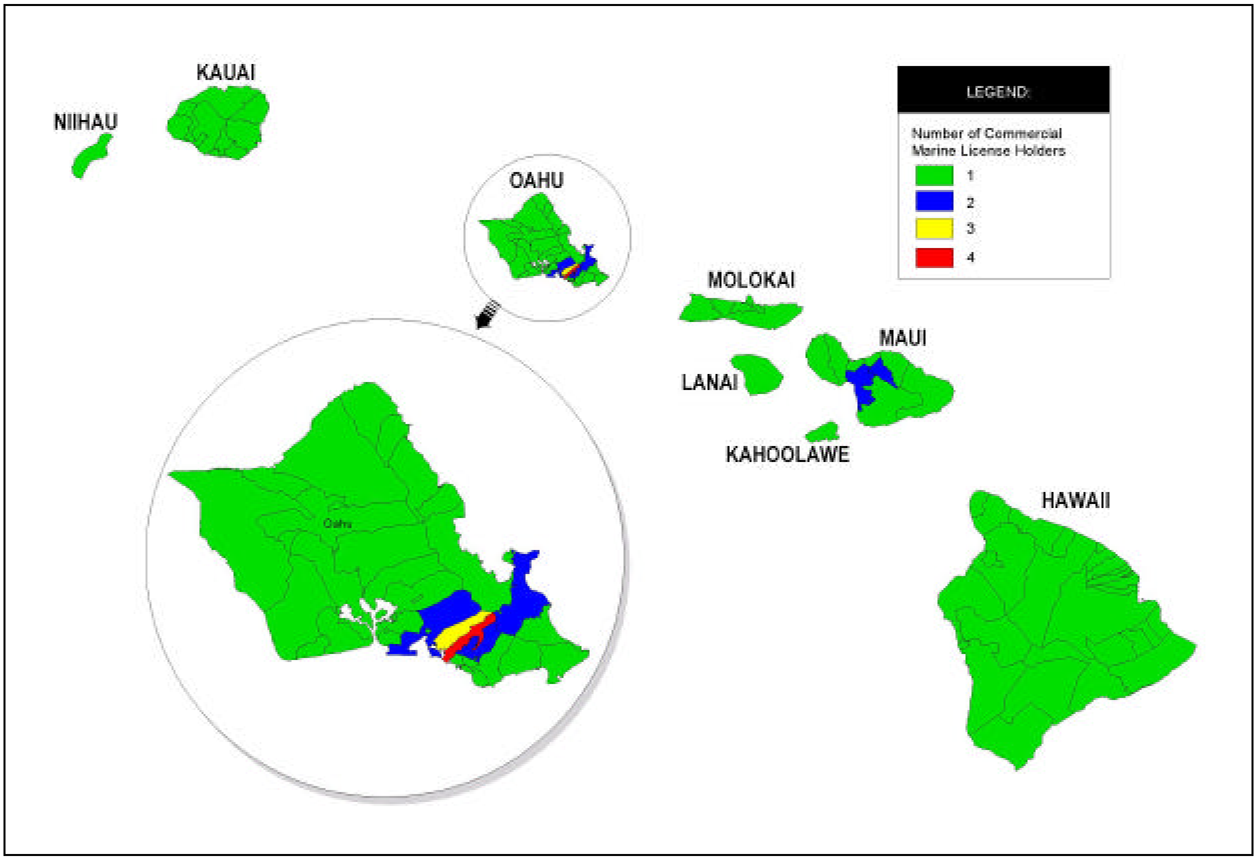
Figure 11. Distribution of HDAR Commercial Marine License holders that participated in the MHI and NWHI bottomfish fishery, by mailing address zip code, 2001 (N=848)



As seen in Figure 11, the HDAR data indicate that each of the five main islands had a substantial number of bottomfish fishery participants.

4.3.3.3 Crustaceans fisheries

Figure 12. Distribution of federal fishing permit holders in the NWHI lobster fishery, by mailing address zip code, 2001 (N=13)



As indicated in Figure 12, holders of federal permits for NWHI lobster were concentrated in the Honolulu area. This distribution is similar to that of the federal longline permit holders, and indeed, the fleets of both fisheries are comprised of relatively large vessels that are predominantly based in the Honolulu area.

4.3.3.4 Other fisheries

Figure 13. Distribution HDAR Commercial Marine License holders that participated in other fisheries in Hawaii, by mailing address zip code, 2001 (N=753)

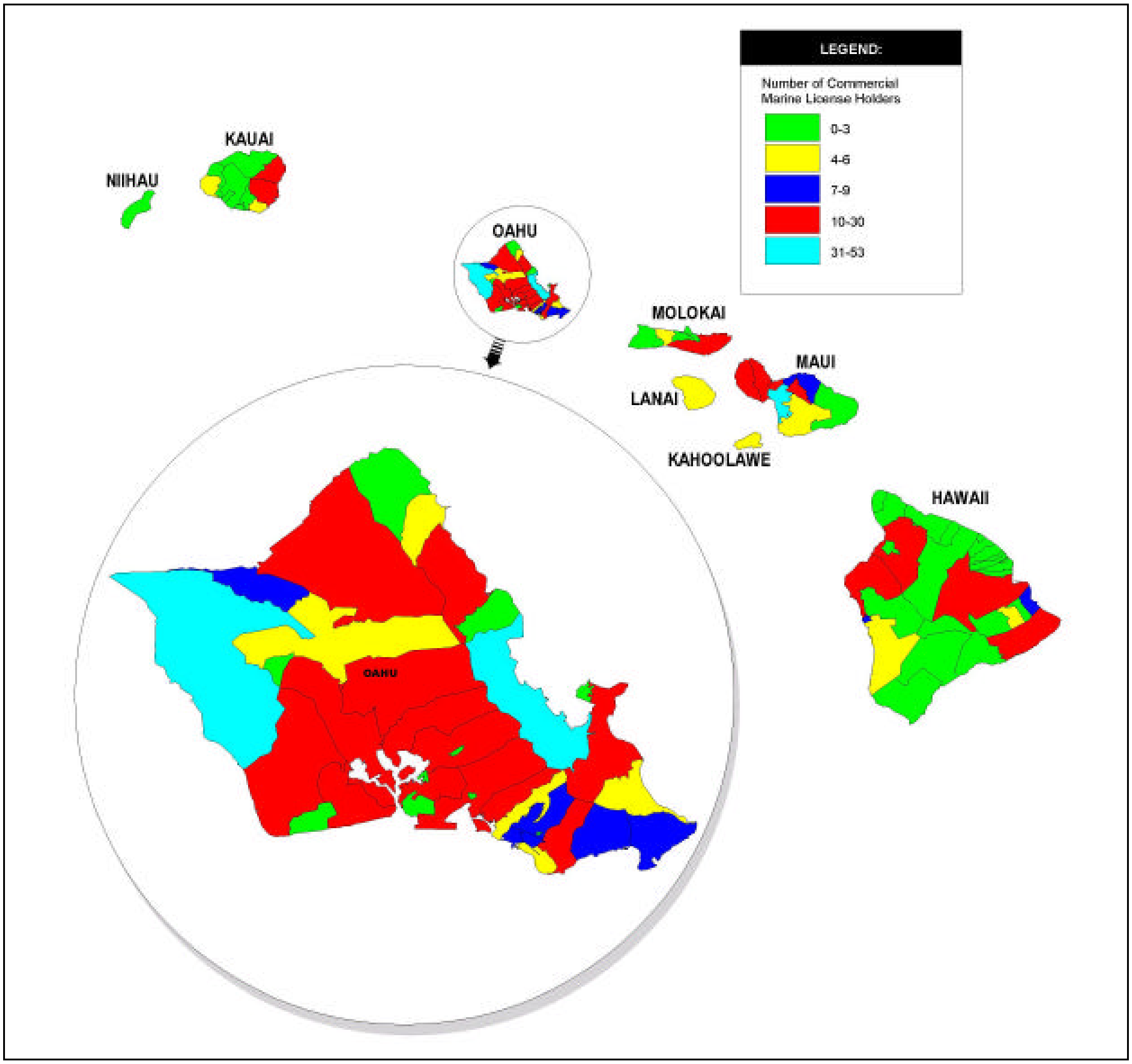
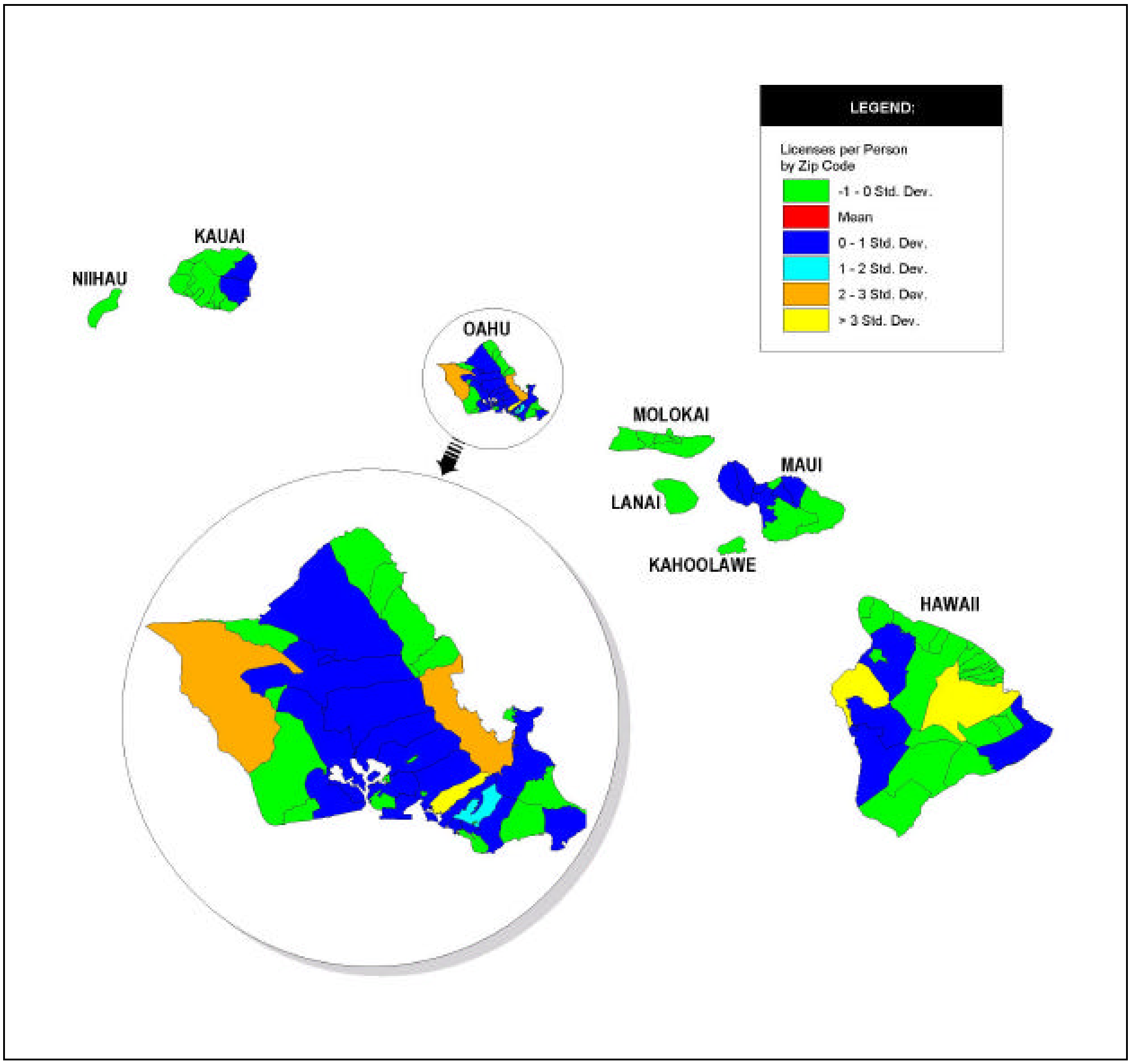


Figure 13 shows the distribution of HDAR license holders that indicated any one of several other fishery or gear types as their primary activity, most of which occur in state waters. The license holders are fairly broadly distributed through the islands.

As a final way of examining the distribution of license holders, Figure 14 shows the distribution in terms of the number of HDAR marine licenses per unit of population in a given zip code. The license density in a given zip code is expressed in terms of the number of standard deviations away from the mean license density among all zip codes. Two zip code areas on Hawaii (one fronting the Kailua-Kona area and the other on the east side, including the town of Hilo) and one on Oahu (which includes part of the Honolulu area) stand out with the highest license densities, followed by two others on Oahu (fronting the Waianae Coast and fronting Kaneohe Bay, including the town of Kaneohe).

Figure 14. Distribution of HDAR Commercial Marine License holders in Hawaii, by mailing address zip code, expressed as the deviation from the mean number of permits per resident, 2001



Non-commercial fishermen do not require state licenses in Hawaii, so no data are available on the spatial distribution of residences of purely recreational fishermen. However, they can probably be assumed to be similar to the distribution of the small-boat portion of the "commercial" fleet, as illustrated in the maps presented above (see Figures 9, 10, and 11 for the troll, pelagic handline, and bottomfish fisheries, respectively). This is because, as explained above, the data set of commercial license holders include not only full-time and part-time fishermen, but also expense fishermen. The ongoing Hawaii Marine Recreational Fishery Survey, which is anticipated to reveal its first results in late 2002, will reveal geographical patterns of launching, fishing, landing, and residence for Hawaii's small-boat fleets (including both recreational and commercial fishing).

As with the data presented above on departure sites and fish landing sites, the fishermen residence data examined above fail to reveal some important dynamics. The commercial marine license data indicate only the "primary" gear type indicated on the license application. Many license applications list multiple gear types, and in fact, many license holders and federal permit holders participate in multiple fisheries and gear types, shifting on time scales ranging from days to years. In a survey of Hawaii's small-boat fishermen, only 30% of 569 respondents indicated that they had fished with only a single gear/method during the previous 12 months (Hamilton and Huffman 1997). The ability to shift among fisheries and gear types is an important factor related to the economic viability of commercial fishing operations and the benefits derived from recreational and expense fishing activities. Fishery participants generally try to take best advantage of market conditions, weather conditions, and fishing conditions to order to use the gears and target the species and areas that are likely to bring the greatest returns.

4.3.4 Fish Processing Facilities and Markets

As with other aspects of Hawaii's fisheries, processing and marketing operations tend to be relatively diffuse. In general, fish products are not necessarily processed and marketed in the same areas that they are landed or in the areas where fishermen reside. Firms that buy, process, and distribute fish products, including seafood wholesalers, restaurants, hotels, and retail markets, are dispersed across Oahu and the other islands. The major fish auction and most of the large-volume, restaurant-oriented wholesalers are located in Honolulu, but there are many smaller wholesale and retail operations outside of the greater Honolulu area. Businesses whose goods and services are used as inputs in the fisheries, such as ice plants, marine rail ways, marine suppliers, welders, and repair operations, are most conspicuously located in the Honolulu area, but have an important presence in other areas. The major firms servicing the large-vessel fleets are located in Honolulu, but there are many fishing supply stores scattered throughout the state. To consolidate businesses involved in fishing supplies and fish processing and marketing in one location, the state government initiated construction of a "domestic fishing village" in an industrial waterfront area of Honolulu. At first, this effort to attract fishing-related shore-side businesses to a single site met with some success. However, uncertainty about the future of the Hawaii-based longline fishery caused by the emergency rules implemented by NMFS in 1999 and subsequent years to reduce sea turtle interactions has since had a chilling effect on further private investment in the project. In addition, concerns over residual toxins in the underlying landfill have recently arisen and are now being addressed.

4.3.5 Other Geographical Factors

The distances between islands and the difficulties in travel between islands create obvious social and economic boundaries between the islands. Given the small sizes of the islands and the generally high mobility of fishery participants, social and economic interactions among fishery participants on the island level are relatively strong. In contrast, interactions among fishery participants between islands are necessarily quite limited.

Another important factor that affects the social and economic cohesiveness of communities is the structure of governmental authority. The county is the lowest form of government in the state. The state has five counties, each of which includes between one and three inhabited islands (with the exception of Kalawao, which contains only a small part of one island). County influence over economic and regulatory affairs is relatively limited compared to most other states, which tend to have less centralized governments than Hawaii. In terms of fisheries, the state and federal governments are clearly the most important authorities. Given the geographical barriers between islands, both the state and federal governments tend to conduct outreach with fishery participants on an island-specific basis. For example, public hearings on a given issue will typically take place on each of the major islands. Thus, to the extent that fishery participants are affected by government and engage in the fishery management process, such as through public fora and interactions among themselves, they tend to do so on an island-specific basis. Again, these factors lend themselves to a particularly strong degree of social and economic cohesion among fishery participants at the island level.

4.3.6 Summary

In terms of geographical patterns, the most marked delineation among fisheries and gear types appears to be that of large vessel versus small vessel. The relative concentration of large-vessel fishing-related activities in the vicinity of Honolulu – particularly those of the longline fleet, as well as the NWHI bottomfish and lobster fleet – contrasts with the widely dispersed nature of small-vessel fishing-related activities. These include the activities associated with the commercial, recreational, and "expense" troll and handline fleets and the bulk of the bottomfishing fleet. The charter boat fleet is concentrated in just a few areas.

The economic activity associated with large-vessel fishing-related activities is mostly concentrated in and near Honolulu, and in economic terms, the community of Honolulu is more engaged in fishing-related activities than any other community in the state. However, the contribution of large-vessel fishing-related activities to the economy and social fabric of Honolulu is small compared to those of other economic sectors. Although the small-vessel fleets show some spatial "nodes" of residency and fishing-related activity among and within islands, the spatial distribution of participants in small-vessel fisheries is not remarkably different from that of the population as a whole. The number of participants in these fishing-related activities is relatively large, but because fishing is a part-time, recreational, or mixed-motivation activity for many of them, there are few localized areas such as towns or villages in which the majority of residents depends on fishing or related activities. In those locales where fishing is known to be especially important, there are inadequate data to determine the level of dependence on fishing and fishing-related activities.

4.4 Determinations

Key findings made here with respect to the identification of fishing communities in Hawaii include the following:

1) Fishery resources have played a central role in shaping the social, cultural and economic fabric of Hawaii society. A large number of Hawaii's residents are substantially dependent on or substantially engaged in fishing or fishing-related activities and industries to meet social and economic needs.

2) Fishery participants tend to shift often among gear types and fisheries. Participation in multiple fisheries and the ability to switch gear types and fisheries are fundamental aspects of fisheries in Hawaii and are important to the viability of fishing operations and industries.

3) Fishery participants often reside in one area, moor or launch their vessels in other areas, fish offshore of other areas, and land their fish in yet other areas, and they tend to move among these areas according to the gear types used, weather conditions, and fishing conditions.

4) The shore-side activities associated with the large-vessel fisheries, particularly the longline fishery, are mostly concentrated in the vicinity of Honolulu. Although many people participate in those fisheries and related activities, Honolulu is a large city with a large economy so its dependency on those fisheries is relatively small. Activities associated with the small-vessel fisheries, in contrast, are fairly widely dispersed within and among islands. Participants in these fisheries do not, generally, stand out geographically from the population as a whole, but there are certain locations in each of the seven inhabited islands in which relatively large concentrations of fishery participants reside or where there are relatively large concentrations of fishing activities or related services.

5) Because of the geographical barriers between Hawaii's islands, social and economic interactions among fishery participants occur primarily at the island level. For the same reason, fishery participants' engagement in fisheries management, such as through public meetings and outreach programs of state and federal agencies, occurs primarily at the island level.

6) The lowest level of government in Hawaii is the county. Each of Hawaii's five counties includes one, two, or three inhabited islands (with the exception of Kalawao County, which includes only a small part of one island).

Available data indicate that the majority of fishing activity is concentrated in fishing communities located on the Islands of Oahu and Hawaii, that the social and economic cohesion of fishery participants is particularly strong at the island level, and that fishing communities are best not distinguished according to fishery or gear type. The most logical unit of analysis for describing the community setting and assessing community-level impacts is the island.

In each of these four FMP amendments, each of the islands of Kauai, Niihau, Oahu, Maui, Molokai, Lanai, and Hawaii is identified as a fishing community for the purposes of assessing the effects of fishery conservation and management measures on fishing communities, providing for the sustained participation of such communities, minimizing adverse economic impacts on such communities, and for other purposes under the MSA.

4.5 Future Investigations

The determinations made here used the best available information. If more detailed information on economic dependence and other factors becomes available such that fishing communities can be more precisely identified, the determinations may be changed. Furthermore, the existence and location of fishing communities are not static. When social or economic conditions change such that the locations of fishing communities change, the determinations made in these amendments may be modified as appropriate. As described in the previous sections, there are several smaller-than-island scale communities in Hawaii that may, upon closer examination, be determined to fit the definition of fishing community. Closer examination might also reveal that some of Hawaii's various fisheries (e.g., gear types) have their own unique sets of fishing communities, and that identification of each of those sets would be important for the purposes of conducting socioeconomic impact assessments. It is also possible that fishing communities are – for the purposes of impact assessment – effectively defined by the action being contemplated; in other words, that the boundaries of a fishing community are determined in part by the scale and scope of the issue being addressed.

Characterizing fishing communities at these finer scales (temporally, spatially, and topically) would require considerably more information than is currently available. The Council, NMFS, the State of Hawaii, and other agencies are continually gathering information about the social and economic importance of fisheries to communities and of important trends. NMFS is in the process of developing a "Sociocultural Practitioners Manual" that will help guide fishing community-related analyses. A draft of the manual is anticipated in late 2002. Over the next two years, the NMFS Honolulu Laboratory will be working with other Laboratory staff, the University of Hawaii (Joint Institute for Marine and Atmospheric Research) and Council staff to attempt to identify Hawaii fishing communities at a finer scale. The initial program will have two components.

The first component is being planned to follow up on the analyses made in these amendments by incorporating more recent as well as more historical data in the analysis of commercial marine license and federal permit holders. As described in the previous sections, there are several smaller-scale communities in Hawaii that may fit the definition of fishing community. This research will pursue those possibilities. Additional geographical information system work will incorporate additional years of data. If funding is available, subsequent study will focus on primary data collection from individuals and groups located in Hawaii.

The second component is designed to provide a sociocultural profile of the Hawaii-based longline fishery through a range of social-anthropological methodologies including direct in-person interviews and focus groups with longline captains, owners, crews, and family members, as well as key individuals in associated shoreside business (e.g., auction, fishing supplies, wholesale and retail seafood, etc.) and participant-observation. The longline industry has been heavily regulated with relatively little understanding of the sociocultural impacts of the regulations and even less awareness of impacts to any associated fishing communities. Critical variables will be explored at several scales, from individuals to households to communities.

Topics of interest at the individual and/or household levels are expected to include lifestyles, the social and cultural functions of fish harvest, distribution, and consumption, and attitudes, beliefs and values regarding longline fishing and its management. At the community scale, variables would include the role of longline fishing in associated communities, social organization and institutions, social and political resources, and perceptions of the health and resiliency of fishing communities. The study will contribute to the identification of a set of indicators of community characteristics and well-being that could be used as dependent variables in social impact analyses.

5. Affected Environment Given Cumulative Impacts to Date

5.1 Bottomfish FMP Fisheries

A summary of available information on the environment associated with the bottomfish and seamount groundfish fisheries of the Western Pacific is provided in this section. The Preliminary Draft Environmental Impact Statement (EIS) for the Bottomfish and Seamount Groundfish FMP (WPRFMC 2001b) can be referred to for additional detail.

5.1.1 Description of the Fisheries

5.1.1.1 Fishing methods and current use patterns

The Bottomfish and Seamount Groundfish FMP manages two fisheries. The seamount groundfish fishery, targeting armorhead and alfonsin at the southeast Hancock Seamount in the NWHI, was conducted by foreign trawlers since the late 1960s. The fishery was closed with FMP implementation in 1986 because of the poor condition of the target stocks and their vulnerability to overfishing. The current moratorium is in effect until 2004, subject to further extension. No seamount groundfish fishing currently occurs in waters under Council jurisdiction. Bottomfish fisheries target etiline snappers, carangids, and groupers in waters mostly between 30 and 150 fathoms (fm) deep. There is also a shallow-water bottomfish fishery throughout the region, but it occurs almost exclusively in state and territorial waters.

Bottomfishing grounds in Hawaii are divided into three management zones, the Mau and Hoomalu Zones in the NWHI and the Main Hawaiian Islands. In the MHI, about 80% of bottomfish habitat lies in state waters. Penguin Banks is the largest and most important bottomfishing grounds in the federal waters around the MHI. In the NWHI all participants fish commercially on a full- or part-time basis, while in the MHI fishery there are also recreational fishermen. Independent, owner-operator fishing operations prevail in both zones of the NWHI. The Mau Zone fleet tends to be comprised of smaller operations than in the Hoomalu Zone, and most of the Mau Zone vessels are part-time and multi-gear operations. Many vessels typically conduct mixed fishing trips (bottomfish, troll and pelagic handline), focusing on the most productive fishing method at any given time.

Bottomfishers in Hawaii use a hook-and-line method of fishing where weighted and baited lines are lowered and raised with electric, hydraulic, or hand-powered reels. The main line is typically 400-450 lb test, with hook leaders of 80-120 lb test monofilament. The hooks are circle hooks, and a typical rig uses 6 to 8 hooks branching off the main line. The weight is typically 5-6 lb.

The hook leaders are typically 2-3 feet long and separated by about 6 feet along the main line. Squid is the bait typically used. It is sometimes supplemented with a chum bag containing chopped fish or squid suspended above the highest hook.

Vessels used in the NWHI fishery are typically 40-60 feet in length, and usually equipped with electronic navigation and fish-finding equipment that allow a skilled captain to harvest target species with relatively little bycatch. Fishing trips to the NWHI typically last 10-25 days, with vessels reaching as far as Kure Atoll.

A single bottom longline vessel operated briefly in the NWHI in 1998-1999, targeting sharks. Although pelagic longlining is prohibited within a protected species zone surrounding the NWHI, this gear, because it is deployed on the bottom and not considered a pelagic gear, was not subject to the closed-area restrictions. The gear consists of a heavy (700- to 1,400-pound test) monofilament groundline. Gangions, buoys, and lead weights are attached to this during deployment. The 10-12 foot long gangions, spaced every 20 fm along the groundline, terminate in baited circle hooks. Buoys allow gear retrieval while weights anchor the groundline to the bottom. The gear was set at an average depth of 34.5 fm.

In American Samoa small skiffs and *alia* catamarans equipped with handlines and hand-powered reels, most without electronic navigation or fish-finding equipment, fish on the deep outer-reef slope. Few boats carry ice, so fishing trips tend to be brief and not venture far from port. Most vessels are used for both bottomfishing and trolling. In recent years a few larger (greater than 35 feet in length) vessels with the capacity to chill or freeze fish have entered the fleet.

The bottomfish fisheries in Guam include both a deep-water (80-120 fm) component dominated by commercial vessels (mostly greater than 25 feet in length) equipped with electric-powered reels, and a shallow-water (15-80 fm) component that includes smaller boats (mostly less than 25 feet in length) using rod-and-reel that occurs mainly in waters under the jurisdiction of the Territory of Guam. The majority of the catch is made in the latter component, in which much of the fishing is done for recreational and subsistence purposes (WPRFMC 2001b). Most bottomfish fishermen that sell their catch also hold jobs outside the fishery. Most participants in the bottomfish fishery also troll for pelagic species, often mixing methods during a given trip. Charter fishing has been a substantial component of the fishery since 1995, accounting for about 15-20% of all bottomfishing trips during that period (WPRFMC 2002b).

As in Guam, the bottomfish fisheries in the CNMI include both deep-water and shallow-water components.[9] The fleet is comprised primarily of vessels smaller than 25 feet in length that primarily target the shallow-water bottomfish complex fairly close to port and fish for both commercial and subsistence purposes. They tend to be equipped with handlines, hand reels, or electric reels, and tend not to have electronic navigation or fish-finding equipment. A few larger commercial vessels with the capacity to fish in the northernmost islands of the chain have periodically entered the fishery, targeting both the deep-water and shallow-water bottomfish complexes. These vessels are generally equipped with electric or hydraulic reels and electronic navigation and fish-finding equipment. Few fishermen depend on fishing for all of their income.

[9] Bottomfish fisheries occurring in the EEZ around the CNMI are not managed under the FMP.

Most participants in the bottomfish fishery also troll for pelagic species, often mixing methods during a given trip. A few charter vessels target shallow-water bottomfish, along with reef fish.

Bottomfish fishing occasionally occurs in the waters around the PRIAs, but the catches have been sporadic and generally small.[10] One such harvest, consisting of about 40,000 lb, was made by Hawaii-based at Kingman Reef in 1999, but part of the catch tested positive for ciguatera and the vessel stopped fishing there (WPRFMC 2001b). No further information on bottomfishing in the PRIAs is provided here.

5.1.1.2 Harvest and participation

Estimated landings of bottomfish from each of the island areas for the years 1989-2001 are indicated in Table 8. Recent historical participation in each of the island areas is described in Table 9.

[10] Bottomfish fisheries occurring in the EEZ around the PRIAs are not managed under the FMP.

Table 8. Bottomfish landings in the Western Pacific, 1989-2001

Year	Landings (1,000 lb)				
	NWHI	MHI	American Samoa	CNMI	Guam
1989	303	1,006	47	20	84
1990	421	646	14	11	77
1991	387	548	19	6	71
1992	424	587	13	8	87
1993	385	348	18	45	98
1994	443	458	45	20	109
1995	369	440	34	29	106
1996	311	440	39	53	153
1997	346	513	40	51	103
1998	332	479	16	46	98
1999	323	455	17	44	129
2000	262	478	28	36	146
2001	286	391	47	57	118

- Source: WPRFMC 2002b and NMFS Honolulu Laboratory.
- 2001 estimates are preliminary.
- Hawaii: includes BMUS only; includes commercial only.
- American Samoa: includes all "bottomfish" (not just BMUS); includes entire catch (not just commercial).
- CNMI: includes all "bottomfish" (not just BMUS); includes commercial only.
- Guam: includes BMUS only; includes entire catch (not just commercial).
- Relatively small catches of bottomfish are also made in the PRIAs.

Table 9. Participation in the bottomfish fisheries in the Western Pacific, 1989-2001

Year	Number of active vessels				
	NWHI	MHI	American Samoa	CNMI	Guam
1989	10	537	29	29	223
1990	19	501	19	29	226
1991	18	469	20	20	246
1992	13	407	14	38	236
1993	12	403	22	20	360
1994	17	423	19	32	298
1995	15	400	25	33	402
1996	16	466	26	69	408
1997	15	495	24	68	332
1998	14	493	16	50	354
1999	13	483	19	50	411
2000	11	495	17	64	312
2001	11	379	18	75	337

- Source: WPRFMC (2002b) and NMFS Honolulu Laboratory.
- Hawaii: accounts for BMUS only; accounts for commercial fishing only.
- American Samoa: accounts for all “bottomfish” (not just BMUS); accounts for all fishing (not just commercial).
- CNMI: accounts for all “bottomfish” (not just BMUS); accounts for commercial fishing only.
- Guam: accounts for BMUS only; accounts for all fishing (not just commercial).
- Relatively small levels of bottomfish fishing also occur in the PRIAs.

5.1.1.3 Markets

Hawaii bottomfish catches are mostly sold in the local Hawaii fresh fish market. Landings from the NWHI tend to consist of larger fish that are preferred by the restaurant market. Bottomfish imports currently supply about 40% of the Hawaii market (WPRFMC 2002b).

More than 90% of the catch of BMUS in American Samoa is sold; some has been exported to Hawaii (WPRFMC 2001b). Much of the year-to-year variation in landings and participation is related to the difference in prices of bottomfish and pelagic products, as most of the fleet is equipped for both types of fishing. Prices for local bottomfish product, for example, are influenced by prices of imported product from Samoa and Tonga. The hurricanes that occasionally reach American Samoa are also responsible for disrupting bottomfish fishing patterns.

Most of Guam’s bottomfish catch is marketed locally. Prices for local product are affected by imports from elsewhere in Micronesia (WPRFMC 2001b).

In the CNMI most of the catch is consumed locally, although there have been some exports to Guam and Hawaii (WPRFMC 2001b).

5.1.1.4 Socio-economic importance

In the Hawaii-wide bottomfish fishery, BMUS landings and real (inflation-adjusted) ex-vessel revenue peaked in 1987 at about 1.8 million lb and $7.3 million (year-2000 $), respectively, after 20 years of growth (WPRFMC 2002b). In 2000 landings had declined by 50% from that peak and real revenue had declined by 60%, due primarily to decreases in participation and fishing effort (due in part to the NWHI limited access programs) and a generally weak market for fresh bottomfish in the 1990s. The trend was especially strong in the NWHI component of the fishery, where real revenue in 2000 was about 25% of that in 1987. Preliminary data for 2000 indicate gross revenue of $1.0 million for the NWHI fleet and $1.9 million for the MHI fleet (WPRFMC 2002b).

Analysis of operating costs and returns in 2000 indicated that, as in previous years, the average Hoomalu Zone vessel and the average Mau Zone vessel did not cover their total costs through bottomfishing operations (WPRFMC 2002b). This is not to say that all vessels in each of the two zones did not operate profitably from bottomfishing. In addition, other fishing activities or other income sources bring additional revenue to some or all vessels. The Mau Zone vessels, for example, are known to engage in multiple types of fishing and are generally recognized to be less reliant on bottomfishing than Hoomalu Zone vessels. Furthermore, although economic performance – based on monetary returns – has, on average, been generally low in the NWHI fishery, there are additional, non-pecuniary, benefits that accrue to fishery participants and the larger fishing community. The PDEIS (WPRFMC 2001b) describes some of these difficult-to-quantify benefits, which include the enjoyment derived from fishing and the lifestyle it entails to providing an identifiable place in the community and allowing activities that strengthen social bonds.

From 1996 through 2000 the average annual inflation-adjusted ex-vessel value of commercial landings of bottomfish in American Samoa was about $60,000 (in year-2000 $) (WPRFMC 2002b). There has been little variation in inflation-adjusted gross revenues per fishing trip since 1989 (WPRFMC 2001b). No information on net revenues for the American Samoa bottomfish fleet is available.

From 1996 through 2000 the average annual inflation-adjusted ex-vessel value of commercial landings of bottomfish in Guam was about $57,000 (in year-2000 $) (WPRFMC 2002b). Inflation-adjusted gross revenues per fishing trip has varied substantially from year to year, apparently due in large part to the entry-exit patterns of highliners. No information on net revenues for the Guam bottomfish fleet is available.

From 1996 through 2000 the average annual inflation-adjusted ex-vessel value of commercial landings of bottomfish in the CNMI was about $157,000 (in year-2000 $) (WPRFMC 2002b). Inflation-adjusted gross revenues per fishing trip increased markedly through the 1990s as a result of increases in both prices and average per-trip catches. No information on net revenues for the CNMI bottomfish fleet is available.

5.1.2 Fish Stocks

The Bottomfish Management Unit Species (BMUS) are listed in Table 10.

Table 10. Bottomfish management unit species

English common name	Local common names	Scientific name
Snappers:		
silver jaw jobfish	lehi (H); palu-gustusilvia (S)	*Aphareus rutilans*
grey jobfish	uku (H); asoama (S)	*Aprion virescens*
squirrelfish snapper	ehu (H); palu-malau (S)	*Etelis carbunculus*
longtail snapper	onaga, ʻulaʻula (H); palu-loa (S)	*Etelis coruscans*
blue stripe snapper	taʻape (H); savane (S); funai (G)	*Lutjanus kasmira*
yellowtail snapper	palu-iʻ lusama (S); yellowtail, kalekale (H)	*Pristipomoides auricilla*
pink snapper	ʻōpakapaka (H); palu-ʻtlenaʻlena (S); gadao (G)	*Pristipomoides filamentosus*
yelloweye snapper	palusina (S); yelloweye ʻōpakapaka, kalekale (H)	*Pristipomoides flavipinnis*
snapper	kalekale (H)	*Pristipomoides sieboldii*
snapper	gindai (H,G): palu-sega (S)	*Pristipomoides zonatus*
Jacks:		
giant trevally	white ulua (H); tarakito (G); sapo-anae (S)	*Caranx ignoblis*
black jack	black ulua (H); tarakito (G); tafauli (S)	*Caranx lugubris*
thick lipped trevally	pig ulua, butaguchi (H)	*Pseudocaranx dentex*
amberjack	kāhala (H)	*Seriola dumerili*
Groupers:		
blacktip grouper	fausi (S); gadau (G)	*Epinephelus fasciatus*
sea bass	hāpuʻupuʻu (H)	*Epinephelus quernus*
lunartail grouper	papa (S)	*Variola louti*
Emperor fishes:		
ambon emperor	filoa-gutumumu (S)	*Lethrinus amboinensis*
redgill emperor	filoa-paʻloʻomumu (S); mafuti (G)	*Lethrinus rubrioperculatus*
Seamount groundfish:		
alfonsin		*Beryx splendens*
ratfish/butterfish		*Hyperoglyphe japonica*
armorhead		*Pseudopentaceros richardsoni*

Source: WPRFMC (2001b).
Notes: G = Guam; H = Hawaii; S = American Samoa.

In addition to the landings of BMUS shown in Table 10, the fishery also results in bycatch of BMUS and landings and bycatch of non-BMUS. Observer data for the period 1990-1993 from the NWHI bottomfish fishery indicate that non-BMUS made up about 5% of the catch, by number, of which about 60% was discarded (Nitta 1999). About 25% of the catch of all species combined was discarded. The majority of discards in the NWHI fishery are comprised of two BMUS, kahala and butaguchi. The observer data indicate about 97% of the former and 48% of the latter, by number, being discarded, and the two species comprising 81% of all discards (Nitta 1999). Kahala from the NWHI has an especially low value because of being implicated in ciguatera poisoning incidents. Other non-target species that are often discarded in the NWHI bottomfish fishery include a variety of carangids (jacks), sharks, and reef-associated species. Relatively small numbers of target species are discarded, such as when damaged by predators.

Bycatch mortality rates in the bottomfish fisheries are difficult to measure. Although bottom-dwelling teleost fishes generally suffer high mortality from the decompression undergone while being brought to the surface, the carangid species that make up most of the bycatch in the NWHI fishery are usually released alive and viable. Sharks, which lack a swim bladder, do not suffer from decompression and most species have high chances of surviving after being released.

In addition to observed bycatch, there is some degree of unobserved mortality in the bottomfish fisheries, primarily due to predation of hooked fish. Simulation modeling by Kobayashi and Kawamoto (1995), using observations of lost hooks and predator-damaged fish, resulted in an estimate of 231 fish lost to sharks for every 1,000 fish boated, plus a relatively small number of additional losses due to predation by monk seals and dolphins.

Reliable bycatch data are not yet available for the bottomfish fisheries in the MHI, American Samoa, CNMI, or Guam, but bycatch rates in those areas are known to be substantially less than in the NWHI bottomfish fishery. The purely commercial nature of the NWHI fishery and its relatively great distance from port make storage space especially valuable and the motivation to discard thereby greater than in the bottomfish fisheries of the other island areas.

The status of stocks managed under the FMP is assessed using a measure called spawning potential ratio (SPR), which is defined as the ratio of the spawning stock biomass per recruit at the current level of fishing to the spawning stock biomass per recruit that would occur in the absence of fishing. Recruitment overfishing is defined to occur when the SPR is equal to or less than 20% (see FMP Amendment 3).[11] SPRs are estimated annually for those stocks for which adequate data are available. In Hawaii, SPR values are estimated for the entire Hawaiian archipelago, as evidence from larval drift simulations and preliminary genetic work has indicated that the primary target bottomfish species should be assessed as archipelagic-wide stocks. SPR values are also estimated for each of the three management zones in Hawaii.

In the most recent assessment, in 2000, SPR values were calculated for five bottomfish species in Hawaii. The latest SPR estimate for armorhead is based on 1997 data. Data have not been

[11] An amendment to this overfishing definition, following the new requirements of the Sustainable Fisheries Act of 1996, which requires thresholds to be specified for both stock biomass and fishing mortality, was prepared by the Council and submitted to NMFS in 1998 as Amendment 6, but it was disapproved. A supplement to Amendment 6, which would revise the overfishing criteria, is currently under development.

available to calculate SPR values for bottomfish stocks in American Samoa, Guam, or the CNMI.

The year-2000 point estimates of SPR for the five assessed bottomfish species in the Hawaiian archipelago were greater than 20%, ranging from a low of 27% for onaga to a high of 52% for uku and opakapaka. The values for ehu and hapuupuu were 40% and 49%, respectively (WPRFMC 2002b). The ranges that accompanied the point estimates (upper and lower bounds of the estimate) overlapped the 20% level for only onaga. SPRs for these five species have been estimated for each of the years 1986 through 2000 and none of the point estimates have reached as low as 20% (WPRFMC 2002b). The NWHI portions of the bottomfish stocks are recognized to be in better condition than those in the MHI. For example, localized SPR for onaga and ehu in the MHI were estimated to be 7% and 8%, respectively, in 2000 (WPRFMC 2002b). In the NWHI, in contrast, localized analyses of SPR in the NWHI indicated no localized depletion problems for any BMUS in either of the two NWHI management zones (WPRFMC 2002b).

The SPR estimates and other indicators of declining stock condition in the MHI, particularly for onaga and ehu, spurred the State of Hawaii to implement several management measures in state waters of the MHI (Hawaii Administrative Rule, Chapter 13-94). The new rules, which became effective June 1, 1998, apply to seven species of bottomfish, onaga, ehu, kalekale, opakapaka, gindai, hapu’upu’u, and lehi. The measures include gear restrictions, bag limits for non-commercial fishermen, areas closed to fishing and possession of fish, and a requirement that bottomfishing vessels be registered with the state. It is prohibited to use nets, traps, trawls, and bottom-set longline, with the intention of restricting the fishery to traditional handline gear. The bag limit for non-commercial fishermen is a total of five onaga and ehu combined. The system of restricted areas, which may be modified at the administration level, includes 20 areas that are broadly distributed through the MHI and include about 20% of all known fishing areas for onaga and ehu. The new rules also establish a control date of June 1, 1998 that may be used to qualify applicants for a limited entry program should one be established in the future.

Based on 1997 data, the SPR for armorhead, a seamount groundfish species targeted in a trans-EEZ-boundary trawl fishery that has been closed within the US EEZ since FMP implementation in 1986, was last estimated at about 1% (WPRFRC 2002b).

In American Samoa, the CNMI, and Guam, stock status indicators in recent years, such as catch-per-unit-effort, have not indicated any cause for concern over stock status.

The status of the bottomfish and seamount groundfish stocks managed under the FMP was reviewed in the Annual Report to Congress on the Status of U.S. Fisheries–2001 (NMFS 2002b). With the exception of armorhead, none of the stocks managed under the FMP was indicated as being in, or approaching, an overfished condition.

5.1.3 Ecosystem and Habitat

The Sustainable Fisheries Act of 1996 requires that fishery management plans identify and describe essential fish habitat (EFH) for managed fisheries, minimize to the extent practicable adverse effects on such habitat caused by fishing, and identify other actions to encourage the conservation and enhancement of such habitat.

Based upon the best available data, the Council designated the EFH for the adult life stage of the seamount groundfish complex as all waters and bottom habitat bounded by latitude 29° - 35° N and longitude 171°E - 179° W between 80 and 600 meters (m) depth. EFH for eggs, larvae and juveniles is the epipelagic zone (from 0 to about 200 m depth) of all waters bounded by latitude 29° - 35° N and longitude 171° E - 179° W. This EFH designation encompasses the Hancock Seamounts, part of the northern extent of the Hawaiian Ridge, located 1,500 nautical miles northwest of Honolulu. For the bottomfish species, EFH was designated to consist of the water column down to 400 m depth for eggs and larvae, and the water column and bottom down to 400 m depth for juveniles and adults. Based on the known distribution and habitat requirements of adult bottomfish, the Council designated all escarpments/slopes between 40 and 280 m depth as habitat of particular concern (HAPC). In addition, the Council designated the three known areas of juvenile opakapaka habitat in the MHI (two off Oahu and one off Molokai) as HAPC.

The line used while bottomfishing is continuously monitored by an individual fisherman. The weight and hooks are maintained near, but not on, the bottom because the target species occur from 1 to 20 m off the bottom. Because of the nature of this type of fishing, it is likely that the risk of direct impacts from fishing gear to EFH/HAPC and other benthic habitats is negligible. Anchors used by bottomfishing vessels can cause damage to benthic habitat. The presence of fishing vessels in the vicinity of shallow and intertidal habitats, including coral reefs, also brings some degree of risk of vessel groundings and pollutant spills that could degrade those habitats (the photic zone where coral reefs and reef building organisms are normally found ranges roughly between 0 and 18 fm). Although shallow-water bottomfish fishing generally puts vessels in closer proximity to shallow-water habitats than does deep-water bottomfishing, the vessels used in the latter tend to be larger than in the former, bringing greater risks of damage due to vessel groundings or pollutant spills.

5.1.4 Protected Species

Five species of sea turtles, all of which are listed as either threatened or endangered under the Endangered Species Act (ESA), occur in fishing areas that are subject to the FMP: the leatherback (*Dermochelys coriacea*), the olive ridley (*Lepidochelys olivacea*), the hawksbill (*Eretmochelys imbricata*), the loggerhead (*Caretta caretta*), and the green turtle (*Chelonia mydas*).

Green turtles nest in the NWHI at French Frigate Shoals and then migrate to and forage around the MHI. There have been no documented takes of green turtles from bottomfishing operations in the NWHI. Vessel lighting and activity near nesting beaches has the potential to cause adverse impacts but no takes have been documented (NMFS 2002c). The NWHI green sea turtle population has increased in recent years without any corresponding increase in interactions with the bottomfish fishery (Laurs 2000). It was therefore concluded in the 2002 Biological Opinion for the Bottomfish FMP (the result of the formal consultation required under Section 7 of the Endangered Species Act) that the fishery, as managed under the FMP, is not likely to adversely affect green sea turtles (NMFS 2002c). Three of the other four sea turtle species – hawksbill, leatherback, and olive ridley – are likely to occur only very rarely in the areas where the fishery takes place. No interactions with those three species or with the loggerhead have been reported or observed, and it was concluded in the 2002 Biological Opinion that the fishery as managed under the FMP is not likely to adversely affect those species (NMFS 2002c).

Vessels intending to fish in the protected species study zone that surrounds the NWHI must notify NMFS at least 72 hours in advance of departure. Vessels must take an observer if directed by NMFS. Vessel operators must participate in a NMFS protected species workshop.

Critical habitat for the endangered Hawaiian monk seal (*Monachus schauinslandi*), which is endemic to the Hawaiian archipelago and listed as endangered under the ESA, extends from the shore to a depth of 20 fathoms in ten areas of the NWHI. Hawaiian monk seals breed primarily at six major colonies, all of which are in the western portion of the NWHI. In addition, a few individuals occasionally breed at Necker and Nihoa islands in the Mau Zone and further east in the MHI. Although little is known of the seal's population status prior to 1950, its range probably declined since humans first settled the islands. Between 1958 and 1993 the population of non-pups is estimated to have declined about 60 percent (NMFS 2002c). Counts from 1993 to 2000 have remained fairly stable, with no statistically identifiable trend. The population was most recently estimated at between 1,300 and 1,400 individuals (Laurs 2000). Some sub-populations within the NWHI have decreased in size during the last two decades while others have increased or remained stable. Poor pup survival in the last two decades in the largest sub-population – that at French Frigate Shoals – has resulted in an unstable age distribution, indicative of a future decline in sub-population size. That decrease will have to be offset by gains in other sub-populations for the population to remain stable.

The causes of the recent poor survival at French Frigate Shoals have been attributed to poor condition from starvation, shark predation, male aggression towards pups, habitat loss, and entanglement in marine debris (NMFS 2002c). The reasons for the possible lack of prey availability are not known but may be related to decadal-scale fluctuations in productivity or other changes in local carrying capacity (NMFS 2002c).

During the vessel observer program conducted in the NWHI bottomfish fishery from 1990 through 1993, monk seals were often observed taking or damaging hooked fish, with an average of one such interaction every 68 hours of fishing. Interactions occurred during 10 out of the 26 observed trips and involved a maximum of 26 seals. No entanglements or hookings of monk seals were observed (Nitta 1999). NMFS has received a number of reports from various sources of monk seals with hooks embedded in their mouths or other body parts. Positively attributing a given hooking event to a particular fishery is difficult. A review of the reports led NMFS to conclude that seven instances of hookings since 1982 may be attributable to direct interactions with the bottomfish fishery. Given those possibilities and the observed behavior of monk seals around bottomfishing vessels, it was concluded in the 2002 Biological Opinion for the Bottomfish FMP that the fishery may incidentally hook monk seals, but "... NMFS expects that the rate of incidental hookings will be very low, notably less than one monk seal per year" (NMFS 2002c:51).

The Biological Opinion also examined the possible adverse effects associated with behavioral modifications of monk seals (following vessels and feeding on hooked fish), the consumption of discarded fish by monk seals, and the possible reduction of prey available to monk seals. With regard to behavioral modifications, adverse effects were found to be difficult to identify but recognized as possible. With regard to the consumption of discarded fish, it was found that monk seals are not likely to be adversely affected, even if the discarded fish contain ciguatoxins. With regard to prey availability, it was found to be that bottomfish vessels are not likely to be competing directly or indirectly with monk seals for the same fish species (NMFS 2002c).

The 2002 Biological Opinion concluded that the bottomfish fishery is not 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" (NMFS 2002c:54). The Biological Opinion found that the bottomfish fishery, as managed by the FMP, 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.

Other marine mammals listed under the ESA that are present in bottomfishing areas include the blue whale (*Balaenoptera musculus*), fin whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), right whale (*Eubalaena glacialis*), sei whale (*Balaenoptera borealis*), and sperm whale (*Physeter macrocephelus*). Sightings of humpback whales were made during the 1990-1993 vessel observer program but no interactions were observed (Nitta 1999). It was concluded in the 2002 Biological Opinion that the probability of an encounter between any of these species and the bottomfish fishery is extremely low and that the fishery, as managed under the FMP, is not likely to adversely affect these species (NMFS 2002c).

Pacific bottlenose dolphins (*Tursiops truncatus*), which are not listed under the ESA (but like all marine mammals are protected under the Marine Mammal Protection Act), are known to damage and take hooked fish from bottomfishing gear. During the 1990-1993 NWHI vessel observer program, an average of 1 bottlenose dolphin interaction was observed for every 38 fishing hours, but no hookings were observed during the 26 observed trips (Nitta 1999). Several sightings of spinner dolphins (*Stenella longirostris*), which are not listed under the ESA, were made during the 1990-1993 vessel observer program (Nitta 1999).

Vessels intending to fish in the protected species study zone that surrounds the NWHI must notify NMFS at least 72 hours in advance of departure. Vessels must take an observer if directed by NMFS. Vessel operators must participate in a NMFS protected species workshop. Participants in the NWHI bottomfish fishery have recently committed to voluntarily retaining all bycatch until well away from monk seals, dolphins, and sharks.

Although there are several seabird colonies in the MHI, the NWHI colonies harbor more than 90% of the total Hawaiian archipelago seabird populations. The NWHI provide most of the nesting habitat for more than 14 million Pacific seabirds. More than 99% of the world's Laysan albatross (*Phoebastria immutabilis*) and 98% of the world's black-footed albatross (*P. nigripes*) return to the NWHI to reproduce. Of the 18 species of seabirds known to be present in the NWHI, only the short-tailed albatross (*P. albatrus*), is listed as endangered under the Endangered Species Act. The short-tailed albatross population is the smallest of any of the albatross species occurring in the North Pacific. Land-based sighting records indicate that 15 short-tailed albatrosses have visited the NWHI over the past 60 years. Five of these visits were between 1994 and 1999 (WPRFMC 2001b). No sightings from, or interactions with, bottomfish vessels have been documented.

The 1990-1993 NMFS observer program for the NWHI bottomfish fishery reported a moderate level of interactions between seabirds and the bottomfish fishery (Nitta 1999). Interactions were characterized by attempted bait theft. Although there is a possibility of accidental hooking, circle hooks used in the bottomfish fishery do not lend easily to snagging. No seabird injuries or mortalities were reported while fishermen were fishing for bottomfish. One interaction involving a Laysan albatross occurred while a bottomfish fishing vessel was trolling for pelagic species. The bird became hooked but was subsequently released alive. The potential for indirect interaction due to competition for prey is negligible, as seabirds do not prey on bottomfish species. The level of fishery interaction with seabirds is expected to have no effect on seabird distribution, survival, or population structure (WPRFMC 2001b).

5.2 Pelagics FMP Fisheries

The information in this document incorporates by reference details provided in the Final Environmental Impact Statement (FEIS) for the Fishery Management Plan for the Pelagic Fisheries of the Western Pacific Region, which is available from the NMFS Southwest Regional Office (501 West Ocean Boulevard, Suite 4200, Long Beach, CA 90802-4213; http://www.nmfs.noaa.gov/). For further details, please see the FEIS.

A summary of the information in the FEIS (NMFS 2001b) (in most cases extracted directly from the FEIS), along with information from NMFS' March 2001 Biological Opinion on the Pelagic FMP (a product of Section-7 consultations under the ESA) (NMFS 2001a), are provided in Sections 5.2.1 through 5.2.5. The FEIS is generally based on fishery data through 1998 or 1999. That information is updated in Section 5.2.6 with information that became available since completion of the FEIS.

5.2.1 Description of the Fisheries

The Pelagics FMP manages unique and diverse fisheries. Longline vessels are capable of traveling long distances to high-seas fishing grounds, with trips typically ranging from 14 to 44 days, while the smaller handline, troll, charter, and pole-and-line fisheries, which may be commercial, recreational, or subsistence, generally occur within 25 miles of land, with trips generally lasting only one day. These fisheries are first briefly described by sector and gear type, then described in more detail by geographical area.

Commercial fisheries

The Hawaii-based longline fleet has historically operated in two distinct modes based on gear deployment: deep-set longlines by vessels that target primarily tuna and shallow-set longlines by those that target swordfish or have mixed target trips including swordfish, albacore and yellowfin tuna. Swordfish and mixed target sets are buoyed to the surface, have few hooks between floats, and are relatively shallow. These sets use a large number of lightsticks since swordfish are primarily targeted at night. Tuna sets use a different type of float placed much further apart, have more hooks per foot between the floats, and the hooks are set much deeper in the water column. These sets must be placed by use of a line-shooter to provide slack in the line which allows it to sink. The fleet includes a few wood and fiberglass vessels, and many newer steel longliners that were previously engaged in fisheries off the U.S. mainland. There is a maximum vessel length of 101 feet for this fleet.

Apart from a few larger (> 40 ft) inboards, longlining out of American Samoa generally takes place on *alia*, twin-hulled (wood with fiberglass or aluminum) boats about 30 feet long, and powered by small gasoline outboard engines. Navigation on the *alia* is visual, using landmarks. The gear is stored on deck attached to a hand crank reel which can hold as much as 10 miles of monofilament mainline. Participants set between 100 and 300 hooks on a typical eight-hour trip. The gear is set by spooling the mainline off the reel and retrieved by hand cranking back onto the reel. Currently most fishing is done within 25 miles of shore, but with better equipped vessels, fishing activity may extend further. Generally, gear setting begins in early morning; with retrieval in the mid-morning to afternoon. The fish are stored in containers secured to the decks or in the hulls. Albacore tuna is the primary species landed followed by skipjack tuna and yellowfin tuna.

The Hawaii-based skipjack tuna or aku fishery is also known as the pole-and-line fishery, or the bait boat fishery because of its use of live bait to target aku (skipjack tuna). The aku fishery is a labor-intensive, and highly selective operation. Live bait is broadcast to entice the primary targets of skipjack and juvenile yellowfin tuna to bite on lures made from barbless hooks with feather skirts. During the fast and furious catching activity, tuna are hooked on lines and in one motion swung onto the boat deck by crew members.

Handline fishing is an ancient technique used to catch yellowfin and bigeye tunas with simple gear and small boats. Handline gear is set below the surface to catch relatively small quantities of large, deep-swimming tuna that are suitable for *sashimi* markets. This fishery continues in isolated areas of the Pacific, and is the basis of an important commercial fishery in Hawaii. Three methods of pelagic handline fishing are practiced in Hawaii, the *ika-shibi* (nighttime) method, the *palu-ahi* (daytime) method, and seamount fishing (which combines both handline and troll methods).

Troll fishing is conducted by towing lures or baited hooks from a moving vessel, using big-game-type rods and reels as well as hydraulic haulers, outriggers, and other gear. Up to six lines rigged with artificial lures or live bait may be trolled when outrigger poles are used to keep gear from tangling. When using live bait, trollers move at slower speeds to permit the bait to swim "naturally."

Charter and recreational fisheries

The region's charter fisheries primarily troll for billfish. Big game sportfishing rods and reels are used, with four to six lines trolled at any time with outriggers. Both artificial and natural baits are used. In addition to lures, trollers occasionally use freshly caught skipjack tuna and small yellowfin tuna as live bait to attract marlin, the favored landings for charter vessels, as well as yellowfin tuna.

The recreational fleet primarily employs troll gear to target pelagic species. Although their motivation for fishing is recreational, some of these vessel operators sell a portion of their landings to cover fishing expenses and have been termed "expense" fishermen (Hamilton 1999). While some of the fishing methods and other characteristics of this fleet are similar to those described for the commercial troll fleet, a survey of recreational and expense fishermen showed substantial differences in equipment, avidity, and catch rates compared to commercial operations. Vessel operators engaged in subsistence fishing are included in this recreational category.

5.2.1.1 Hawaii pelagic fisheries

Hawaii's pelagic fisheries are small in comparison with other Pacific pelagic fisheries such as distant-water purse seine fisheries and other foreign pelagic longline fisheries (NMFS 1991), but they comprise the largest fishery sector in the state of Hawaii (Pooley 1993b). Tuna, billfish and other tropical pelagic species supply most of the fresh pelagic fish consumed by Hawaii residents and support popular recreational fisheries (Boggs and Kikawa 1993).

Of all Pelagics FMP fisheries, the Hawaii-based limited access longline fishery is the largest. This fishery accounted for 85 percent of Hawaii's commercial pelagic landings (28.6 million lb) in 1998 (Ito and Machado 1999). The fleet operates under a limited entry regime with a total of 164 transferable permits (119 of which were active in 1999, the last full year prior to Court-required restrictions) and a maximum allowable vessel length overall of 101 feet. Based on federal logbook data, this fleet's 1999 landings were 28.3 million pounds (238,000, pounds per vessel) and gross ex-vessel revenue was $47.4 million ($398,000 per vessel). This fleet took 1,137 trips in 1999 (1,103 in 2000), an average of 9.5 trips per vessel. Thirty-one (6%) of these trips targeted swordfish, 296 (26%) had mixed swordfish/tuna targets, and 776 (68%) targeted tunas. Landings consisted of 6,830,000 pounds ($13 million) of swordfish, 10,300,000 pounds ($27 million) of tunas, and 10,620,000 pounds ($7.3 million) of other billfish (marlins), mahimahi, wahoo, moonfish and sharks. In 1999, 48% of fleet effort was expended on the high seas, 34% within the EEZ surrounding the Main Hawaiian Islands, 12% within the EEZ surrounding the Northwestern Hawaiian Islands, and 6% within the EEZ surrounding the US Pacific Remote Island Areas.

The longline fishery provides approximately 85% of fresh commercial seafood landings in Hawaii. As such it supports a substantial fishery supply sector (fuel, oil, bait, gear etc.) as well as an auction house, and numerous fish wholesaling and retailing operations. The Hawaii longline fishery, valued at $46.7 million in a 1998 baseline economic analysis, has been estimated to have a total impact on Hawaii business sales of $113 million using an input-output model of the Hawaii commercial fishery (Sharma et al. 1999). This model calculates the inter-relationship of industries producing inputs to the longline fishery – what are termed "backward" linkages. The total sales figure includes the direct effect of the ex-vessel sales and the indirect and induced income effects on other industries – what we term associated businesses. Using this model, the personal and corporate income effect of the longline fishery is $50 million with upwards to 1,500 jobs directly associated with the Hawaii longline fishery. State and local taxes are approximately $8 million. In addition there are "forward" linkages which refer to the supply effect of Hawaii longline-caught fish on the seafood auction, wholesalers and retailers, etc. These measures are more difficult to measure but have been estimated to represent an additional $8-16 million in value-added.

Landings by Hawaii-based fisheries in 1998 ranged from to 28.6 million pounds by the longline fleet to 696,000 pounds by the aku boats and are summarized in Table 11. Tunas (*Thunnus* spp.) and broadbill swordfish (*Xiphias gladius*) are the dominant target species, but a variety of other pelagic species are also landed incidentally, including blue sharks *(Prionace glauca*), opah

(*Lampris guttatus*), marlin (Families *Tetrapturidae* and *Makairadae*), and mahimahi (*Coryphaena* spp.).

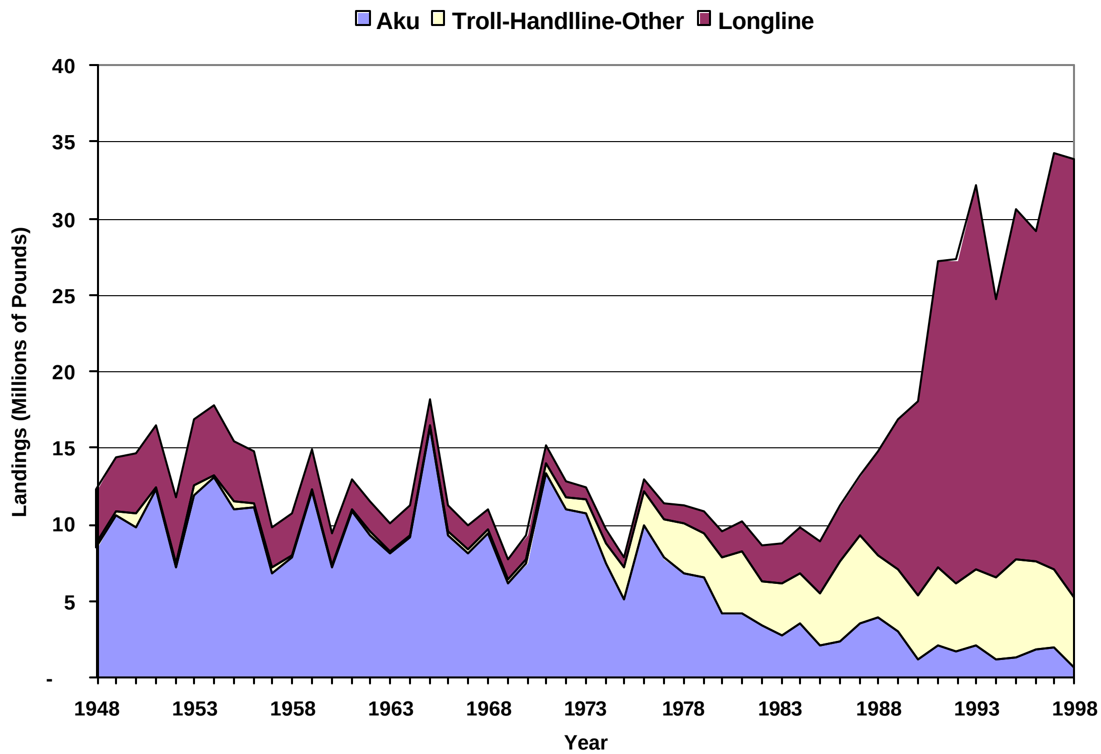
Table 11. Fishery information for Hawaii pelagic fisheries, 1998

Gear/Vessel Type	Longline	Charter Fishery	Troll/Handline Fisheries	Pole-and-line Fishery (Aku Fishery)
Area Fished	EEZ around Hawaii (25-200 nm) and high seas	Inshore and EEZ	Inshore and EEZ	Inshore and EEZ
Total Landings	28.6 million pounds	1.8 million pounds	4.6 million pounds	0.7 million pounds
Catch Composition	24% bigeye tuna 24% pelagic sharks 12% albacore tuna 11% swordfish 6% yellowfin tuna	billfish wahoo yellowfin tuna skipjack tuna (catch percentages are unknown)	yellowfin tuna skipjack tuna mahimahi wahoo striped marlin bigeye tuna (catch percentages are unknown)	99.6% skipjack tuna
Season	All year	All year	All year	All year
Active Vessels	114	199	1,824	6
Total Permits	164 (transferable) (limited entry)	NA	NA	NA
Total Trips	1,140	16,700	26,203	223
Total Ex-vessel Value	$46.7 million	$15.3 million	$7.2 million	$0.9 million

Source: Adapted from WPRFMC 1999b and NMFS 1999.
Note: Data do not include all landings for recreational fishers. For the charter fishery, gross revenue estimates include charter fees, fish sales, and mount sales commissions for a 12-month period in 1996-1997.

Total pelagic landings experienced a slow decline from the early 1950s through the mid-1980s, as shown in Figure 15. The decline was primarily due to reduced landings by the aku fleet although decreases in longline landings are also apparent in Figure 15. Landings by the troll fleet began to increase in the early 1970s but the overall decline in pelagic landings continued. The pelagic landings of the longline fleet began to slowly increase in the late 1970s but it wasn't until the mid-1980s when longline landings began to increase substantially that the decline of more than three decades was overcome. Total pelagic landings increased dramatically through the mid-1990s with substantial variability since that time.

Figure 15. Pelagic landings in Hawaii, 1948-1998



Markets for the pelagic fisheries of Hawaii

The marketing and distribution system for fresh pelagic fish landed in Hawaii is part of a larger network of interconnected local and worldwide components that supplies a variety of fresh and frozen products to consumers in Hawaii and elsewhere (Pooley 1986). Hawaii's fishers supply a variety of pelagic fish in a range of qualities and quantities.

Local fishers using a variety of fishing methods are the dominant source of fresh pelagic fish for the Hawaii market. Hawaii's large pelagic longline fleet targets bigeye, yellowfin, and albacore tunas as well as swordfish. Longliners also supply marlin to the market, primarily as incidental catch. The handline fishing fleet targets yellowfin, bigeye, and skipjack tunas. Commercial trollers provide a variety of pelagic fish, especially mahimahi, wahoo, marlin, and yellowfin tuna, depending on the season (DBEDT 2000; Bartram 1997). Table 12 shows 1999 reported landings and sales of the major pelagic species in Hawaii.

Table 12. Hawaii reported landings and sales of pelagic species, 1999

	Landings (lb)	Sales (lb)
Bigeye tuna	5,139,432	5,105,270
Yellowfin tuna	3,930,995	3,785,305
Albacore tuna	3,348,820	3,326,670
Skipjack tuna	1,839,834	1,728,767
Blue marlin	1,090,920	985,385
Striped marlin	849,041	830,386
Swordfish	3,834,710	3,833,810
Mahimahi	1,179,583	1,103,132
Ono	899,880	819,144
Moonfish	1,000,844	1,000,665
Pomfret	288,435	287,449
Sharks	256,794	166,316
Total	**23,659,288**	**22,972,299**

Source: NMFS Honolulu Laboratory; Western Pacific Fishery Information Network.
The figures for sharks do not include data on sharks whose fins were retained and carcasses discarded.

Export markets are important for tuna and swordfish, which are produced and traded extensively on an international scale. However, much of the highest-quality tuna never finds it way out of the Hawaii market, where consumers are among the most discriminating in the world.

Historically, swordfish did not have a strong demand in Hawaii, and the bulk of landed swordfish is exported to larger, established markets on the U.S. mainland and in Japan. Subsequently, a market niche developed. Other pelagic species harvested in Hawaiian waters, such as blue marlin, striped marlin, mahimahi (also known as dolphinfish) and ono (also known as wahoo), are consumed largely in the local market. Marlin, prized in some markets, is considered an affordable alternative to the more expensive tuna. Mahimahi and ono have an established niche in the local market, which consumes the entire local supply, supplemented by imports of these species from other fisheries (Bartram 1997).

Per capita seafood consumption by residents and visitors to Hawaii is twice the U.S. average. Therefore, it is not surprising that the local supply falls short of local demand. For certain grades and species of fish, such as aku (skipjack tuna), demand is greater than landings in Hawaii's waters. To meet the excess demand, much fresh and frozen fish is imported to Hawaii. Although the imported volume may be as high as two-thirds of local production, substantial portions of the imports are re-exported to other markets. Hawaii's central Pacific location is convenient for consolidating fish shipments from other Pacific islands for shipping on to the U.S. mainland (Bartram 1997).

Markets for pelagic species fluctuate throughout the year. Prices for a given species may vary seasonally with fluctuations in quality, quantity, demand, and quantities of substitutes. Quality is a function of several factors. Gear and fishing method affect the condition of the fish and the quality of the meat. Fish quality is also thought to change seasonally with water temperature fluctuations.

Tuna forms the largest segment of Hawaii's fish production and is an expanding market. Variation in uses of different species is apparent, as Hawaii has both significant imports and exports of tuna (Bartram 1997). The high-quality tuna that is exported from Hawaii is sold mostly to Japanese buyers. Hawaii exporters and fishers target the Japanese tuna market because of its renowned high prices for fish. Tuna is also sold to mainland U.S. markets. These markets rely on sources other than Hawaii for high-quality fish. However, they import some lesser grades of tuna from Hawaii to serve the demand for lower-quality fish (Bartram et al. 1996).

Although significant exports are made, annual local consumption of fresh tuna alone is approximately 6,349,000 pounds. Several niches within Hawaii's tuna market have developed, each with its own quality standards. The market for tuna served raw as *sashimi* is generally known as the most demanding. Other markets include cooking (highly variable in quality demanded), *poke* (raw cubes served with spices and condiments), and smoking or drying (with the lowest quality requirements) (Bartram 1997).

As much as 40 percent of local tuna consumption is raw, in the form of *sashimi* and *poke*, a local favorite. Bigeye and yellowfin tunas are commonly used for *sashimi*, but bigeye is the species of choice because of its brighter muscle color, higher fat content, and longer shelf life (Bartram 1997).

Hawaii's consumers have traditionally placed a high demand on the Hawaii market for high-quality tuna. The Hawaii market has historically supplemented its local supply by importing substantial quantities of bigeye and yellowfin tunas, mostly from the Indo-Pacific region. Imports have declined in recent years as consumers have sought to satisfy more of their demand from the local supply. The reasons for the decline in imports are somewhat unclear. One contributing cause is the decline of the tuna fleet in the Marshall Islands in the mid-1990s and changes in fleet operations in the Pacific. In addition, the Hawaii market has seemed more willing to substitute local, high-quality albacore at times when top-quality bigeye and yellow fin tunas are in short supply (Bartram 1997).

Swordfish is the second largest fishery in Hawaii after bigeye tuna. The majority of swordfish is exported to the continental United States. Although swordfish is used locally for *sashimi* at times, grilling is the most popular method of preparation.

Most swordfish are caught by the longline fleet using nighttime shallow fishing techniques with luminescent attractants. Swordfish are also occasionally caught by tuna longline fishers as incidental catch. Trollers and handliners also participate in this fishery, but to a minor degree.

The peak season for swordfish is the early summer months from April to July. Most of the fish are sold at the Honolulu fish auction. A portion, however, is sold directly to wholesalers and exporters. Most of the fish are shipped to the US East Coast, where Hawaii swordfish brings a premium price. East Coast purchasers commonly purchase swordfish in airline container quantities to realize economies of scale in shipping.

Harvest levels grew substantially during the early 1990s due to the adoption of the nighttime surface fishing techniques. In 1987 and 1988, swordfish landings averaged 50,000 pounds. By 1991, landings had grown to more than ten million pounds. Swordfish landings peaked in 1993 at slightly more than 13 million pounds and have since ranged between 5.5 million and slightly more than seven million pounds a year (WPRFMC 1999b).

Hawaii generally is one of many suppliers of swordfish to a major US market served by a worldwide supply. In 1998 (when Hawaii landings were slightly more than seven million pounds), approximately 34.6 million pounds of swordfish were imported into the continental US market. Imports of fresh swordfish in excess of two million pounds were received in the United States from Brazil, Chile, and Australia. Singapore alone exported more than eight million pounds of swordfish to the U.S. market (WPRFMC 1999b; Seafood Market Analyst 2000). In addition, other areas of the continental United States recorded significant harvests. In 1998, the U.S. Pacific fleet (excluding Hawaii) caught three million pounds of swordfish, and the Atlantic and Gulf fleets caught an additional 4.8 million pounds (Hamm et al. 1999).[12] Assuming that most of this domestic landings are used in the U.S. East coast market, Hawaii's landings comprise less than 15 percent of the U.S. East coast swordfish market.

Neither marlin species, blue marlin or black marlin, is targeted by commercial fishers in Hawaii. The majority of the landings are caught incidentally by the longline tuna fleet. Trollers also contribute to Hawaii marlin harvests. Sport fishers, however, target blue marlin and often sell their landings in the commercial market, with proceeds going to the boat and crew. Most commercial marlin landings are sold in the Honolulu auction. Sport fishers and trollers, however, may sell their landings directly to wholesalers, retailers, or restaurants (DBEDT 2000).

Marlin is used as *sashimi* and *poke* in Hawaii. Large group caterers often prefer marlin because it discolors more slowly than tuna. Premium *sashimi*-quality striped marlin, which has orange-red meat and higher fat content, is thought to be of higher quality than blue marlin, although blue marlin with acceptable fat content is used as *sashimi*. Both are cooked by Hawaii restaurants. Blue marlin is popular with lower-income and fixed-income groups and often is smoked (Bartram 1997; DBEDT 2000).

The blue marlin and striped marlin harvests are a significant but secondary part of the Hawaii market. The combined annual landings of both species in the past ten years typically have been about two million tons. Historically, striped marlin harvests have exceeded blue marlin harvests, but in two of the last four years, blue marlin exceeded striped marlin by more than 100,000 lb (WPRFMC 1999b.).

Seasonal variability in price is greater for both blue marlin and striped marlin than for tuna. The Hawaii blue marlin season peaks between June and October. The peak of the striped marlin season is opposite, beginning in November and continuing until June. The seasonal price changes are similar for the two fish, suggesting that the prices are driven by changes in tuna

[12] Data for the 1999 U.S. catch are unavailable. In the last four years for which data are available, catch was relatively stable, between 7.5 million and 8.0 million pounds.

supply and total demand for fish rather than by the volume of marlin harvests. Marlin prices reach annual highs from February to April and again in September and December. The high prices early in the year coincide with a period of low tuna supplies. The transition from summer yellowfin to winter bigeye is the likely explanation for the high price for marlin in September. Marlin is also likely substituted for tuna in December when demand is high. The low prices in June and July occur during the period when tuna supply is at its highest and overall demand is at a low. Low prices occur in October, when marlin and bigeye are in high supply (DBEDT 2000).

The markets for billfish in particular have been affected by limits on mercury in imported fish. The U.S. Food and Drug Administration has a limit of 1.0 parts per million for methyl mercury in fish imports. Every lot imported is tested before release for sale. The procedures allow an importer to obtain a "green card" limiting testing requirements if the importer's first five shipments all test below the limit. The procedure is costly for minor importers and is believed to limit the inflow of swordfish into the United States. The sampling procedure is also costly and can damage fish, further deterring imports of swordfish into U.S. markets (Bartram 1997).

Other important PMUS are mahimahi, ono, moonfish, and pomfret. Most Hawaii restaurants have diversified menus that include mahimahi and several other species, such as marlin, ono (wahoo), opah (moonfish), and large-scale black pomfret. Demand for these pelagic species has led to substantial landings by Hawaii fishers, who sell to the Hawaii market. Harvests of mahimahi and ono, the most commonly targeted species, fluctuate seasonally. Significant quantities of opah and pomfret are caught incidentally. Quantities of these two species fluctuate significantly, but follow no seasonal trend. All of these species are sold fresh, because almost no market exists for frozen local landings (Bartram 1997; DBEDT 2000).

Most mahimahi and ono are caught by trollers, although portions of the harvest are taken by longline and pole-and-line fishers. These species are sold through the Honolulu and Hilo fish auctions and directly to wholesalers and restaurants. Mahimahi is a favorite in many local restaurants. Ono is generally substituted when mahimahi is in short supply. The limited local supply of mahimahi has led to import of substantial quantities to Hawaii from Taiwan, Japan, and Latin America. Since imported fish tend to be slightly cheaper than fresh local fish, imported fish tend to be directed toward less expensive restaurants. Little of either of these species is exported, because local consumers consume most of the local supply.

Pomfret and moonfish are also frequently sold in local restaurants. These species complement the supply of mahimahi and ono in the local fresh market. Both species are primarily incidental catch of the longline fleet and are sold almost exclusively through auctions (Bartram 1997, DBEDT 2000).

Prior to its prohibition of by the Hawaii Legislature and the U.S. Congress in 2000, shark finning had been a source of significant revenue for crew members in the Hawaii-based longline fishery. Most of these revenues are generated by sales of blue shark fins sold to satisfy the demand for fins in the Asian market. A small market has also developed recently for thresher and mako sharks. The landings of these two species is small and does not contribute substantially to the overall revenue in the fleet.

The prohibitions on finning of sharks are likely to substantially limit the activity of Hawaii-based longline vessels in the Asian market for shark fins. No market exists for the carcass of blue sharks, which is the dominant incidental catch species in Hawaii longline fisheries (WPRFMC 2001c), and until such a market develops, the landing of these sharks is unlikely.

5.2.1.2 American Samoa pelagic fisheries

American Samoa-based pelagic fisheries consist of a small fleet of *alia* longliners, a few mid-size and larger longliners, and a small fleet of trolling vessels. These fleets target albacore, skipjack tuna, yellowfin tuna, and other pelagic species. Landings and other attributes of these fisheries for 1998, along with those of Guam and the CNMI, are summarized in Table 13.

Table 13. Pelagic fishery information for American Samoa, Guam, and CNMI, 1998

Islands	American Samoa		Guam	CNMI
Gear	Longline	Troll/Charter	Troll/Charter	Troll/Charter
Area Fished	Inshore and EEZ	Inshore and EEZ	Inshore and EEZ	Inshore and EEZ
Total Landings	884,154 lb	25,271 lb	817,087 lb	192,568 lb*
Catch Composition	72% albacore tuna 8% yellowfin tuna < 5% all others	74% skipjack tuna 6% barracuda 4% yellowfin tuna < 4% all others	31% mahimahi 23% skipjack tuna 19% yellowfin tuna	70% skipjack tuna 11% mahimhai 8% dogtooth tuna 6% yellowfin tuna
Season	All year	All year	All year	All year
Active Vessels	25	24	438	89
Total Permits	50 (open access)	NA	NA	NA
Total Trips	2,359	123	14,324	2,230
Total Ex-vessel Value	$968,361	$29,949	$711,066**	$398,086

Source: adapted from WPRFMC 1999b; NMFS 1999.
* Landings for CNMI are recorded commercial landings, but not all commercial landings are recorded (D. Hamm, NMFS Honolulu Laboratory, pers. comm., November 3, 2000).
** Total ex-vessel value of landings in Guam are estimated from commercial landings, which are less than 50 percent of total landings.

Despite a 40-year history of tuna canning in American Samoa by two large processors, commercial fishing for tuna by domestic (local) vessels in the EEZ around American Samoa is a relatively recent endeavor. The importance of pelagic fish as a source of income and employment in American Samoa's small-scale fishery has increased rapidly since 1996, following the adoption of longline fishing methods patterned after those in the neighboring country of Samoa. American Samoa's small-scale fishery is presently evolving from the realm of traditional subsistence activities to more commercial activities.

The small-scale pelagic fishery in American Samoa employs relatively simple troll and longline fishing technology. More than 90 percent of the respondents in a survey of 20 longline fishermen planned to increase their efforts at longlining (Severance et al. 1999). Until very recently, most of the small-scale fleet was comprised of boats under 30 feet in overall length.

New and safer types of small-scale vessels have begun to enter the pelagic fishery and they are capable of extending the safe range of fishing farther offshore.

The American Samoa based longline fishery consists of vessels that fish under a western Pacific general longline permit. This permit allows the vessel to fish for PMUS using longline gear in the EEZ around American Samoa, Guam, the Commonwealth of the Northern Mariana Islands (CNMI) or other U.S. island possessions, excluding the Hawaiian Islands. Unlike Hawaii longline permits the number of Western Pacific general longline permits is not restricted. As of 1998, there were 48 general longline permitted vessels in American Samoa, three in Guam and one in the CNMI, however, however only those based in American Samoa were active during 1998.

Prior to 1995, the non-purse seine pelagic fishery in American Samoa was largely a troll-based fishery. In mid-1995, four vessels began longlining and by 1997, 33 vessels had permits to longline. Approximately 17 of these were actively fishing on a monthly basis. In 1998, only 26 of the 50 federally permitted longliners actually fished. These 26 vessels reported total landings of 884,000 pounds in 1998.

Apart from a few larger (> 40 ft) inboards, longlining out of American Samoa generally takes place on *alia*, twin-hulled (wood with fiberglass or aluminum) boats about 30 feet long, and powered by small gasoline outboard engines. Navigation on the *alia* is visual using landmarks. The gear is stored on deck attached to a hand crank reel which can hold as much as 10 miles of monofilament mainline. Participants set between 100 and 300 hooks on a typical eight-hour trip. The gear is set by spooling the mainline off the reel and retrieved by hand cranking back onto the reel. Currently most fishing is done within 25 miles of shore, but with better-equipped vessels, fishing activity may extend further. Generally, gear setting begins in early morning with retrieval in the mid-morning to afternoon. The fish are stored in containers secured to the decks or in the hulls. Albacore tuna is the primary species landed followed by skipjack tuna and yellowfin tuna. Most fish are sold to large-scale canneries, but some are sold to restaurants, and donated for family functions.

As stated above, this fishery is presently open access, with no limits on the number of longline vessels, individual or total vessel capacity, catch or effort, but a control date has been established for the purpose of providing notice that vessels entering the fishery after the control date would not be assured of being allowed to use longline gear to fish for pelagic management unit species in the EEZ around American Samoa should a limited access program be established (WPRFMC 2000a) (see Section 2.2 for details).

The length distribution of vessels owned by longline permit holders, as of October 2000, is summarized in Table 14.

Table 14. Longline permit holders based in American Samoa as of October 2000

No. of Vessels, by Length Overall					
< 30 ft	**31-35 ft**	**35-40 ft [a]**	**41-45 ft [b]**	**46-50 ft [c]**	**50+ ft**
34	14	9	2	0	5

Source: NMFS in WPRFMC 2000a.
[a] A newer and safer version of *alia* (a catamaran-style vessel that is the most common type of fishing boat in American Samoa and Samoa) is being assembled in Samoa from pre-cut aluminum plates manufactured in New Zealand. Mostly 38 to 42 ft in length, this version is equipped with a larger fuel tank, navigational aids, higher freeboard, and more safety equipment to extend fishing range to well over 100 nm from shore. Several new fishing enterprises in American Samoa have plans to acquire vessels of this type.
[b] In addition to planned acquisitions in this length class, FAO is designing a 45 ft catamaran-style vessel for the next phase of longline fishery expansion in neighboring Samoa. This design will also be available for boatbuilding in American Samoa.
[c] A design for a monohull vessel assembled from precut steel plates in the 46 to 50 ft class has been prepared in American Samoa.

5.2.1.3 Guam pelagic fisheries

Pelagic fishing vessels based on Guam fall into two broad categories: (1) distant-water purse seiners and longliners that fish primarily outside the EEZ around Guam and transship through Guam; and (2) small, primarily recreational trolling boats that are either towed to boat launch sites or berthed in marinas and fish only local waters (within the EEZ around Guam or in the adjacent EEZ waters of the CNMI. This discussion covers primarily the local small boat pelagic fishery (WPRFMC 1999b). As of 1998, there were three vessels with general longline permits in Guam, but none were active (NMFS 2000a).

Aggregate landings of all pelagics, tuna, and non-tuna PMUS by the small boat fleet fluctuate greatly, but appear to be increasing. In the early 1980s, the pelagic landings consisted primarily of tunas. Then beginning in 1985, non-tuna PMUS, primarily mahimahi, began making up the bulk of the landings. The commercial landings of all pelagics also show a similar trend (WPRFMC 1999b).

The total landings data are extrapolated from the Guam Division of Aquatic and Wildlife Resources (DAWR) offshore creel sampling program and other available commercial fishing data. Unfortunately, the information necessary to reconcile the difference between commercial and all landings is not available. Therefore, this analysis assumes that the balance of the total landings is associated with fishing for personal and recreational purposes.

Most fishing boats are less than ten meters (33 ft) in length and are typically owner-operated by persons who earn a living outside of fishing (WPRFMC 1999b). Most fishers sell a portion of their landings at one time or another, and it is difficult to distinguish among recreational, subsistence, and commercial fishers. A small, but significant, segment of the pelagic fleet consists of marina-berthed charter vessels that are operated primarily by full-time captains and crews (WPRFMC 1999b).

In Guam, trolling with lures and (occasionally) baited hooks conducted from catamarans and other small commercial, recreational, and charter vessels in coastal waters, near seamounts, or around FADs. Charter boat activity decreased between 1997 and 1999, primarily because of a significant drop in the number of tourists as a result of the Asian economic crisis.

In 1981 and 1984, the bulk of pelagic landings consisted of tunas. However, after 1984 non-tuna PMUS began making up the bulk of pelagic landings due to an interest in targeting blue marlin, an increase in mahimahi landings, and a lack of interest in skipjack tuna. In 1998, total pelagic landings increased ten percent, tuna landings increased nine percent, and non-tuna PMUS increased nine percent. Charter trolling trips accounted for 15 percent of overall pelagic landings (WPRFMC 1999b).

In 1998, skipjack tuna landings decreased by nine percent from 1997 landings, while yellowfin tuna landings increased 52 percent. For most years, skipjack landings exceeded yellowfin landings by a two-to-one ratio. Given the relative unmarketability of skipjack tuna in the local market and the desirability of yellowfin tuna, the availability of skipjack tuna probably exceeds yellowfin availability by a wider margin.

Reliable estimates of the total economic contribution of the domestic fishing fleets in Guam are currently unavailable.

5.2.1.4 CNMI pelagic fisheries

The CNMI is a string of islands in the western Pacific Ocean (longitude 145° E, and latitude 14° N to 21° N). Inhabitants live on three primary islands: Saipan, Rota, and Tinian. The pelagic fishery activities occur primarily from the island of Farallon de Medinilla south to the island of Rota (NMFS 2000a). Commercial, subsistence, and recreational fishing are practiced.

Trolling is the most common fishery in the CNMI, with bottomfishing and reef fishing also conducted (Glazier 1999b). The product is primarily skipjack tuna. This fishery is on the increase, most likely due to increasing population in CNMI (WPRFMC 1999b). All domestic commercial fishery product is consumed locally. Yellowfin tuna and mahimahi are targeted to a lesser degree, and are easier targets for the local fishermen during seasonal runs. (Yellowfin are preferred to skipjack, but are rarely encountered. These species are accepted by all ethnic groups in the CNMI and have maintained their market demand with the ongoing in-migrating population growth on Saipan (more than half of the population on Saipan is non-native) (WPRFMC 1999b).

No large-scale longline or purse seine activity occurs around the CNMI at this time. However, fishery development consultants for the CNMI have suggested providing incentives for the longline fleet to move into CNMI waters (University of Hawaii 2000). If longline fleets move into the CNMI, the domestic commercial fisheries will be affected. Currently only one vessel in CNMI has a General Longline Permit, which allows the vessel to fish with longline gear in the EEZ around CNMI, Guam, and American Samoa. This vessel was not active as a longliner in 1998 (WPRFMC 1999b).

Because skipjack are common in nearshore waters off the CNMI, these fish are caught with minimal travel time and fuel costs. Trolling is the primary gear. Most trips are less than a full day. Trolling for skipjack tuna takes place throughout the year. The mahimahi season is February through April, and the yellowfin tuna season is April to September (WPRFMC 1999b).

The pelagic fishing fleet, other than charter boats, consists primarily of vessels less than 7.32 m (24 ft) in length, which usually travel in a limited 20-mile radius from Saipan (WPRFMC 1999b). Most are 3.66-7.32 m (12-24 ft), outboard-powered, runabout-type vessels (NMFS 2000a).

According to WPRFMC (1999b), about 82 percent of all boats registered with the DPS participated in some form of fishing activity in the CNMI in 1998 (75 full-time commercial, 65 part-time commercial, and 143 subsistence/recreational). Of the registered vessels, 24 were charter vessels, which generally retain their landings and sell to local markets (WPRFMC 1999b). The amount of charter boat sales is not known. However, it constitutes a small portion of the local fish market, and most fish are typically consumed by the charter crew (Hamm et al. 1999).

Official estimates of the number of crewmembers involved in the commercial fishery in CNMI are not available. However, since the primary gear is trolling, it is reasonable to assume that there is one crew person in addition to the skipper, as is typical on troll boats in Hawaii (Hamilton and Huffman 1997).

Most vessels in the CNMI pelagic fishery are based on Saipan. Although available data do not indicate actual residence of vessel owners, it is reasonable to assume that most landings in Saipan are made by residents of Saipan.

Cost studies of the pelagic fisheries in CNMI similar to studies for Hawaii in Hamilton and Huffman (1997) do not appear to have been conducted. Nor does it appear that an input-output study, similar to work in Sharma et al. (1999), is available.

5.2.1.5 PRIA pelagic fisheries

There is limited knowledge of fishing activity and effort in the PRIA because of limited reporting requirements for vessels active in this fishery. Longline vessels that fish in EEZ waters around the PRIA must be registered under a longline general permit or the Hawaii-based longline limited access permit. These vessels have federal reporting requirements. There are no federal reporting requirements for commercial troll and handline vessels targeting pelagic species in these areas. The only existing reporting requirement for recreational and charter vessels in this area is a U.S. Fish and Wildlife Service requirement for maintaining a "Midway Sports Fishing Boat Trip Log." This requirement applies to fishing within the Midway Atoll National Wildlife Refuge. The log, however, need not include any information about interactions with protected species.

Two Hawaii-based troll and handline vessels are known to have fished recently in EEZ waters around Palmyra and Kingman Reef targeting pelagic (including yellowfin and bigeye tunas, wahoo, mahimahi, and sharks) and bottomfish species. Catch and effort data on these vessels are unavailable.

Five charter vessels are known to be based on Midway, two of which troll for pelagic species. The other three are used for nearshore and lagoon fishing. Approximately seven vessels are maintained and used for recreational fishing by Midway residents. Three of these are known to troll for pelagic species including yellowfin tuna, ono, and blue and striped marlin.

5.2.1.6 Foreign pelagic fisheries

Fisheries managed under the Pelagics FMP compete with a variety of foreign fleets operating on the high seas and within the EEZs of many Pacific nations in the Central and Western Pacific. Large-scale, distant-water foreign fisheries include three gear types: longline, pole-and-line and purse seine.

The pole-and-line fleet in the western and central Pacific Ocean (WCPO) was composed of approximately 1,400 vessels in 1999. Most of the vessels are small to medium-sized and operate in the domestic fisheries in Indonesia and Japan. There are few environmental issues concerning pole-and-line fishing because the technique is very selective in catching tuna species, primarily skipjack tuna.

Purse seine vessels from Japan and the United States have fished in the WCPO since the mid-1970s and new vessels from Korea and Taiwan entered the fishery in the early 1980s. In 1999 the WCPO purse seine fleet was comprised of 223 vessels including 159 distant-water vessels, 31 domestic Pacific Island vessels, and 33 domestic non-Pacific Island vessels (e.g., Australia, Indonesia, Japan and New Zealand). The 1999 catch of 1,033,000 mt was comprised of: skipjack tuna – 781,000 mt (76% of the total), yellowfin tuna– 218,000 mt (21%) and bigeye – 35,000 mt (3%) (Coan et al. 2000).

The diverse longline fleet in the WCPO was composed of roughly 4,700 vessels in 1999. These vessels can be divided into four components largely based on the area of fishing operations: (1) over 400 vessels are domestically based in the Pacific Islands with the Samoa (formerly Western Samoa) *alia* fleet representing half of these vessels; (2) approximately 3,000 vessels are domestically based in non-Pacific Island countries, largely in Japan and Taiwan; (3) about 750 large distant-water freezer vessels from Japan, Korea and Taiwan that operate over large areas in the region; and (4) about 450 offshore vessels based in Pacific Island countries and composed of roughly equal numbers of vessels from mainland China, Japan and Taiwan. Pacific-wide longline effort increased from 300 to 500 million hooks from 1962 to 1980. Since 1980, annual pelagic longline effort has been roughly 560 million hooks. Effort in the longline fishery is the most widespread of any industrial fishery in the Pacific.

Longline fisheries usually target tuna or swordfish. Tuna longlining is characterized by day fishing at moderate depths (100-250 m) to target albacore and yellowfin tunas, or deeper depths (250-400 m) to effectively target bigeye tuna (Hanamoto 1976; Boggs 1992). The Japanese longline fleet had mainly targeted albacore for canning until the early 1970s. These longliners deployed "conventional" longline gear of four to six hooks between floats (HBF) fishing a depth of approximately 90-150 meters. In the early 1970s longliners changed to 'deep' sets by placing more hooks between longline floats. The deeper longline gear was more effective in catching bigeye tuna and the fleet shifted activities in waters near the equator where the thermocline is shallower.

In addition to the sector of the Hawaii-based longline fishery, which targets swordfish, there are several foreign fleets (e.g., longline, gillnet, and harpoon) that target swordfish in the Pacific. While most of the foreign longline effort targets tuna species, the shallower swordfish longlining has a higher incidence of encountering a protected or endangered species. Foreign longline fisheries specifically targeting swordfish occur in Japan, Chile and Australia. Fishing methods by the Japanese swordfish fleets are similar to the Hawaii fleet: night fishing with three or four branch lines between each float which results in a shallow gear configuration.

5.2.2 Socioeconomic Importance of the Pelagic Fisheries

5.2.2.1 The regional context

Fishing industry sectors related to the harvest, processing and transshipment of tuna and other highly-migratory pelagic species have made U.S. ports in the Western Pacific Region among the nation's leaders in terms of value of catch landed. However, fisheries occurring inside the U.S. EEZ of the Western Pacific – that is, the area covered by the FMP – account for only a small fraction of the volume of pelagic species caught in the Pacific basin. This small percentage reflects the fact that Pacific pelagic stocks are capable of extensive movement and are the targets of intense competition among a multitude of distant-water U.S. and foreign fishing fleets that operate on the high-seas and within the EEZs of many nations.

Hawaii is unique in the Western Pacific Region in that a relatively high proportion of the pelagic fish landed in this sub-region are harvested within the U.S. EEZ. Even then, about half of the catch of the pelagic fishery of greatest economic importance to Hawaii - the longline fishery - occurs outside the EEZ. The sub-region with the next highest landings of pelagic species harvested within the U.S. EEZ is American Samoa. Yet, the quantity of fish landed by boats operating in federal waters around the territory are far eclipsed by the landings of domestic and foreign distant-water fishing vessels that deliver tuna to American Samoa's fish canneries. Similarly, in Guam catches of pelagic species in the EEZ are much smaller than the landings by the international fleet of distant-water tuna vessels that utilize the territory as a reprovisioning and transshipment center. Even in the CNMI, which benefits the least from distant-water fishing fleets in the Pacific, the quantity of tuna that enters local air transshipment operations from island areas outside the commonwealth exceeds catches of pelagic species within the EEZ around the CNMI. In considering the baseline or existing conditions of the pelagic fisheries of the Western Pacific Region (and the subsequent analysis of alternatives) it is fundamentally important to understand the relative role of that portion of the fishery subject to direct management under the FMP.

5.2.2.2 Economic importance

The management of pelagic fisheries is of particular importance to the sub-regions and communities of the Western Pacific, as the harvest of pelagic species is the major component of fishing industry or activity in the region. The Pacific basin contains immense pelagic fisheries resources and provides more than 40 percent of the world tuna catch. The annual landings of various tuna species harvested from the entire Pacific islands region total over one million metric tons (mt), with a dockside value of $1.5 billion (Lawson 1995).

When the WPRFMC was created in 1977, foreign fleets were fishing heavily for tuna as close as twelve miles to American-flag Pacific islands. The Council's initial priority was to restrict foreign fishing and allow domestic fishers more opportunities to catch fish. Hawaii, being the most industrialized and populated island area, was in the best position to support an expansion of the domestic commercial fishery. At that time it was the policy of the United States that highly migratory fish could be effectively managed only through international arrangements. This policy led to a provision in the Magnuson Act of 1976 that effectively precluded the authority of coastal nations to establish exclusive fishing rights over tuna within their EEZs.[13] Despite the inability of the WPRFMC to manage tuna fishing by foreign vessels in the U.S. EEZ, the number of domestic longline vessels based in Hawaii grew from 14 in 1979 to 141 in 1991. Landings by longline vessels increased from 1,900 mt to 11,500 mt between 1987 and 1993. The inflation-adjusted ex-vessel value of the catch more than tripled during this period to $56 million. Swordfish catches accounted for most of this revenue and represented about 60 percent of the total domestic landings for this species. More recently, the longline fleet has returned to targeted tuna species, and the harvest of albacore, bigeye and yellowfin reached a record high of 7,651 mt in 1997. In 1998, the port of Honolulu ranked 30th in the nation in terms of the quantity of fish landed, but it ranked 7th in terms of the value landings (Table 15).

Table 15. Ex-vessel value of fish landings by commercial domestic and foreign vessels at major U.S. ports, 1996-1998

Port	Value of Landings ($ millions)		
	1996	1997	1998
Pago Pago, American Samoa	211.8	192.7	~232.0
Dutch Harbor-Unalaska, Alaska	118.7	122.6	110.0
New Bedford, Massachusetts	100.5	103.2	93.5
Agana, Guam	94.2	NA	NA
Kodiak, Alaska	82.3	88.6	78.7
Brownsville-Port Isabel, Texas	60.0	46.1	64.2
Honolulu, Hawaii	50.1	53.7	49.0
Key West, Florida	62.8	54.9	NA
Reedville, Virginia	NA	29.5	42.6
Point Judith, Rhode Island	46.0	47.6	41.8

Source: WPRFMC 1999b.

The expansion of the longline fishery in Hawaii during the past two decades has been accompanied by a general trend away from bulk fisheries for pelagic species (e.g., fish cake and canned tuna) and development of quality, high-price products (e.g., *sashimi* tuna) that have enhanced the market value of Hawaii's pelagic fisheries (Boehlert 1993). Local and export markets for Hawaii's seafood products have expanded enormously in recent years, and fresh fish from Hawaii's waters now appears on restaurant menus throughout the United States, from

[13] In 1992, the Magnuson Act was amended to include all tunas as management unit species so that the United States recognized coastal state jurisdiction over highly migratory species within EEZ boundaries.

Honolulu to Des Moines to Boston (Pooley 1993b).

Hawaii's smaller-scale troll and handline fisheries have also benefited in recent years from this expanding local and export markets for high-quality seafood products. Annual revenues within these fisheries total around $10 million.

Related to the troll fishery is the charter boat industry that targets billfish, tuna and other pelagic species mainly for a tourism-based clientele. With direct revenues of $17 million from patrons' fees and fish sales and indirect revenues of up to $30 million, and some 77,000 anglers participating annually, charter fishing is a notable component of tourism in Hawaii (Glazier 2000). Selling the catch is a priority for many charter vessel operators, with the revenues from fish sales generally being split evenly among the captain, crew and vessel owner (Hamilton 1998). One component of recreational fishing that has gained in popularity is tournament fishing. Most notable is the Hawaiian International Billfish Tournament conducted annually on the Island of Hawaii. Since its inception in 1958, this tournament has consistently attracted the most serious big game anglers in the world. In 1995, 72 boats with fishers from 15 countries participated. An indication of the economic significance of these tournaments is that the winner of a 1998 fishing tournament in Kona won $111,000 after landing a 500 lb blue marlin. Recreational fishing is also of economic importance in Hawai'i. The U.S. Fish and Wildlife Service (USFWS 1998) estimates that in 1996, 260,000 anglers in the state spent $130 million on fishing trip-related items.

The other areas within the Western Pacific Region have not experienced the same increase in domestic industrial-scale fisheries that occurred in Hawaii, at least within the harvest sector. The local fishing fleets that operate in the EEZs around American Samoa, Guam, and the CNMI consist mainly of small boats operated by part-time commercial or recreational fishers. However, these islands have discovered alternative ways to take economic advantage of expanding Pacific pelagic fisheries. Tuna processing, transshipment and home port industries have developed in these islands because they possess a comparative economic advantage over other locations in the Pacific basin. These advantages include proximity to fishing grounds, shipping routes and markets; the availability and relatively low cost of fuel and other goods and services that support tuna fishing operations; tariff-free market access to the United States; and significant tax incentives.

American Samoa has seen a level of fish processing related activity unequaled elsewhere in the United States, with the capital of Pago Pago easily being the leading port in the United States in terms of the value of fish landings. For many years Pago Pago has been the site of a major tuna canning industry, and the StarKist cannery in Pago Pago is the current world's largest tuna processing facility. In 1998, American Samoa received 208,300 short tons of fish worth approximately $232 million. Since the tuna processing industry began in American Samoa four decades ago, it has been the largest private sector employer in the territory and leading exporter.

The link between local waters and processors in American Samoa, however, is not a straightforward one. The principal suppliers of tuna to the canneries are island-based U.S. purse seiners that fish primarily between five and ten degrees north or south of the Equator for skipjack and yellowfin tuna. From 1990 to 1998, about 95 percent of the domestic purse seine harvest in the central and western Pacific occurred outside the U.S. EEZ, with most of the fishing taking place between Papua New Guinea, the Federated States of Micronesia and Kiribati. However, during some years, particularly during an El Niño-Southern Oscillation event, a substantial portion of the U.S. purse seine harvest comes from the U.S. EEZs around Palmyra Atoll, Jarvis Island, Howland Island and Baker Island. For example, 36,970 mt of skipjack and yellowfin tuna (26% of the total harvest) were caught around these islands in 1997. Other major suppliers of tuna to the canneries in American Samoa include U.S. albacore trollers operating in the North and South Pacific and foreign longline vessels that fish for large albacore, yellowfin and bigeye tuna. In addition, freezer vessels deliver tuna to American Samoa from various transshipment centers around the Pacific.

Guam has also benefited from the development of an industrial scale pelagic fishery that is not focused exclusively either on a locally based harvest fleet, or on fish from its portion of the U.S. EEZ. During the past decade Guam has been one of the largest tuna transshipment centers in the Pacific, and the value of the fish transshipped in Guam in 1996 was estimated to be more than $94 million. Frozen fish is delivered by domestic and foreign purse seiners and fresh fish is landed by foreign longliners or air-freighted from the Marshall Islands, Federated States of Micronesia and other neighboring Pacific islands. The fish is then shipped from Guam to markets in Japan and elsewhere.

Some Western Pacific Region communities have also found ways to benefit from the regional pelagic fisheries beyond involvement in just the harvesting and processing sectors. A particularly lucrative activity related to the tuna canning and transshipment industry is the re-supplying of the fishing boats that deliver the fish. Pago Pago Harbor in American Samoa and Apra Harbor in Guam are home ports to several hundred foreign and domestic longline and purse seine vessels. Expenditures by these fleets on fuel, provisions and repairs make an important contribution to the economies of these islands. Fleet expenditures in American Samoa were estimated in 1994 to be between $45 million and $92 million (Hamnett and Pintz 1996). Fleet expenditures in Guam were about $68 million in 1998 (Guam Department of Commerce 1999). This home port industry in the islands has both created primary jobs and enhanced investment opportunities for local entrepreneurs.

It should be specifically noted that with the exception of the U.S. Pacific remote island areas, all of the sub-regions in the Western Pacific benefit from foreign as well as domestic fishing operations. While the importance of foreign longline vessels as suppliers of fish to the tuna canneries in American Samoa has steadily decreased in recent years, Pago Pago remains an important re-provisioning base for foreign distant-water '*sashimi*' vessels that transship their catch to carrier vessels in the harbor. Foreign longline and purse seine vessels are the principal customers in Guam's home port and transshipment industry. This type of support activity is not limited to surface transportation, as Guam is also the center of a large air transshipment operation that flies fresh fish caught by foreign vessels to overseas markets. A similar air transshipment operation is based in the CNMI. Finally, a substantial number of foreign fishing vessels find Hawaii an attractive and convenient location for port calls. These vessels also transship a large volume of shark fins through the state.

5.2.2.3 Sociocultural importance

The sociocultural setting of the Western Pacific Region pelagic fisheries reflects the particular cultural and social history of the area, with different aspects of the fisheries encompassing, by varying degrees, aspects of lifeways of a divergent mix of groups, from the traditions of the descendants of the earliest inhabitants of the islands to those of some of the most recently arrived groups. In general, the sociocultural setting or aspects of a fishery include the shared technology, customs, terminology, attitudes and values related to fishing of a wide variety of these groups. While it is the fishers that benefit directly from the fishing lifestyle, individuals who participate in the marketing or consumption of fish or in the provision of fishing supplies often share in the fishing culture. An integral part of this framework is the broad network of inter-personal social and economic relations through which the cultural attributes of a fishery are transmitted and perpetuated. The relations that originate from a shared dependence on fishing and fishing-related activities to meet economic and social needs can have far-reaching effects in the daily lives of those involved. For example, they may constitute important forms of social capital, i.e., social resources that individuals and families can draw on to help them achieve desired goals.

The products of fishing supplied to the community may also have sociocultural significance. For instance, beyond their dietary importance fish may be important items of exchange and gift-giving that also help develop and maintain social relationships within the community. Alternatively, at certain celebratory meals various types of seafood may become imbued with specific symbolic meanings.

The sociocultural context of fishing may include the contribution fishing makes to the cultural identity and continuity of the broader community or region as well. As a result of this contribution, the activity of fishing may have existence value for some members of the general public. Individuals who do not fish themselves and are never likely to, may derive satisfaction and enjoyment from knowing that this activity continues to exist. They may value the knowledge that the traditions, customs and lifestyles of fishing are being preserved.

It is also important to note that fishing is a traditional economic activity in the islands of the Western Pacific Region, and that fishing, in many cases, represents a continuity with the past that may or may not have parallels in other aspects of life and making a living in the modern context. The degree of 'traditional-ness' can and does vary by vessel and gear type, with some types of fishing more closely associated with particular social, cultural, and ethnic groups than others. This is important for the analysis of fishery management measures for pelagic species to the extent that specific measures may differentially impact specific regions and communities, and social, cultural, or ethnic groups.

Culturally distinct ideas and values of relevance to the management of the pelagic fisheries are not restricted to the domain of the target species and activities associated with the use of those species. For example, issues of primary concern to the contemporary management of the longline fishery relate to the incidental mortality of sea turtles and seabirds and the controversy associated with shark finning. In these cases there are concerns that could be categorized as 'existence' or 'ethically motivated' values. For example, value may emanate from the satisfaction of just knowing that a leatherback turtle or Laysan albatross exists in a natural state.

Alternatively, the public, or some portions of the public, may place an intrinsic value on sea turtles and seabirds for religious or philosophical reasons. These animals may have symbolic value as a unique life form similar to the way some marine mammals have become ‘charismatic megafauna.’ However, perceptions of the value of sea turtles and appropriate protection strategies vary considerably from culture to culture and between social and ethnic groups in the Western Pacific Region. In the CNMI, for example, Saipan Carolinians have strongly argued that they should be allowed to capture green sea turtles for cultural purposes if it is determined that the stock could support a limited harvest (McCoy 1998). Some Native Hawaiians have also requested a limited harvest of green sea turtles for traditional and customary uses (Charles Ka‘ai‘ai, pers. comm., WPRFMC, 20 November 2000).

5.2.3 Fish Stocks

5.2.3.1 Pelagic management unit species

The Pelagics Management Unit Species (PMUS) are listed in Table 16.

Table 16. Pelagic Management Unit Species

English common name	Scientific name	Samoan or AS	Hawaiian or HI	Chamorroan or Guam	S. Carolinian or NMI	N. Carolinian or NMI
mahimahi	*Coryphaena* spp.	masimasi	mahimahi	botague	sopor	habwur
wahoo	*Acanthocybium solandri*	paala	ono	toson	ngaal	ngaal
Indo-Pacific blue marlin	*Makaira mazara*	sa'ula	a'u, kajiki	batto'	taghalaar	taghalaar
black marlin	*Makaira indica*					
striped marlin	*Tetrapturus audax*		nairagi			
shortbill spearfish	*Tetrapturus angustirostris*	sa'ula	hebi	spearfish		
swordfish	*Xiphias gladius*	sa'ula malie	a'u ku, broadbill, shutome	swordfish	taghalaar	taghalaar
sailfish	*Istiophorus platypterus*	sa'ula	a'u lepe	guihan layak	taghalaar	taghalaar
pelagic thresher shark	*Alopias pelagicus*	malie	mano	halu'u	paaw	paaw
bigeye thresher shark	*Alopias superciliosus*					
common thresher shark	*Alopias vulpinus*					
silky shark	*Carcharhinus falciformis*					
oceanic whitetip shark	*Carcharhinus longimanus*					
blue shark	*Prionace glauca*					
shortfin mako shark	*Isurus oxyrinchus*					
longfish mako shark	*Isurus paucus*					
salmon shark	*Lamna ditropis*					
albacore	*Thunnus alalunga*	apakoa	'ahi palaha, tombo	albacore	angaraap	hangaraap
bigeye tuna	*Thunnus obesus*	asiasi, to'uo	'ahi po'onui, mabachi	bigeye tuna	toghu, sangir	toghu, sangir
yellowfin tuna	*Thunnus albacares*	asiasi, to'uo	'ahi shibi	'ahi, shibi	yellowfin tuna	toghu

English common name	Scientific name	Samoan or AS	Hawaiian or HI	Chamorroan or Guam	S. Carolinian or NMI	N. Carolinian or NMI
northern bluefin tuna	*Thunnus thynnus*		maguro			
skipjack tuna	*Katsuwonus pelamis*	atu, faolua, ga'oga	aku	bunita	angaraap	hangaraap
kawakawa	*Euthynnus affinis*	atualo, kavalau	kawakawa	kawakawa	asilay	hailuway
moonfish	*Lampris* spp.	koko	opah		ligehrigher	ligehrigher
oilfish family	Gempylidae	palu talatala	walu, escolar		tekiniipek	tekiniipek
pomfret	family Bramidae	manifi moana	monchong			
other tuna relatives	*Auxis* spp., *Scomber* spp., *Allothunus* spp.	(various)	ke'o ke'o, saba (various)	(various)	(various)	(various)

Source: WPRFMC (2002a).
This list includes changes that would be made through FMP Amendment 10. It would remove from the PMUS list dogtooth tuna (*Gymnosarda unicolor*) and all species of shark except the nine pelagic species listed here. NMFS issued a Record of Decision on June 14, 2002 that approves this aspect of Amendment 10 but it has not yet implemented it through a final rule.

Species of oceanic pelagic fish live in tropical and temperate waters throughout the world's oceans, and they are capable of long migrations that reflect complex relationships to oceanic environmental conditions. These relationships are different for larval, juvenile and adult stages of life. The larvae and juveniles of most species are more abundant in tropical waters, whereas the adults are more widely distributed. Geographic distribution varies with seasonal changes in ocean temperature. Migration patterns of pelagic fish stocks in the Pacific Ocean are not easily understood or categorized, despite extensive tag-and-release projects for many of the species. This is particularly evident for the more tropical tuna species (e.g., yellowfin, skipjack, bigeye) which appear to roam extensively within a broad expanse of the Pacific centered on the equator. Likewise, the oceanic migrations of billfish are poorly understood, but the results of limited tagging work conclude that most billfish species are capable of transoceanic movement, and some seasonal regularity has been noted.

Movements of pelagic species are not restricted to the horizontal dimension. In the ocean, light and temperature diminish rapidly with increasing depth, especially in the region of the thermocline. Many pelagic fish make vertical migrations through the water column, often moving toward the surface at night to feed on prey species that exhibit similar diurnal vertical migrations. Certain species, such as swordfish, are more vulnerable to fishing when they are concentrated near the surface at night. Bigeye tuna may visit the surface during the night, but generally, longline catches of this fish are highest when hooks are set in deeper, cooler waters.

Adult swordfish are opportunistic feeders, preying on squid and various fish species. Oceanographic features such as frontal boundaries that tend to concentrate forage species (especially cephalopods) apparently have a significant influence on adult swordfish distributions in the North Pacific.

The status of the pelagic stocks managed under the FMP was reviewed in the Annual Report to Congress on the Status of U.S. Fisheries–2001 (NMFS 2002b). None of the stocks were indicated as being in, or approaching, an overfished condition.

The results of stock assessments for pelagic stocks are increasingly being expressed in terms of MSY-based reference points, which are now required under the MSA. Summarized below are the results of recent stock assessments that provide estimates of: 1) adult stock biomass at a given time relative to the adult stock biomass associated with maximum sustainable yield (B_t /B_{MSY}), and 2) the fishing mortality rate at a given time relative to the fishing mortality rate associated with maximum sustainable yield (F_t /F_{MSY}). Using the terminology of the MSA, the smaller the ratio B_t /B_{MSY}, the closer the stock is to being "overfished." The greater the ratio F_t /F_{MSY}, the closer the stock is to having "overfishing" take place.[14]

Boggs et al. (2000) tabulated then-recent estimates of F_t /F_{MSY} and B_t /B_{MSY} for the pelagic stocks managed under the FMP. These estimates, along with the year for which they were made, are shown in Table 17. Also shown are estimates of natural mortality rates (M) presented in Boggs et al. (2000) for the purpose of specifying reference points. It can be seen that for two stocks,

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[14] The Council is in the process of preparing amendments to its bottomfish, pelagics, and crustaceans FMPs that would specify MSY-based reference points against which these ratios could be compared in order to determine whether overfishing is taking place or the stock is overfished.

bigeye tuna and eastern Pacific yellowfin tuna, the fishing mortality ratio was estimated to exceed 1.0 and the stock biomass ratio was estimated to be less than 1.0 (but see Hampton 2002a, below, for contrary results for bigeye tuna).

Table 17. Estimates of status indicators for Pacific pelagic stocks

Stock	Year	F_t / F_{MSY}	B_t / B_{MSY}	M
Bigeye tuna	1994	1.09	0.99	0.4
Northern Pacific albacore	1995	0.9	1.1	0.3
Southern Pacific albacore	1993	0.62	2.5	0.3
Eastern Pacific yellowfin tuna	1997	1.08	0.95	0.8
Western Pacific yellowfin tuna	1998	0.11 – 0.22	1.65	0.8 – 1.6
Eastern Pacific skipjack tuna	1997	unknown	2.5	> 0.5
Western Pacific skipjack tuna	--	0.25	2.5	> 0.5
Other tunas		unknown	unknown	
Northern Pacific swordfish	1997	0.1	2.47	0.3
Blue marlin	1997	0.46 – 0.88	1.1 – 1.7	0.2
Other billfishes		unknown	unknown	
Pelagic sharks		unknown	unknown	
Other MUS		unknown	unknown	

Source: Boggs et al. (2000).

In a recent assessment of the northern Pacific blue shark stock (using 1992-1998 catch data), it was concluded that MSY was probably between 1.8 and 4 times the level of catch during that period and that fishing mortality during the period was between one fifteenth and one half of F_{MSY} (Kleiber et al. 2001).

The Secretariat for the Pacific Community recently published stock assessments for western and central Pacific bigeye tuna (Hampton 2002a), western and central Pacific yellowfin tuna (Hampton 2002b), western and central Pacific skipjack tuna (Hampton 2002c), and south Pacific albacore (Hampton 2002d). The results are summarized below. The assessments covered the period from the early 1960s through 2001 for all stocks except skipjack, for which the study period started in the early 1970s.[15]

Western and central Pacific bigeye tuna: Estimated values of F_t / F_{MSY} generally increased from the early 1960s through the mid-1990s, followed by an apparent decrease through 2001. F_t / F_{MSY} remained below 1.0 during the entire period, peaking at about 0.7 to 0.8 in the mid-1990s.

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[15] Please see these publications for further details, including the methods used, the confidence intervals associated with the estimates, and a brief discussion of the possible shortcomings of using MSY-based indicators of stock status – particularly about the questionable assumptions that have to be made about the equilibrium behavior of populations.

Estimated values for the period since 2000 were between 0.3 and 0.7. Estimated values of ${}_aB_t$ $/{}_aB_{MSY}$ (adult biomass over adult biomass-at-MSY) for bigeye tuna generally decreased from the early 1960s through the mid-1990s, followed by an apparent increase through 2001. Estimated ${}_aB_t$ $/{}_aB_{MSY}$ remained above 1.0 during the entire period, with a low of about 1.5 to 2.0 in the mid-1990s. Estimated values for the period since 2000 were between 2 and 4.

Western and central Pacific yellowfin tuna: Estimated values of F_t $/F_{MSY}$ generally increased from the early 1960s through 2001. F_t $/F_{MSY}$ remained well below 1.0 during the entire period, peaking at about 0.3 to 0.6 in the last year or two. Estimated values of ${}_aB_t$ $/{}_aB_{MSY}$ for yellowfin tuna remained above 1.0 during the entire period, with a low of about 2 in the mid-1970s. Estimated values for the period since 2000 were between 2.0 and 3.5.

Western and central Pacific skipjack tuna: Estimated values of F_t $/F_{MSY}$ were well below 1.0 since the early 1970s, peaking at less than 0.2 in the mid-1990s. Estimated values of ${}_aB_t$ $/{}_aB_{MSY}$ for skipjack tuna remained well above 1.0 during the entire period, with a low of about 2 in the mid-1970s. Estimated values for the period since 2000 were between 3 and 9.

Southern Pacific albacore tuna: Estimated values of F_t $/F_{MSY}$ were well below 1.0 for the entire period, peaking at about 0.2 to 0.3 in the late 1980s. Estimated values of ${}_aB_t$ $/{}_aB_{MSY}$ for albacore tuna remained above 1.0 during the entire period. The 1990s had the lowest values, estimated to be between 1.5 and 5.

Stock assessment results for other pelagic stocks, including the other tunas, other billfishes, and other management unit species, are not available.

5.2.3.2 Non-target finfish species

Pelagic fisheries catch a number of non-target species, both PMUS and non-PMUS. This is particularly true for the longline fishery. NMFS observers recorded more than 60 different species caught by the Hawaii-based longline fleet between 1994 and 1997. Of significance are the 85,523 sharks reported caught by the fleet in 1997, of which the majority (93%) was blue sharks. As a result of the growing demand for shark fins in Asian markets the practice of shark finning increased during the late 1990s. Logbook data for 1997 indicate that 0.3% of blue sharks were retained whole, 57% were finned, and 43% were discarded. The practice of finning is now prohibited by the Shark Finning Prohibition Act. Logbook data for 1997 indicate that about one percent of sharks, mainly mako and thresher, are headed and gutted and retained for later sale.

Most non-PMUS caught by the Hawaii-based longline fleet is discarded. Observer data for 1994-1997 indicate that the discarded non-PMUS included (in descending order, by number) lancet fish, pelagic stingray, snake mackerel, escolar, remora, crocodile shark, and mola mola.

In the troll and handline fisheries, there is relatively little information on the nature and amount of bycatch because of current reporting requirements. However, as the gears in use tend to be selective, bycatch probably constitutes a small part of the catch. Almost all the fish caught by troll and handline vessels, including charter boats, in Hawaii, American Samoa, Guam, and the CNMI are either sold or kept for personal consumption. In recent years, fishing tournaments, such as the Hawiian International Billfish Tournament, have provided various incentives for participants to release their catch.

The albacore troll fishery occurring in the North and South Pacific outside the EEZ has an estimated discard rate of about 10% of the catch, comprised primarily of small-sized (< 60 cm) albacore.

The pole-and-line gear used to target aku in Hawaii is highly selective. Non-target species that are occasionally caught, such as kawakawa, blue marlin, striped marlin, and rainbow runner, are usually either sold or retained for personal consumption by the crew.

5.2.4 Ecosystem and Habitat

It is important to recognize that the pelagic ecosystem responds to ambient climatological and oceanographic conditions on a variety of spatial and temporal scales, and that even in the complete absence of any fishing stock sizes would fluctuate, sometimes quite dramatically. It is also clear from the species accounts that initiation of very marked declines in some groups such as sea turtles, seabirds and possibly sharks coincided with prosecution of the high seas drift-gillnet fishery in the 1980s and early 1990s. Added to the serious impacts to protected species resulting from that fishery was a regime shift that markedly lowered the carrying capacity and productivity of the ecosystem at that time. Because of the long life spans and limited reproductive potential of sea turtles, seabirds and sharks, these populations are likely only beginning to recover from these circumstances.

Essential Fish Habitat (EFH) for the adult and juvenile life stages of the PMUS was designated through FMP Amendment 8 as the water column to a depth of 1,000 m. Although most PMUS are epipelagic (the surface layer to about 200 m depth), bigeye tuna are abundant at depths greater than 400 m and swordfish have been tracked to a depth of 800 m. The vertically migrating mesopelagic fishes and squids associated with the deep scattering layer are important prey organisms for PMUS and they are seldom abundant deeper than 1,000 m.

EFH for the eggs and larvae of PMUS is the epilelagic zone, including the water column from the surface to a depth of 200 m, from the shoreline to the outer limit of the EEZ. The eggs and larvae of all teleost PMUS are pelagic, and are slightly buoyant when first spawned, spreading throughout the mixed surface layer and subject to advection by ocean currents. Eggs and larvae of PMUS are found throughout the tropical (and in summer, subtropical) epipelagic zone.

Habitat Areas of Particular Concern (HAPC) have been designated as the water column from the surface to a depth of 1,000 m that lies above all seamounts and banks with the EEZ that rise to within 2,000 m of the surface. The rationale for the HAPC designation included the ecological function provided by those waters, the rarity of the habitat type, and the susceptibility of the areas to human-induced environmental degradation.

5.2.5 Protected Species

In addition to PMUS and non-PMUS fish species, pelagic fisheries interact with protected species. In particular, the longline fisheries interact with sea turtles. All sea turtles are designated under the U.S. ESA as either threatened or endangered. The breeding populations of Mexico olive ridley turtles are currently listed as endangered, while all other ridley populations are listed as threatened. Leatherback turtles and hawksbill turtles are also classified as endangered. The loggerhead turtles and the green turtles are listed as threatened (note the green turtle is listed as threatened under the ESA throughout its Pacific range, except for the endangered population nesting on the Pacific coast of Mexico). These five species of sea turtle are highly migratory, or have a highly migratory phase in their life history, and therefore, are susceptible to being incidentally caught by fisheries operating in the Pacific Ocean.

All five sea turtle species of concern forage in the waters surrounding the Hawaiian Archipelago. However, leatherback, loggerhead, and green sea turtles are the species of principal concern with regard to incidental take in the Hawaii-based pelagic longline and other commercial fisheries of the Pacific. These fisheries are conducted mainly by Japan, Taiwan, Spain, Korea, and, to a lesser extent, the United States. It is estimated that on average about 570 million longline hooks are set by all fleets in the Pacific each year.

In a March 2001 Biological Opinion (a product of Section-7 consultations under the ESA), NMFS estimated the following ranges of annual mortalities in the Hawaii-based longline fishery: 28-57 leatherback, 102-195 loggerhead, and 7-26 green sea turtles (NMFS 2001a). A more recent Biological Opinion issued by NMFS on November 15, 2002, estimated that the annual mortality rates from the longline fishery were as follows: 7 green turtles, 3 leatherbacks, 8 loggerheads for vessels fishing above 22 deg N and zero below 22 deg N, and 24 Olive Ridleys. These mortality rates reflect the management changes to the Hawaii-based longline fishery, with a ban on shallow set swordfish longlining, and a seasonal (April-May) closure of tuna fishing grounds south of 15 deg N.

For the American Samoa-based longline fishery, the federal logbooks from 1992 to 1999 indicate a range of interactions with sea turtles (i.e., hooking/entanglement). There is no observer coverage of this fishery, so none of the species' identifications were validated by NMFS. In addition, logbook data may not be a reliable method to measure sea turtle interactions in this fishery. From 1992-1999, interactions with sea turtles by the American Samoa-based longline fishery included at least four hardshelled turtles (with three released alive, one mortality), one leatherback, and one unidentified sea turtle (NMFS 2001a).

There have been no reported interactions with sea turtles in the fisheries of the Pelagics FMP other than the Hawaii-based longline fishery, the American Samoa-based longline fishery, and the central and western Pacific U.S. purse seine fishery. There is a chance, based on fishing methods including bait used and gear type, that these other fisheries do interact with sea turtles although the information is not reported. Due to low effort and target-species selectivity of the gear, incidental take and mortality in these fisheries is likely minimal and has an insignificant effect on the survival and recovery of sea turtle populations (NMFS 2001a).

Logbook data during this period show that there are no reported sea turtle takes. The U.S. fleet is required to have 20 percent observer coverage and to maintain catch and bycatch logbooks. Collecting data on sea turtles is a lower priority for observers, and since vessels are likely to release turtles immediately after pursing the net, it is likely that very little information on the bycatch of turtles is recorded (NMFS 2001a).

Based on information collected in the eastern tropical Pacific tuna purse seine fishery (100 percent coverage), the mortality of sea turtles taken by purse seine is low (around ten percent).

Most sea turtles taken by purse seine fishery are able to reach the surface to breathe, and therefore they are not forcibly submerged. In addition, the mesh is small enough that the likelihood of entanglement is low. Purse seiners setting on fish aggregating devices do tend to take more turtles because of the close association that exists between floating objects and sea turtles in the open ocean. Since 1997, U.S. purse seiners fishing in the central and western Pacific Ocean have begun shifting their strategy to setting more often on drifting FADs. This may increase the likelihood of sea turtle interactions with the fishery. However, NMFS cannot speculate as to what effect this change in fishing strategy may have on sea turtles in the central and western Pacific (NMFS 2001a).

Based on observer data, logbooks, and information from the Forum Fisheries Agency (K. Staisch, pers. comm., February 2001, in NMFS 2001a), NMFS cannot quantitatively estimate the amount or extent of sea turtle take by the central and western Pacific purse seine fishery; however, it is believed to be low (NMFS 2001a).

5.2.6 New Information on Affected Environment

The information described in the previous subsections came from the March 2001 FEIS for the pelagic fisheries, which generally included fishery data only through 1998. Updates to that information are provided here.

Several important regulatory changes have recently taken place in the fishery (see Section 2.2 for details), with consequent impacts on fishing activity. They include a ban on the practice of shark finning (retaining the fins without the carcass), an effective closure of the swordfish-directed longline fishery, a large area closure south of Hawaii during April and May for the longline fishery, requirements to use certain gear-related measures to reduce the incidental catch of sea turtles and seabirds, and an area closure out to 50 nm for large longline vessels (greater than 50 feet in length) in American Samoa.

Table 17 shows the estimated catch and revenues from pelagic fishing in the Western Pacific Region in 2001.

Table 18. Summary of US federally managed pelagic fishing activity in the Western Pacific Region, 2001

<table>
<tr><th>Fishery</th><th>Landings (1,000 lb)</th><th>Ex-vessel revenue (1,000 $)</th><th>Number of active vessels</th><th>Number of trips</th></tr>
<tr><td>Hawaii pole-and-line</td><td>1,200</td><td>1,600</td><td></td><td>246</td></tr>
<tr><td>Hawaii longline</td><td>15,400</td><td>32,700</td><td>101</td><td>1,075</td></tr>
<tr><td>Hawaii troll</td><td>2,600</td><td>3,800</td><td></td><td>20,281</td></tr>
<tr><td>Hawaii handline</td><td>1,320</td><td>2,300</td><td></td><td>3,967</td></tr>
<tr><td>Hawaii other</td><td>600</td><td>500</td><td></td><td></td></tr>
<tr><td>American Samoa longline</td><td>8,131</td><td rowspan="2">7,817</td><td>65</td><td>(# sets:) 4,700</td></tr>
<tr><td>American Samoa troll</td><td>23</td><td>18</td><td>335</td></tr>
<tr><td>Guam commercial troll</td><td>686</td><td rowspan="2">680</td><td rowspan="2">375</td><td>9,563</td></tr>
<tr><td>Guam charter troll</td><td>74</td><td>2,453</td></tr>
<tr><td>CNMI commercial troll</td><td>143</td><td>286</td><td>111</td><td>2,176</td></tr>
<tr><td>Total</td><td>30,000</td><td>50,000</td><td></td><td></td></tr>
</table>

Source: WPRFMC 2002d and NMFS Honolulu Laboratory.
Most estimates are preliminary.
Revenues account only for sales of fish, not for charter fees or other income from fishing.

During the year 2001, 101 Hawaii-based longline vessels were active, landing 15.4 million pounds of fish worth $32.7 million ex-vessel, a decrease in landings of about 35% compared to 2000. As a result, 2001 total commercial pelagic landings (21.1 million lb; $41.3 million) for all pelagic gear types combined fell by 30% from 2000. Swordfish landings decreased by more than 90% from 2000 because of the closure of the swordfish-directed fishery, and bigeye tuna landings declined by about 10% despite a considerable shift in fishing effort from the swordfish and mixed-target sector into the tuna target sector (WPRFMC 2002d). According to logbook data compiled by the NMFS Honolulu Laboratory, the number of sharks caught in the Hawaii-based longline fishery decreased substantially (from an annual average of 102,000 during 1992-2000 to 47,000 in 2001), largely as a result of the closure of the swordish-directed longline fishery. The percentage shark bycatch rate increased substantially (from an average of 63% in 1997-2001 to 96% in 2001) as a result of the ban on shark finning. The absolute number of sharks discarded was 45,000 in 2001, compared to an annual average of 67,000 during the 1992-2001 period.

The regulatory changes in Hawaii's longline fishery have had substantial effects on rates of interaction with sea turtles and seabirds. Interaction and mortality rates have not yet been estimated for 2001, but differences in estimated interaction rates between two periods of 2000 indicate the magnitude of the regulatory impacts. During the first eight months of 2000 there was an area closure in place, but during the last four months of the year the restrictions on the fleet were expanded to include a limit of 154 sets within a certain area and swordfish-directed fishing was prohibited in waters bounded by the equator and 28° N and by 173° E and 137° W (see Section 2.2 for details). There were an estimated 372 sea turtle interactions in the first period of 2000, compared to 52 in the second period, and there was a statistically significant difference between the two periods in the number of interactions per set for all species but the green (WPRFMC 2002a). The estimated number of interactions with albatrosses decreased from 2,343 in the first period to 90 in the second period, and there was a statistically significant difference between the two periods in the number of interactions per set for both species (WPRFMC 2002a). (Note that there is a substantial degree of uncertainty – not described here – in these estimates of interaction rates.)

Landings, revenues, and catch rates in 2001 in Hawaii's small-boat commercial fisheries were within the ranges of recent years.

Like the Hawaii fishery, pelagic fishing in American Samoa is experiencing a period of rapid change. In 1994, five vessels were engaged in longlining, all *alia*. In 2001, 65 vessels were in the fishery, including a number of vessels larger than 50 feet in length (WPRFMC 2002d). Longline landings have consequently skyrocketed, increasing from less than a quarter of a million pounds in 1994 to 8.1 million pounds in 2001.

Eighteen vessels participated in the American Samoa troll fishery in 2001, substantially less than the average for the last 20 years of 35 vessels (WPRFMC 2002d). Landings in 2001 were 23,000 pounds.

Guam's pelagic landings of about 750,000 pounds in 2001 were about equal to the annual average of the last five years. The estimated number of boats in the troll fleet, about 375, is not significantly different from the numbers estimated for the previous ten years or so.

The estimated 2001 commercial landings in the CNMI's pelagic fisheries, about 143,000 pounds, were about the same as the previous two years, but substantially less than estimated landings during 1996-1998, which had an estimated peak of 225,000 pounds in 1996. The number of vessels engaged in the fishery has been fairly steady during the last six years, with 111 boats making commercial landings in 2001.

5.3 Crustaceans FMP Fisheries

A summary of available information on the environment associated with the crustaceans fisheries of the Western Pacific is provided in this section. Much of the information has been taken from the Preliminary Draft Supplemental EIS for the Crustaceans FMP (WPRFMC 2001d), which can be referred to for additional detail.

5.3.1 Description of the Fisheries

5.3.1.1 History

The largest component of the FMP crustaceans fisheries is the NWHI lobster fishery. Although there is a lobster fishery in the MHI, there are few shallow banks in the EEZ around the MHI so the MHI lobster fishery occurs almost entirely within State of Hawaii waters. One federally permitted vessel began to operate in the EEZ surrounding the MHI in 1997, but it since discontinued operations. No federally permitted lobster vessels have operated in the EEZ surrounding American Samoa or Guam since the development of the FMP in 1983 (the waters around the CNMI and PRIAs are not currently subject to the FMP).

The Northwestern Hawaiian Islands (NWHI) crustacean fishery, which has operated for nearly 20 years, is a distant-water trap fishery with the red spiny lobster (*Panulirus marginatus*) and common slipper lobster (*Scyllarides squammosus*) as the primary target species. Other lobster species, including ridgeback slipper lobster, Chinese slipper lobster, and the green spiny lobster, are caught in relatively small numbers. Most of the NWHI lobster fishery occurs in federal waters of the U.S. exclusive economic zone (3 to 200 nm offshore).

The NWHI lobster fishery developed rapidly in the 1970s in parallel with several surveys of the NWHI lobster resources. Many of the participants came from areas such as the Pacific Northwest where crustacean fisheries were experiencing declining catches (Clarke and Pooley 1988; Pooley 1993a). These newcomers came with large vessels, some longer than 100 ft, with advanced technology freezing and processing equipment (Pooley 1993a). In addition, a number of smaller, multi-purpose boats began fishing for spiny lobsters in the NWHI, combining that operation with bottomfish fishing (HDAR 1979).

A period of low catches was followed by a rapid increase in landings as more vessels entered the fishery and markets were developed (Polovina 1993). By the mid-1980s, the NWHI lobster fishery was Hawaii's single most lucrative fishery (Pooley 1993b). Changing the trap gear from wire to plastic traps introduced from the U.S. mainland led to significant catches of slipper lobster, which had been essentially unexploited with wire traps, and an increase in fishing efficiency (Boehlert 1993; Pooley 1993a). From 1985 to 1987, the fishery targeted and largely depleted the population of slipper lobsters (Polovina 1993).

Trapping activity declined in 1987 principally due to the exit of several large vessels from the fishery (Samples and Sproul 1988), but landings reached a record high in 1988 when wind and sea conditions allowed for an extended period of fishing in the upper bank areas where spiny lobsters tend to congregate (Clarke 1989). In 1990, however, lobster catch rates fell dramatically. Overfishing is not thought to be responsible for the decline (Polovina and Mitchum 1992). Rather, the decrease was likely due to a climate-induced change in oceanic productivity (Polovina et al. 1994). Nevertheless, the 1990 season showed that there was excessive fishing capacity in the industry given the reduced population size and raised concern that an economic threshold might not prevent overfishing (Polovina and Haight 1999). Responding to this concern, the Council established a limited access program and a fleet-wide seasonal harvest quota in 1991 that significantly altered fishing operations (Kawamoto and Pooley 2000). During the 1980s, fishery participants had averaged three trips per year to the NWHI, each trip lasting about two months (Polovina 1993). With the implementation of a fleet-wide harvest quota vessels no longer fished for lobster year round, but instead shifted from other Hawaii-based fisheries or moved from fisheries in Alaska or the West Coast to participate in a short-term (less than one month) lobster fishery concentrated on the banks around Necker Island, Gardner Pinnacles and Maro Reef that were the historic mainstays of the fishery. The lobster fishery was open from July to December but it typically closed earlier because the harvest guideline was reached. Given the derby-style fishing conditions there was no incentive for fishermen to operate on secondary or marginal banks. From 1992 through 1997, Necker Island accounted for 48 to 64% of the total effort and Gardner Pinnacles and Maro Reef accounted for most of the remaining effort (WPRFMC 1999c). In 1998, the quota was allocated among four fishing areas (Necker Island Lobster Grounds, Gardner Pinnacles Lobster Grounds, Maro Reef Lobster Grounds and General NWHI Lobster Grounds) to prevent localized depletion of the lobster population at the most heavily fished banks and encourage fishermen to broaden the geographical distribution of their effort.

In 2000, NMFS promulgated emergency regulations to close the NWHI lobster fishery because of uncertainty about the dynamics of the lobster stocks and the models used to describe those stocks, and because of concerns about the potential for overfishing the lobster stocks. The closure was extended through the 2001 and 2002 seasons because of continuing uncertainty in stock status and the ability to assess the stocks using available methods. Currently under development are new population models that will incorporate stock characteristics not recognized in the models used to date, including spatial heterogeneity and differences in the population dynamics of the several lobster species. Another factor making the future of the NWHI lobster fishery uncertain is the NWHI Coral Reef Ecosystem Reserve. A process is underway to designate the Reserve as a National Marine Sanctuary, which may result in changes to the management regime. Also affecting the fate of the NWHI lobster fishery is the need to prepare an EIS and issue a Biological Opinion (under the ESA), both of which are court-ordered prerequisites for re-opening the fishery.

5.3.1.2 Fishing Methods and Current Use Patterns

Two distinct types of vessels have recently operated in the NWHI lobster fishery (Maine Aquaculture Innovation Center 2000). About one-third of the permit holders operate North Pacific catcher-type crab vessels that travel to Hawaii for the lobster season. The other two-thirds operate Honolulu-based vessels that are also used in the pelagic longline fishery. The North Pacific crabbers are larger than the longline boats, but every vessel has the capability to carry and deploy the maximum number of traps allowed.

All the participants in the NWHI fishery use a plastic dome-shaped, single-chambered trap with two entrance funnels located on opposite sides (Polovina 1993). Although the minimum size limit established in 1985 was revoked in 1996 the traps are still required to have escape vents. The traps are typically fished in strings of several hundred traps per string. The traps are set before sunset in depths from 20 to 70 m, and retrieved the next day. Both spiny and slipper lobsters may be caught in the same trap, but fishermen can alter the proportion of each species by selecting the trapping area and depth (Polovina 1993). Almost all lobsters harvested are sold as a frozen tail product. Catch is processed, packed and frozen at sea by the individual vessels, in contrast to most other lobster fisheries in which each vessel’s catch is held live on-board and transported to shore-side plants for processing and packing (Sample and Gates 1987). From 1996 to 1998, the fleet also landed a significant quantity of live lobsters.

The NWHI lobster fishery is a seasonal fishery, with many vessel operators participating in other Hawaii or U.S. mainland fisheries during other parts of the year. Fishing beyond September involves the risk of encountering severe weather. Poor sea conditions increase operational problems, increase trap losses and reduce the fishing effectiveness of traps (Maine Aquaculture

Innovation Center 2000). In 1999, the average vessel fished for lobster for 42 days (WPRFMC 2000b). Although all participants in the lobster fishery engage in other fisheries, the lobster fishery occurs during a comparatively slow season for alternate fishing activities (NMFS 2000b). Therefore, the lobster fishery may represent an important component of the participants' annual fishing operations and income.

As provided in the FMP, the NMFS annually determines the harvest guidelines for the fishery. The harvest guidelines are expressed as the maximum number of lobsters (spiny and slipper lobsters combined) that may be harvested by permit holders from each of the four established fishing grounds: Necker Island, Maro Reef, Gardner Pinnacles, and all other NWHI waters combined (sub-area 4). The harvest guidelines are based on NMFS estimates of the exploitable (harvestable) lobster population at the beginning of each fishing season (July 1). In 1999, the NWHI exploitable lobster population was estimated to be 1,870,000 lobsters and the harvest guideline for the entire fishery was determined to be 243,100 lobsters (spiny and slipper lobsters combined). This total NWHI harvest guideline was allocated among the four established lobster fishing grounds as follows: Necker Island, 54,600 lobsters; Gardner Pinnacles, 27,690 lobsters; Maro Reef, 89,570 lobsters; and sub-area 4 (all other areas combined), 71,240 lobsters. During the 1999 lobster season, six boats participated in the fishery, which is limited to a maximum of 15 permits – that is, 15 vessels. The harvest guideline is derived by using a constant harvest rate (13 percent of the estimated exploitable lobster population) which is associated with a 10 percent risk of overfishing, as specified by the FMP. NMFS scientists used a risk-based simulation model to compute harvest rates for a variety of risk levels of overfishing.

When the harvest guideline of a lobster ground is reached, NMFS closes that ground until the next season. The fishery automatically closes on December 31 each year unless all the individual (bank-specific) harvest guidelines are reached earlier. Federal regulations also specify the number of traps that are allowed on a lobster boat, the number and dimensions of escape vents required for each trap, areas prohibited to lobster fishing, etc. In 1996, FMP Amendment 9 removed the minimum size requirements for harvesting lobster and prohibition on the harvest of reproductive (berried) lobster females resulting in an optional "retain-all" fishery. As a result, fishermen are not required to return decked undersized lobsters and berried females to the ocean, as was the case prior to Amendment 9. The basis for this retain-all fishery was an apparently high discard mortality rate caused by handling techniques on board the vessel, predation by sharks, and displacement of lobsters. Under the amendment every lobster brought on board the vessel, whether kept or discarded, must be counted against the harvest guideline

Necker Island, Gardner Pinnacles and Maro Reef have been the most productive banks in the NWHI lobster fishery. Starting in 1998, the first year that area-specific quotas were established, fishermen have spread out their effort over a larger area (Kawamoto and Pooley 2000). During both the 1998 and 1999 seasons all four designated sub-areas received fishing pressure. In 1999, the Necker Island, Gardner Pinnacles and Maro Reef Lobster Grounds were closed within two months while the all-other-banks area remained open until the fishery was closed at the end of the year. Five of the six vessels that participated in the fishery that year fished in the all-other-banks sub-area. Three vessels fished on Necker Bank and Gardner Pinnacles and four vessels fished on Maro Reef. The harvest from Necker Island, Gardner Pinnacles and Maro Reef accounted for about 75% of the total landings. The fishery has been closed since 1999.

5.3.1.3 Harvest and Participation

Between 1985 and 1991, total landings showed an overall downward trend (Figure 16). Since 1992, landings were largely determined by the harvest guideline. Participation followed a similar downward trend, but not in proportion to the landings trend (Figure 17).

Figure 16. Landings of spiny and slipper lobsters in the NWHI lobster fishery, 1983-1999

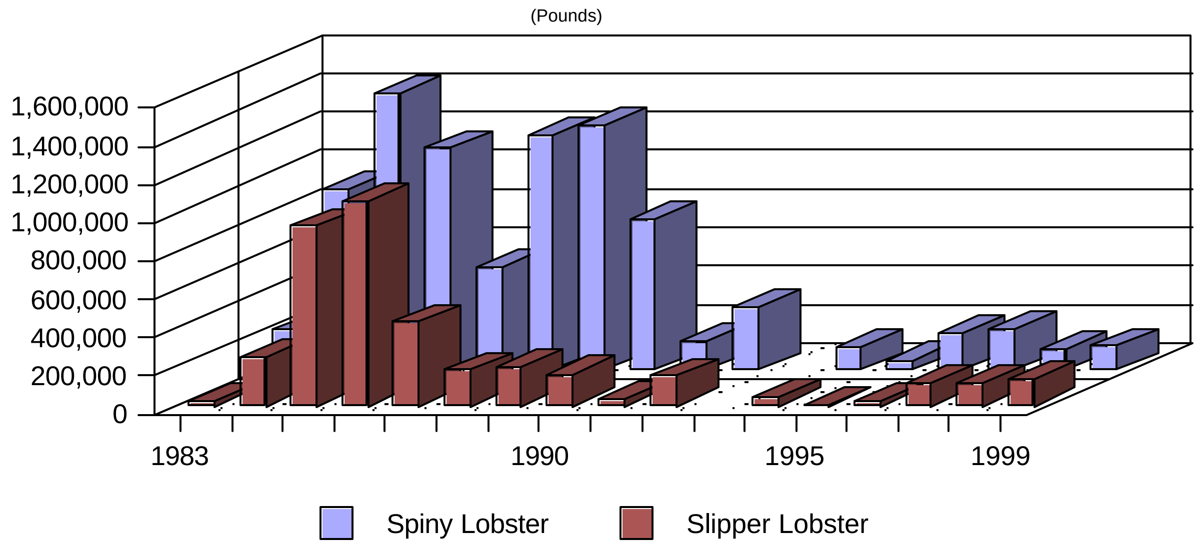
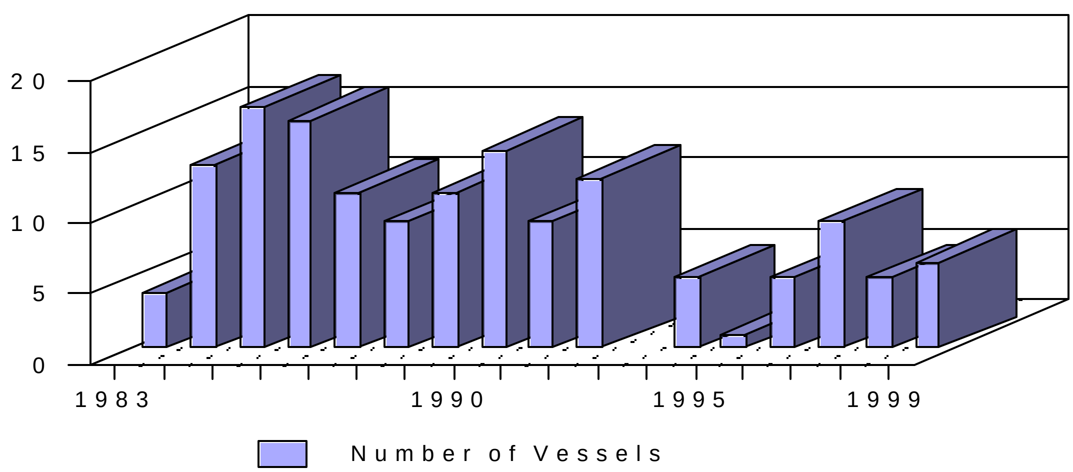


Figure 17. Number of vessels participating in the NWHI lobster fishery, 1983-1999



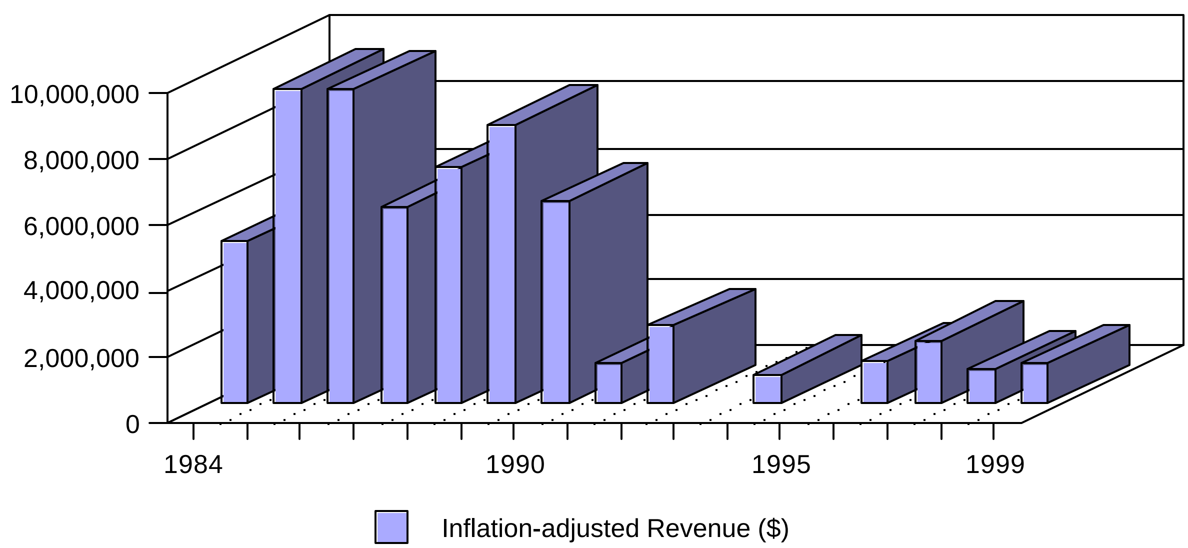
During the first years of the fishery the turnover of participants was relatively high due to the profit-seeking entry-exit behavior of vessel owners who were flexible in the choice of fishing activities (Samples and Sproul 1988). The high turnover continued after 1992, the first year of the limited access program and harvest quota. The quota announced prior to the start of the fishing season weighed heavily in the participation decision as did the annual start-up costs of participating in the lobster fishery and the potential earnings in alternative fisheries (Kawamoto and Pooley 2000). In addition, during the first five years of the limited access program there were a total of 20 permit transfers. By 1997, less than half of the permits that were issued in 1991 were still held by the original recipients.

Through 1999, approximately 37 limited access permits to participate in the NWHI lobster fishery had been issued, but only 19 of the permits had been actually used. The turnover rate has been fairly high, with only 4 of those19 active permit holders participating in the fishery for more than two years.

5.3.1.4 Economic Performance

The total gross revenue of the NWHI lobster fishery has followed the trend in landings (Figure 18). The average gross revenue per trap has declined sharply since 1997 due to a decrease in catch-per-unit-effort and the proportionately higher catches of slipper lobsters, which have a smaller average size and lower by-weight value in comparison to spiny lobsters (Kawamoto and Pooley 2000).

Figure 18. Gross revenue in the NWHI lobster fishery, 1984-1999



A cost-earnings study of the NWHI lobster fleet was conducted by Clarke and Pooley (1988) based on economic data collected in 1985 and 1986. The study found that despite record revenues in the fishery in 1986, fishermen as a group earned little or no profit. Low fleet net returns appeared to be tied to high fishing costs and diminished average catch rates. The findings in that study do not, however, reflect the more recent operational characteristics of the fleet.

Since the mid-1980s, adjustments in the regulatory regime for the fishery have changed the economic conditions of the fishery (Pooley and Kawamoto 1998). Because the fishery is now seasonal rather than year-round, start-up costs have become significant determinants as to whether a given permit holder is likely to participate in a given year. The brief fishing season means that fixed costs have to be amortized over a shorter time period. Similarly, travel costs have become a higher percentage of total costs due to a decrease in the number of fishing days per trip. The establishment of area-specific quotas in 1998 and the resultant successive closure of banks during the 1998 and 1999 seasons as quotas were reached caused an increase in travel times and associated vessel operating costs as vessels were forced to move from bank to bank (WPRFMC 1999c).

At least some of the permit holders have been able to adapt to these changing economic conditions. Fishery participants during the 1998 season realized a positive return on operations (gross revenues less operating costs) and were able to cover a portion of their fixed costs (WPRFMC 1999c). In addition, the market value of the freely transferable limited access permits indicates that economic profits can still be earned in the fishery. Although the price of transferred permits is not recorded by NMFS, dockside reports in 1998 indicated that a permit was worth $40,000 to $100,000 (Pooley and Kawamoto 1998). However, the fact that generally only about half of the permits holders have actually participated in the fishery in recent years suggests that profits from lobster fishing are low (Maine Aquaculture Innovation Center 2000).

5.3.1.5 Markets

As an internationally traded commodity, supply and demand circumstances for lobsters tend to be volatile, resulting in frequent price adjustments (Samples and Gates 1987). In addition, the Hawaii fishery has changed over the years in terms of target species and product form. In the early years of the fishery (1977-1984) landings consisted mainly of spiny lobsters. However, for a three-year period from 1985 to 1987 the fishery targeted and largely depleted a previously lightly exploited population of slipper lobsters (Polovina 1993). Between 1988 and 1997 the target was again spiny lobsters, but the catch in 1998 and 1999 consisted mainly of slipper lobsters.

The traditional way of marketing lobsters in Hawaii was selling them live in local markets (HDAR 1979). In 1978, however, a Hawaii-based fishing company leased a modern fishing boat from the U.S. mainland equipped with on-board refrigeration for storing frozen lobster tails. Soon almost all lobsters harvested in Hawaii were sold as a frozen tail product to Hawaii and U.S. mainland buyers (Pooley 1993b). This product form dominated until 1996, when the fleet landed a significant amount of live lobsters, which were exported to Japan, Taiwan and Hong Kong or sold in up-scale restaurants in Hawaii (Pooley and Kawamoto 1998). In 1999, however, nearly all fishery participants reverted to producing frozen tails because of a drop in the price of live spiny lobsters caused by the economic downturn in Asia (Kawamoto and Pooley 2000).

Because the NWHI lobster fishery is relatively small and harvest levels have fluctuated widely, product marketing has been challenging (NMFS 2000b). Typically, seafood wholesalers and retailers prefer predictable and reliable supply sources. However, NWHI lobster has established a reputation as a locally produced quality product, and fishery participants have found buyers willing to participate on a seasonal basis.

Imports of frozen lobster tails into Hawaii from various Pacific Basin countries have shown an overall decline over the past decade, from 41,023 lb in 1990 to 3,866 lb in 1999 (NMFS Fisheries Statistics and Economics Division n.d.). A small number of live spiny lobsters are imported into Hawaii from Australia and Kiribati. The average annual amount during the past decade has been about 1,450 lb (NMFS n.d.).

5.3.1.6 Socio-economic importance

Hawaii's commercial fishing sector includes a wide array of fisheries. The Hawaii longline fishery is by far the most important economically, accounting for 73 percent of the ex-vessel value of all commercial fish landings in the state in 1999. In the same year, the NWHI lobster fishery had an ex-vessel value of about $1.0 million from landings of 260,000 lb, contributing about 2% of the total ex-vessel value of Hawaii's commercial fisheries (data from NMFS Honolulu Laboratory).

For the period 1996-1999, the ex-vessel value of annual landings in the NWHI lobster fishery averaged about $1,349,000 (Kawamoto and Pooley 2000). However, this value reflects only the gross revenues that accrue to fishery participants from direct sales. It does not take into account the employment and income that are generated indirectly within the state by the NWHI lobster fishery. The fishery has an economic impact on businesses whose goods and services are used as inputs in the fishery such as fuel suppliers, chandlers, gear manufacturers, boatyards, tackle shops, ice plants, bait shops and insurance brokers. In addition, the fishery has an impact on businesses that use fishery products as inputs for their own production of goods and services. Firms that buy, process or distribute fishery products include seafood wholesale and retail dealers, restaurants, hotels, and retail markets. Both the restaurant and hotel trade and the charter fishing industry are closely linked to the tourism base that is so important to Hawaii's economy. Finally, people earning incomes directly or indirectly from the fishery make expenditures within the economy as well, generating additional jobs and income.

Some of the fishing vessel owners, operators and crew in the NWHI lobster fishery are year-round residents of Hawaii, while others maintain principal residences outside the state.

The home port of the majority of vessels used in the NWHI lobster fishery is Honolulu during the fishing season. Most of the large-volume, restaurant-oriented wholesalers that buy, process and distribute fishery products are located in the greater Honolulu area. Businesses whose goods and services are used as inputs in Hawaii's offshore commercial fisheries, such as ice plants, marine railways, marine suppliers, welders and repair operations, are similarly concentrated in Honolulu. However, the contribution of the harvesting and processing of fishery resources to the total economic fabric of Honolulu is small in comparison to other economic activities in the metropolitan area, such as tourism.

The Honolulu-based "sampan" fleet began to fish in the waters around the NWHI for bottomfish, lobster and other species in the early twentieth century. Most of these fishermen were Japanese immigrants who established tightly knit communities in Hawaii and adhered to many of the traditional fishing practices and customs of their homeland. As late as the 1970s, the majority of full-time commercial fishermen in the state were of Japanese descent (Garrod and Chong 1978). By the 1980s, however, a growing number of fishermen from the continental U.S. were relocating in Hawaii.

The arrival of newcomers from outside the state and increasing ethnic diversity within Hawaii's commercial fishing industry diminished some of the social cohesiveness that existed among Hawaii's early commercial fishermen. Nevertheless, networks of relations among fishery participants are still present and have a significant effect on fishing activity. For example, various groups of fishermen are still represented by a *hui* or organization, and these voluntary associations continue to play an important role in Hawaii's fishing industry. A case in point is the *hui* that permit holders in the NWHI lobster fishery formed in 1998. The members of the association negotiated an agreement whereby some permit holders consented to forego the 1998 season in exchange for a share of the revenues earned by those who would participate in the fishery.

The products of fishing supplied to the community at large may also have socio-cultural significance. For instance, beyond their dietary importance fish may be important items of exchange and gift giving that also help develop and maintain social relationships within the community. Alternatively, at certain celebratory meals various types of seafood may become imbued with specific symbolic meanings. Nearly a century ago Bryan (1915) developed a list of the various fish purchased in the Honolulu market by each of Hawaii's principal "nationalities." With specific regard to spiny lobster, Bryan (1915:469) wrote that the "... lively demand for them, owing to their excellent food qualities, brings large numbers of them fresh and sprawling into the markets every day." He also noted that the slipper lobster was "quite common in the markets" and "is a favorite food of the native people." The ethnic identification of Hawaii's *kama*ʻā*ina* (long-time residents) with particular species has continued to the present day. The large variety of fish typically offered in Hawaii's seafood markets reflects the diversity of ethnic groups in Hawaiʻi and their individual preferences, traditions, holidays and celebrations. For example, lobster are among the foods that take on a special meaning during *Oshogatsu* (Japanese New Year's), considered the most important cultural celebration for people of Japanese ancestry in Hawaii. According to Japanese tradition, a lobster symbolizes old age because of its bent body, but at the same time it expresses wishes for a youthful spirit and longevity (Clarke 1994).

5.3.2 Fish Stocks

The Crustaceans Management Unit Species are the spiny lobsters (*Panulirus marginatus* and *Panulirus penicillatus*), slipper lobsters (family Scyllaridae), and the Kona crab (*Ranina ranina*). The majority of the lobster catch in the Western Pacific Region is taken in the NWHI fishery, which targets two species: the endemic Hawaiian spiny lobster, *Panulirus marginatus,* and the common slipper lobster, *Scyllarides squammosus.* Three other species, the pronghorn spiny lobster *(Panulirus penicillatus),* ridgeback slipper lobster (*S. haanii*) and the Chinese slipper lobster (*Parribacus antarcticus*) are caught incidentally and in low abundance in the NWHI fishery.

Adult and juvenile Hawaiian spiny lobster occur throughout the NWHI from Nihoa Island to Kure Atoll (Uchida and Tagami 1984) at depths of 4-174 m (Uchida and Uchiyama 1986). In Hawaii, adult spiny lobster are typically found on rocky substrates in well-protected areas such as crevices and depressions in coral reef habitat. Although the Hawaiian spiny lobster inhabits waters up to 200 m in depth, most of the catch is taken from water depths less than 60 m. In an extensive resource survey conducted by the NMFS during the 1970s, populations of spiny lobster were found at 18 (69%) of the banks in the NWHI extending from Nihoa Island to Kure Atoll.

No *P. marginatus* were found at the banks north of Kure Atoll (Uchida and Tagami 1984). Within the Hawaiian Archipelago, lobster abundance, size, and species ratio vary widely among islands and banks. Variations in abundance and species composition between banks is related to various environmental and biological factors including length of larval cycle, advection of larvae by oceanographic processes, availability of juvenile refuge habitat, and suitability of adult habitat.

5.3.2.1 Overfishing criteria and harvest guideline

To prevent overfishing a limit reference point was specified in Amendment 6 of the FMP. The amendment defined overfishing for the NWHI lobster stocks in terms of a spawning potential ratio (SPR) of 20%. Amendment 9 adopted a constant harvest rate strategy, with the rate based on acceptance of a 10% risk of overfishing. This level of risk was found through simulation modeling to correspond to a harvest rate of 13% of the exploitable NWHI lobster population. Additionally, the SPR level associated with optimum yield (50%) was established in Amendment 6 as a warning point that, if breached, would trigger consideration of remedial management action.

To calculate the harvest guideline for a given fishing season, estimates of the NWHI exploitable lobster population are produced by NMFS by applying a dynamic population model to the time-series of NWHI commercial catch and effort data. After each fishing season the model is updated with the current year's catch and effort data. Then model-based estimates of catchability, recruitment, and survival are used to estimate the exploitable population at the start of the next year's fishing season. The current year's catch and effort data provide both an input for model performance and a reference point for estimating the next year's exploitable population. After the exploitable population is estimated for the beginning of the next year's fishing season, the constant harvest rate of 13% is then applied to calculate the annual harvest guideline. Additionally, the current year's commercial catch and effort data are used to calculate SPR and fishing mortality as an indicator of how the fishery is performing with respect to the control rule criteria.

5.3.2.2 Stock status

In early 2000 NMFS scientists calculated preliminary year-2000 estimates of the NWHI exploitable lobster population, but for several reasons, the estimates were found to have an unacceptable degree of uncertainty associated with them. On June 26, 2000, NMFS made an emergency closure of the year-2000 fishery. The action was taken as a precautionary measure to protect lobster stocks because of shortcomings in understanding the dynamics of the NWHI lobster populations, the increasing uncertainty in population model parameter estimates, and the lack of appreciable rebuilding of the lobster population despite significant reductions in fishing effort throughout the NWHI. The closure was continued in 2001 and 2002 because of continuing uncertainty about the status and dynamics of the lobster populations and the models used to describe them, as well as because of a federal court order to keep the fishery closed until completion of an Environmental Impact Statement (under the National Environmental Policy Act) and a Biological Opinion (under the Endangered Species Act). Also considered in the actions was the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve, established in December 2000.

The most recent assessment of the status of lobster stocks in the NWHI (DiNardo and Marshall 2001) found several indicators of both stock decline and increasing uncertainty in stock status. Since 1983, NWHI catches-per-unit-effort (CPUE) in the commercial fishery have generally declined, but concurrent shifts in the spatial distribution of fishing effort and catch likely disguise actual trends in abundance. There was an appreciable decline in CPUE in sub-area 4 (all-other-banks) between 1983 and 1999. The lack of any appreciable population rebuilding at those banks was found to be indicative of poor recruitment. Estimates of historical SPRs were found to vary widely depending on the value of the catchability parameter, *q*, which was estimated from different sources and methods. Based on estimates of *q* generated using a discrete population model, SPR values for Maro Reef from 1997 through 1999 were found to range between 0.67 and 0.79 (all above the warning level of 0.5). During the same period at Necker Island, SPR values based on the same source for *q* were found to range between 0.3 and 0.61 (in some cases below the warning level but in all cases above the overfishing threshold). In contrast with those estimates, using alternative estimates of *q* derived from tagging and depletion experiments, estimates of SPR values at Maro Reef during that period ranged between 0.08 and 0.20 (in all cases at or below the overfishing threshold), and at Necker Island, between 0.15 and 0.46 (in one case below the warning point and in one case below the threshold) (DiNardo and Marshall 2001).

DiNardo and Marshall (2001:16) concluded that "Excessive fishing likely led to the depletion of many local populations of spiny lobster in the NWHI." "Despite significant reductions in commercial fishing activities in the NWHI, local populations of spiny lobster remain depressed, exhibiting no signs of rebuilding."

Although there is substantial uncertainty about the status of the NWHI lobster stock, it has not been determined to be overfished, as indicated in the NMFS Annual Report to Congress on the Status of U.S. Fisheries—2001 (NMFS 2002b).

Much of the uncertainty with the population models used to assess the NWHI lobster stocks has to do with processes related to spatial scale and species resolution. Previous assessments have not recognized the importance of spatial heterogeneity within the NWHI and have pooled data from the several lobster species. Currently under development are spatially structured population models, or metapopulation models, that incorporate spatial heterogeneity, species-specific population parameters, and other important factors of metapopulation dynamics (DiNardo and Marshall 2001; Botsford et al. 2002). Efforts are also underway to gather fishery-independent data that can be used to parameterize the new models.

5.3.3 Ecosystem and Habitat

For the purposes of designated Essential Fish Habitat (EFH), the Management Unit Species were separated into two assemblages based on their ecological relationships and preferred habitats. The Kona crab assemblage includes only Kona crab; the spiny and slipper lobster assemblage includes all the spiny and slipper lobster species.

The Council has designated Essential Fish Habitat (EFH) for larvae of the lobster species assemblage as the water column from the shoreline to the outer limit of the EEZ to depths of 150 m. The EFH for the settled, benthic juveniles and adults has been designated as the bottom habitat from the shoreline to a depth of 100 m. Benthic surveys of three NWHI banks (Necker Island, Maro Reef, and Lisianski Island) indicated that much of the lobster EFH was hard, relatively even substrate, with small depressions, often filled with sand. Macroalgal assemblages dominated most of this habitat (Parrish and Polovina 1994).

Research indicates that banks with summits shallower than 30 m deep support successful recruitment of juvenile spiny lobster, while deeper summits do not. For this reason, all summits shallower than 30 m deep have been designated as Habitat Areas of Particular Concern (HAPC).

The Council has designated EFH for the juvenile and adult life stages of the Kona crab as the shoreline to a depth of 100 m. EFH for this species larval stage is designated as the water column from the shoreline to the outer limit of the EEZ down to 150 m.

5.3.4 Protected Species

Concerns have been raised over prey competition between the lobster fishery and the endangered Hawaiian monk seal. One fatal interaction occurred in 1986 when a monk seal was drowned after becoming entangled in the bridle rope of a lobster pot set near Necker Island (Kinan 2002). However, there have been no further reports of such interactions. Monk seal colonies are located at Midway Atoll (a National Wildlife Refuge with no commercial fishing permitted within approximately 20 miles of shore) and five islands in Sub-area 4 (Pearl & Hermes Reef, Laysan Island, Lisianski Island, Kure Atoll, and French Frigate Shoals). In June 1999 an informal Section 7 consultation on the crustaceans fisheries examined the impacts of the implementation of bank-specific harvest guidelines and the potential for adverse impacts on monk seals resulting from the redistribution of fishing effort across the NWHI. The consultation also considered the preliminary results from a fatty acid study conducted to determine the importance of lobsters and other items in the diets of monk seals, as well as data from each major sub-population on the girth of monk seal pups at weaning. At the time of the consultation, the fatty acid results were inconclusive. Girth measurements of pups were provided as a measure of the ability of a mother to provision her offspring from energy stores and were used as an index of prey availability to pregnant females during their pregnancy. Pup girths were highest where sub-populations were growing (Pearl and Hermes Reef and Kure Atoll), intermediate where sub-populations were stable (Laysan or Lisianski Islands), and lowest where the sub-populations were declining (French Frigate Shoals). During the mid- and late 1990s pup girths increased at most sites, most notably at French Frigate Shoals, Laysan Island, and Lisianski Islands. Since that time, the fatty acid study has continued and preliminary results have indicated that lobster can be detected in monk seal blubber. To date, however, it has not been possible to determine the importance of lobster in diet of monk seals using the fatty acid technique. Monk seal pup girths have continued to increase at French Frigate Shoals, Laysan Island, and Lisianski Island and have shown little change at Pearl and Hermes Reef and Kure Atoll. Trends in the growth of each sub-population have not changed since this consultation.

The consultation concluded that there was no evidence to suggest that the establishment of bank-specific harvest guidelines based on a conservative 13% annual harvest rate would likely adversely affect Hawaiian monk seals.

No direct interactions with other protected species (e.g., sea turtles, seabirds, or other marine mammals) have been reported or observed in the NWHI lobster fishery.

5.4 Precious Corals FMP Fisheries

A summary of available information on the environment associated with the precious corals fisheries of the Western Pacific is provided in this section. Much of the information has been taken from a Preliminary Draft EIS for the Precious Corals FMP (WPRFMC 2002f), which can be referred to for additional detail.

5.4.1 Description of the Fisheries

Most of the information in this section pertains only to the precious corals fishery occurring around the Hawaiian Archipelago. No precious coral harvester has received a federal permit to fish in the EEZ surrounding American Samoa or Guam since the implementation of the FMP in 1980. There are two distinct and separate precious coral fisheries in Hawaii. One fishery focuses on the harvest of deep-water (400 to 1,500 m) pink, gold, and bamboo corals, using tangle net dredges or manned and unmanned submersibles. The other fishery involves the hand harvest of black coral by scuba divers at depths of 30 to 100 m.

5.4.1.1 Harvest of deep-water precious corals

In 1965, Japanese coral fishermen discovered a large pink coral bed (*Corallium* spp.) on the Milwaukee Banks in the Emperor Seamount Chain near the northwestern end of the Hawaiian Archipelago (Grigg 1993). Intermittently over the next two decades, dozens of foreign vessels employed tangle-net dredges to harvest precious corals in the waters around the NWHI. During the 1980s, Japanese and Taiwanese coral vessels frequently fished illegally in the EEZ near the Hancock Seamounts (Grigg 1993). In 1985, Taiwanese vessels reportedly poached about 100 mt of pink coral from north of Gardner Pinnacles and Laysan Island (Grigg 1993). Poaching probably stopped in these areas in the late 1980s because there was no longer enough precious coral to sustain an economically viable fishery (Carleton 1987).

In 1966, researchers at the University of Hawaii located a small pink coral bed off Makapu‘u, Oahu. Over the next three years, a small group of fishermen harvested this bed using tangle net dredges. By 1969, the precious coral industry in Hawaii was producing about $2 million in retail sales. Part of these sales consisted of pink coral jewelry imported from Taiwan and Japan. Further research on precious corals conducted by the University of Hawaii led to the development of a selective harvesting system using a manned submersible. Starting in 1973, Maui Divers of Hawaii, Inc., the leading manufacturer and retailer of precious coral jewelry in Hawaii, adopted this system for the commercial harvest of pink, gold and bamboo coral at the Makapu‘u Bed. However, harvest operations were discontinued in 1978 because of high operating costs.

In 1988, the domestic vessel *Kilauea* used a tangle net dredge to harvest beds at Hancock Seamount. The owners of the *Kilauea* received a federal Experimental Fishing Permit that allowed them to collect an amount of precious coral in excess of the harvest quotas that had been established by the Council in 1980. However, their catch consisted mostly of dead or low quality pink coral, and the operation was soon discontinued (Grigg 1993). One company in Hawaii has recently been experimenting with manned submersibles and remotely operated vehicles. These technologically advanced devices are equipped with spotlights, cameras, and a variety of maneuverable tools. They have been able to harvest individual colonies, chosen by size and quality prior to cutting, and place them in collecting cages to bring to the surface in a highly controlled and efficient manner. While this gear is still very expensive, innovations in submersible technology within the petroleum and defense industries during the past two decades have significantly reduced the capital and operating costs. In particular, the expense of operating manned submersibles has declined. These submersibles are smaller and, consequently, the tender vessels can be smaller. In addition, participants in the deep-water precious coral fishery may defray capital costs by finding other lucrative uses for the gear, such as salvage and research.

Recently, American Deepwater Engineering, a division of the Hawaii-based American Marine Services Group, received a federal permit to gather precious corals in the waters around Hawaii. The firm is using two one-person submersibles capable of diving to 2,000 feet. In 2000, precious coral harvesting occurred at the Makapu‘u Bed and in the Exploratory Area of the EEZ. The harvest levels of this operation cannot be reported here because of NOAA confidentiality restrictions. Other firms have expressed an interest in harvesting deep-water precious corals in Hawaii using selective gear, but have delayed entry into the fishery because of uncertainty about the fishery’s profitability. It is too early to determine if this fishery will be profitable. The ex-vessel value of precious coral varies widely according to color and size. It is uncertain whether the coral harvested by the current firm will be of sufficient quality to receive the high prices required to offset the high fishing costs.

The worldwide glut of *Corallium* produced during the boom years of the early 1980s caused the market value of pink coral to fall even below breakeven prices for Taiwanese and Japanese coral fishermen (Grigg 1993). Consequently, many fishermen dropped out of the fishery and the worldwide supply of deep-water precious corals has dwindled. For the past 20 years Hawaii businesses engaged in the manufacture of deep-water precious coral jewelry have relied on local stockpiles of gold coral and imports of pink coral from foreign suppliers. Prices for precious corals gradually increased, with specimens of the highest quality pink coral selling for $5,000/lb. in international auctions. However, changes in the jewelry industry during the past decade may have diminished the demand for precious corals. Products such as black pearls have captured a substantial share of the market formerly held by precious corals (C. Marsh, Maui Divers of Hawaii, Inc., pers. comm.). In 1993 Hawaii’s precious coral jewelry industry was valued at about $25 million at the retail level (Grigg 1993).

5.4.1.2 Harvest of black corals

Before European explorers first visited the Hawaiian Islands the indigenous people of the islands used *ekaha ku moana* (black coral) medicinally to treat various respiratory and childhood diseases and may have collected the coral with hook and line (Iversen et al. 1990). The commercial harvest of black coral did not begin until the late 1950s when sport divers discovered beds of *Antipathes dichotoma* and *A. grandis* about 4.8 km west of Lahaina, Maui at an area now known as “Stonewall” (Grigg 1993). A cottage industry producing curios and black coral jewelry soon developed in Lahaina.

The collection of black coral has continued in Hawaii since the inception of the fishery, although harvest levels have fluctuated with changes in demand. In the 1960s and early 1970s, as much as 10,000 kg were harvested annually from black coral beds off Kauai and Maui. During the 1970s, the State of Hawaii drafted a regulation requiring a minimum size limit (height) of 48 inches, which corresponded to the recommended MSY levels. This regulation was never codified. However, divers and jewelry makers have voluntarily complied with it. A 1998 survey of the Au‘au Channel Bed reexamined five areas first studied in 1975. In summary, there was no difference between the two time periods in the age structure of colonies less than 19 years old, which represents the recommended size limit of 48 inches. This demonstrates excellent compliance by the divers with this management guideline. The study also found that the population had almost completely replaced itself since 1975. In fact, 97% of the colonies surveyed in 1998 were less than 23 years old. This means that the regeneration time of the bed is equivalent to the age of its oldest colonies and that the bed is experiencing undiminished recruitment (Grigg 1998).

Annual harvest and sales estimates for black coral for the years 1990 through 2001 are shown in Table 19. As noted above, the harvest of black coral has occurred mainly in State of Hawaii waters. Since 1980, virtually all of the black coral harvested around the Hawaiian Islands has been taken from the bed located in the Au‘au Channel. Most of the Au‘au Channel harvest has occurred in State of Hawaii waters, and no black coral diver has ever received a federal permit to harvest precious coral. However, a substantial portion of the black coral bed in the Au‘au Channel is located in the EEZ. The annual harvests have generally been well below the recommended MSY for this bed of 5,000 kg per year (11,000 lbs/year).

Table 19. Volume and value of black coral landings in Hawaii

Year	Harvested (lb)	Sold (lb)	Ex-Producer Value ($)
1990	2,349	2,169	31,575
1991	2,305	2,250	35,080
1992	2,398	2,328	46,560
1993	864	769	15,380
1994	4,354	4,209	84,180
1995	6,017	5,912	122,765
1996	4,865	1,703	41,325
1997	1,520	415	10,394
1998			
1999			
2000	7,295	3,380	84,500
2001	15,820	0	0

Source: Hawaii Division of Aquatic Resources.
The estimates of annual value have not been adjusted for inflation.
In 1998 and 1999 there were so few harvesters that harvest and sales data are confidential.
Year-2001 estimates are preliminary.

Since the inception of the black coral fishery in Hawaii in the late 1950s, generally fewer than 10 individuals have been active in the fishery at any one time. Participation has probably been limited by the relatively small market for black coral in Hawaii and the extreme physical danger of harvesting operations. Currently, there are probably less than five active commercial black coral harvesters in Hawaii. However, the introduction of new technology may increase the output from old harvest areas or allow the discovery and exploitation of new beds at greater depths.

Today, considerably less black coral is required by the industry because the jewelry items produced are smaller and of higher quality and because modern cutting procedures have become much more efficient (Carleton 1987). But the demand for small, immature black coral colonies has increased recently because of the growing popularity of household marine aquaria. In 1999, despite the voluntary compliance with the 48 inch minimum size limit, concern about the potential for greater harvesting pressure on black coral resources led the State of Hawaii to prohibit the harvest of black coral with a base diameter of less than 3/4 inches from state waters.

5.4.1.3 Socioeconomic importance

Living precious corals do not form an overt part of the human environment in the region, in part because they inhabit great depths, and because most of the known beds are in isolated locations. They are not within the range of observation of recreational or commercial free divers, and are seen *in vivo* only by the operators of the submersible vessel employed to harvest them in Hawaii, and occasionally by research scientists. It should be noted however, that precious corals, like any species of wildlife, have scientific value apart from socio-economic considerations.

The public does not notice the handling and processing of the product—a small volume of an inert mineral skeletal material—in the same way as other fishery operations, which often produce cannery odors or localized pollution of harbor waters. Probably the majority of the inhabitants of the Hawaiian Islands and elsewhere in the region are unaware that there are precious coral resources in the surrounding waters, except when it is brought to their attention by the advertisement and display of coral jewelry by local retailers.

Precious corals are rarely, if ever, harvested accidentally by any type of the domestic commercial or recreational fisheries in the region. By the same token, it does not appear that any group of non-precious coral fishermen in the region considers precious corals in any way related to the success of their fishing operations. Foreign fishermen, who from time to time carry on deep trawling for finfish in some parts of the EEZ, may occasionally encounter incidentally harvested precious corals in their trawls.

Aside from a few scientists and administrators, generally only the people employed in the precious corals fishery and the associated processing industry, and members of environmental groups, are aware of and concerned about the precious corals resources. The largest firm in the precious corals industry employs about 308 people, including 35 involved directly in fishing and/or processing of locally harvested coral. It is reported that there are about 15 other firms in Hawaii engaged in making jewelry from imported coral, and it is estimated that as many as 500 retail outlets in the state handle coral jewelry, among other types, of which an unknown proportion is made of locally harvested coral. In total, about 800 to 1,000 people, from fishermen to retail sales clerks, are employed in the precious coral industry in Hawaii. In the other island groups in the region, the local population is much less involved in precious coral industries, although most curio shops and airport terminal duty-free shops sell coral jewelry.

When considering the human environment of the precious coral fishery in the Western Pacific Region, it should be kept in mind that people in parts of the region outside of Hawaii may in the future begin precious coral harvesting, and perhaps also processing precious coral into jewelry. There are no such activities right now. But an industry could develop from the small quantities of black corals (*Antipathes* spp.) that are reportedly collected by local divers at some of the islands from time to time. It is generally agreed that the people of American Samoa, Guam, and the Northern Mariana Islands need to develop a variety of new economic activities in order to become self-supporting, and, because of the scarcity of terrestrial natural resources, they must look to ocean resources as the basis for such development. Coral harvesting by simple methods, such as dredging, would be relatively easy for island residents to take up, if organized surveys by government agencies or private prospecting should reveal the existence of significant coral beds in locations accessible to them. On the other hand, dredging as practiced on the Makapu‘u Bed in Hawaii in the 1960s was apparently not efficient enough to be profitable, and there is some question as to whether it could be made to pay in American Samoa, Guam, or the Northern Mariana Islands.

Since the inception of the black coral fishery in Hawaii in the late 1950s generally fewer than five individuals have been active in the fishery during any one year. Between 1990 and 2001, the annual harvest of black coral in Hawaii varied from 900 to 16,000 lb, with an average of about 4,800 lb. This average annual is substantially lower than the MSY for the Au‘au Channel black coral population, which is estimated to be about 11,000 lb/year (Grigg 1976). Average annual ex-producer sales during the same period have been about $47,000 (unadjusted for inflation).

The two one-manned submersibles currently based in Hawaii provide additional benefit beyond their use in harvesting precious corals. They were used during the National Geographic Society’s Sustainable Seas Expedition, which brought national attention to the Humpback Whale Sanctuary and other underwater treasures in Hawaii. The submersibles were employed to search for Japanese submarine wreckage related to the bombing of Pearl Harbor in anticipation of the 2001 release of the movie, garnering additional positive publicity for Hawaii. They are an integral part of a research initiative for the unexplored deep reef habitat in the NWHI Coral Reef Ecosystem Reserve. This project will supplement NMFS and National Ocean Service research of the shallow habitat in the Reserve, classifying habitat and associated fauna at depths beyond where scuba divers are permitted to descend.

5.4.2 Fish Stocks

Precious corals management unit species (MUS) include any coral species of the genus *Corallium* and the following coral species:

Pink coral (also known as red coral), *Corallium secundum*
Pink coral (also known as red coral), *Corallium regale*
Pink coral (also known as red coral), *Corallium laauense*
Gold coral, *Gerardia* spp.
Gold coral, *Narella* spp.
Gold coral, *Calyptrophora* spp.
Bamboo coral, *Lepidisis olapa*
Bamboo coral, *Acanella* spp.
Black coral, *Antipathes dichotoma*
Black coral, *Antipathes grandis*
Black coral, *Antipathes ulex*

Adult pink, gold, and bamboo coral are found in deep water (350-1500 m) on solid substrate where bottom currents are strong. Black coral also typically occurs on solid substrate, but generally at depths less than 100 m. Precious coral polyps form colonies resembling small trees, and these colonies form aggregations called beds. Asexual reproduction (by fragmentation and re-attachment) appears rare.

All precious corals are slow growing and are characterized by low mortality and recruitment rates. Natural populations are relatively stable, and a wide range of age classes are generally present. This life history pattern (longevity and many year classes) has two important consequences with respect to exploitation. First, the response of the population to exploitation is drawn out over many years. Second, because of the great longevity of individuals, and the associated slow rates of turnover in populations, a long period of reduced fishing effort is required to restore the ability of the stock to produce at the maximum sustainable yield (MSY) if a stock has been overexploited for several years.

In general, western Pacific precious corals share several ecological characteristics: they lack symbiotic algae in tissues (they are ahermatypic) and most are found in deep water below the euphotic zone; they are filter feeders; and many are fan shaped to maximize contact surfaces with particles or microplankton in water column. Most species are uni-sexual or dioecious (sexes are separate) and the age at reproductive maturity is 12-13 years for *Corallium secundum* and *Antipathes dichotoma*, with fertilization appearing to take place in the water column. Western Pacific precious coral larvae are more affected by light and temperature than are adults. Larvae of both *Antipathes* species occurring in Hawaii are known to be negatively phototactic, which is why they are not found shallower than 30 m. The duration of the larval stage is unknown for most species, but Mediterranean studies of *Corallium rubrum* suggest that their larvae remain competent for several weeks. *Corallium* species live below the euphotic zone at depths between 350 and 1500 m where temperature varies between 3° and 14° C. These larvae may avoid settling deeper, where lower temperatures may prevent reproduction. Similarly, the lower limit of the *A. dichotoma* and *A. grandis* black corals coincides with the top of the thermocline in the high Hawaii islands (Grigg 1993).

Little information is available on the ecological associations of the precious corals or their significance to the lives of other organisms. Microzooplankton and particulate organic matter are important in the diets of related Gorgonians, and like other Anthozoan species, they are associated with numerous kinds of commensal invertebrates. They are also associated with many species of other Anthozoans. They have not been observed to be consistently associated with any kind of finfish or free-swimming invertebrate. Eucidarid sea urchins are known to prey on precious corals.

Because of the great depths at which they live, precious corals are probably insulated from many of the short-term drastic changes that occur in the physical environment. For the same reason, it is difficult to imagine circumstances in which man-made pollution would affect their environment, except in the unlikely event that large quantities of heavy material, such as waste from manganese nodule refining, were dumped directly on a bed. Nothing is known of the long-term effects of changes in environmental conditions, such as water temperature or current velocity, on the reproduction, growth, or other life activities of the precious corals. The oldest corals observed at Makapu‘u are thought to be 75 years old, and it is believed that black corals may live even longer. Hawaii populations of *Corallium secundum* and *A. dichotoma* appear relatively stable, implying a balance between recruitment and mortality.

Precious corals are known to exist in the EEZ around Hawaii and very likely exist in the EEZ around American Samoa, Guam, the Northern Mariana Islands, and the remote US Pacific Island possessions, but virtually nothing is known of their distribution and abundance in these areas. To date, beds of pink, gold and/or bamboo coral have been found only at eight locations in the Council's jurisdiction, all in the EEZ around Hawaii. This number includes two recently discovered beds, one near French Frigate Shoals in the NWHI and a second on Cross Seamount, approximately 150 nm south of Oahu. There are also two known major black coral beds in the Council's area, in addition to several minor beds (Grigg 1998). Most of these are located in Hawaii's state waters. However, the largest (the Au'au Channel Bed) extends into the EEZ. The approximate areas of six of these eight beds have been determined. These beds are small; only two of them have an area greater than 1 km^2, and the largest is 3.6 km^2 in size. The Ke'ahole Bed off Hawaii's Kona coast is substantially larger than originally thought. Scientists and industry are currently assessing its actual size. Initial estimates reveal a size twenty time larger than previously thought. There are undocumented and unconfirmed reports that precious corals have been observed or exploited in widely scattered locations in the Western Pacific Region: off American Samoa, Guam, the Northern Mariana Islands, and Wake Island, but no details are available. In some cases attempts at scientific surveys in areas referred to in such reports have failed to turn up any evidence of precious corals. Undocumented reports of large past commercial production by Japanese vessels on the Milwaukee Banks, some 500 miles beyond the northwestern extreme of the Leeward Hawaiian Islands, and the large physical area of those banks, lead to conjecture that at some locations precious corals may occur in much larger aggregations than have as yet been demonstrated by scientific surveys. Asian coral fishers, who have roamed the western and central Pacific for decades, undoubtedly have undocumented and unorganized information on precious coral beds that is unavailable to US researchers and administrators. It must be said that in general the available information on precious coral occurrence and distribution is fragmentary and incomplete, and there is a high probability that further surveying and prospecting will reveal significant additional precious coral resources in areas under US jurisdiction.

An assessment of the biological condition of the black coral in the Au'au Channel was conducted in July 1998 (Grigg 1998). The age frequency distributions of sample populations in 1975 and 1998 are very similar, suggesting that harvesting during the intervening years has had no significant effect on recruitment. However, the black coral resources in other areas of State waters (for example, "Stonewall" off Lahaina, Maui) which are easily accessible with conventional scuba gear were intensely harvested in the 1970s and have not recovered significantly under the relatively light fishing pressure they are now experiencing.

While the condition of the Au'au Channel Bed is generally good, there are a number of potential factors that could result in greater harvesting pressure on black coral resources in the near future. The first is the possible introduction of new coral harvesting technology (Grigg 1998). To date, black coral in Hawaii has been hand harvested by a small group of divers using conventional scuba gear with compressed air. As noted above, the maximum depth to which divers using this gear can safely descend is less than 75 m. However, the introduction of mixed-gas diving methods and re-breathers would enable scuba divers to dive to the maximum depth (about 110 m) at which colonies of black coral are known to occur. The segment of the population between 80 m and 110 m, which currently may represent a reservoir for recruitment, would be exposed to fishermen. These new diving methods also allow harvesters to extend the length of time which they can safely spend underwater. The cost of this equipment has declined in recent years, making it financially feasible for many divers to purchase the gear. For example, the price of a re-breather is about $20,000, not including the training expenses that use of this diving equipment may entail. Although this new diving gear is not yet being used to harvest black coral in Hawaii, some harvesters are experimenting with towed underwater camera systems and other new technology that could increase the output from old harvest areas and lead to the discovery of new beds. An increase in the demand for black coral could also result in greater harvesting pressure on black coral resources. In the past, the market for colonies of black coral small enough to fit inside the typical curio display case or household aquarium was small in comparison to the market for larger trees that are processed for jewelry (Oishi 1990). However, according to the Hawaii Division of Aquatic Resources, the demand in Hawaii for small, immature black coral colonies may increase in the near future as the popularity of marine aquaria grows. The demand for coral harvested in the waters around Hawaii could also increase significantly if out-of-state markets for raw black coral are aggressively pursued by Hawaii coral processors or if current imports of cut and polished black coral from Taiwan into Hawaii decrease (Grigg 1998).

The status of the precious corals stocks managed under the FMP was reviewed in the Annual Report to Congress on the Status of U.S. Fisheries–2001 (NMFS 2002b). None of the stocks managed under the FMP was indicated as being in, or approaching, an overfished condition.

5.4.3 Ecosystem and Habitat

For the purposes of designating Essential Fish Habitat for precious coral species, the MUS were separated into two assemblages, the shallow-water (30-100 m) assemblage, including the black corals (*Antipathes dichomata*, *A. grandis*, and *A. ulex*), and the deep-water (300-1500 m) assemblage, including all the other MUS.

The six precious coral beds known at the time of designation were designated as Essential Fish Habitat, Keahole, Makapu’u, Kaena, Wespac, Brooks, and 180 Fathom gold/red coral beds. Three black coral beds were also designated as Essential Fish Habitat, a bed between Miloli’i and South Point off the island of Hawaii, a bed in the Au’au Channel between Maui and Lanai, and a bed off the southern coast of Kauai.

Three beds in the Hawaiian archipelago were designated as Habitat Areas of Particular Concern, Makapu’u, Westpac, and Brooks Bank. Also designated as HAPC for black coral was Au’au Channel.

5.4.4 Protected Species

Concerns about the harvest of gold coral have been raised by an array of recent studies on foraging and feeding behavior of the endangered Hawaiian monk seal (Parrish 1998). The studies have focused on the monk seal population at French Frigate Shoals in the NWHI where the species' largest breeding colony resides. In 1998, a total of 410 seals were identified at French Frigate Shoals (Johanos 1998). This breeding colony has experienced a high juvenile mortality during the past several years which could place the future of the Hawaiian monk seal in jeopardy (Laurs 1999). A significant decline in prey availability might explain the observed changes in condition and survival of immature seals (Johanos 1998).

A multi-year, multi-season study of the movements of the Hawaiian monk seal population at French Frigate Shoals, using satellite tags, found seals (34 males and females) to range between Gardner Pinnacles and Necker Bank (Abernathy and Siniff 1998). Depth-of-dive records from the study show that a small percentage of the seals' dives reached depths of 350-500 m, where precious corals are found. The time spent by seals at these depths ranged from occasional visits to as much as half the seals' sea-going effort. Based on this sample of deep-foraging seals, it is estimated that 25 seals in the French Frigate Shoals population dive to these depths.

A study of the diving behavior of the monk seal population at French Frigate Shoals, using video cameras harnessed to 24 adult male seals, found that these seals preferred to forage outside the atoll (Parrish et al. 2000). Three seals carrying video cameras dove below 350 m. The seals were heard to make feeding sounds at these depths, and one seal was observed ascending with a deep-water bottomfish in its mouth. According to the video camera data, the foraging male seals prefer to exploit habitats that afford improved prey density or accessibility. Studies of the diet of Hawaiian monk seals show that deep-water bottomfish and eels may be a significant component (Goodman-Lowe 1998). In summary, the data collected by these various studies suggest that some monk seals from the resident population on French Frigate Shoals concentrate much of their foraging at the depths where precious corals occur.

In September 1998, submersibles were used by NMFS to survey the ocean floor at two sites around French Frigate Shoals where previous studies showed monk seals focused their deep dive activity. The survey found an abundance of live and dead colonies of gold coral at both sites, one of which was located at the southeast part of Brooks Bank and the other on the east ridge of French Frigate Shoals (FFS). The latter was a previously unknown bed of precious corals and has been named the FFS-Gold Pinnacles Bed. Submarine surveys of nearby sites, where there were no records of monk seal foraging activity, found no precious corals suggesting that monk seals may specifically target precious coral beds.

Many of the gold coral colonies observed at Brooks Bank and the FFS-Gold Pinnacles Bed were greater than 40 inches high. These coral trees may provide enough vertical relief and structure to constitute an important element of fish habitat/cover. The shelter afforded by these precious corals beds may aggregate monk seal prey and improve the seals' foraging success. Based on this information, a framework measure is under development that would establish a "mega-refugium" at the southern end of the NWHI in order to protect what is a unique ecological area, including the gold coral beds.

6. Alternatives Considered

These amendments do not propose any new regulatory measures in the four FMPs. They identify fishing communities so that the effects of new management measures can be appropriately assessed in the context of National Standard 8 and other provisions of the MSA. It should be emphasized that the task in this management action is not to *designate* fishing communities, but rather to *identify* them – that is, to find them if they exist and describe them. For that reason, it would not be appropriate to consider alternative sets of fishing communities. The identifications made here are based on the MSA definitions and, using the best available information, on examination of the social and economic importance of fisheries to communities in Hawaii.

6.1 Alternative 1: No Action

Under the no-action alternative, the Council would not make any determinations in the Bottomfish, Pelagics, Crustaceans, or Precious Corals FMPs as to the existence of fishing communities in Hawaii. It should be emphasized that this alternative is not equivalent to determining that no fishing communities exist in Hawaii; rather it would simply be a lack of action to identify them and incorporate those identifications in the FMPs. It would not preclude fishing community identifications from being made in the future.

6.2 Alternative 2: Identify Fishing Communities in Hawaii (Preferred Alternative)

Under the preferred alternative the Council would adopt in each of the Bottomfish, Pelagics, Crustaceans, and Precious Corals FMPs the identification of each of the seven inhabited islands of the State of Hawaii as a fishing community, as described in Section 4 of this document.

7. Environmental Consequences of the Management Alternatives

This section describes the likely environmental impacts of each of the alternatives, including the no-action alternative, based on criteria outlined in NOAA Administrative Order 216-6 (Section 6.02). The impacts of the alternatives are considered in seven categories. These are: 1) socioeconomic impacts, including fishery economic performance, markets and consumers, and fishing communities, 2) target and non-target fish stocks, 3) ocean and coastal habitat and Essential Fish Habitat, 4) public health and safety, 5) protected species, 6) biodiversity and ecosystem function, and 7) cumulative impacts. In Section 7.9 is a discussion of the reasons for selecting the preferred alternative as the proposed measure.

It is emphasized that neither of the alternatives includes any management measures that would have impacts themselves. The preferred alternative makes determinations that would be used in the future in the process of fulfilling the requirements of National Standard 8 and other provisions of the MSA (i.e., assessment of impacts on fishing communities). The implications of those requirements do not need to be assessed here. As explained in the introduction to Section 6, the pertinent aspect of the preferred alternative for the purpose of this assessment (i.e., comparing its likely impacts to those of the no-action alternative) is not the particular set of fishing communities that is identified, but rather the fact that fishing communities are identified and those identifications are incorporated into the four FMPs.

Alternative 1, no action, would not identify fishing communities in Hawaii for the purpose of assessing the impacts of management measures on fishing communities, as required in the context of MSA National Standard 8, §303(a)(9), and for other purposes under the MSA. Under this alternative, fishing communities in Hawaii, if they exist, would, in order to satisfy the requirements of the MSA, have to be identified at some point prior to, or in the process of, conducting the necessary impact assessments associated with proposed management measures in the future.

Alternative 2, the preferred alternative, would identify specific fishing communities in Hawaii and incorporate these determinations in the four FMPs. The action would be merely one of making a determination as to the existence of certain fishing communities – findings that will be needed in order to take management action in the future. Because under the no-action alternative this determination would likely be made at some point in the future (because it is required under the MSA as a prerequisite to taking management action), the only substantial difference between the two alternatives is the point in time at which the determinations are made. The sooner they are made, the sooner and more likely that the potential impacts of proposed management measures on fishing communities will receive adequate consideration in the Council's fishery management process. Because of that time difference, the preferred alternative would have a slightly greater likelihood than the no-action alternative of resulting in a management regime that will achieve the sustained participation of fishing communities and the minimization of adverse effects on fishing communities. It would also likely have the effect of fishing communities being identified and treated more consistently among future impact assessments. This is because in the case of the no-action alternative, each future impact assessment may come up with different findings as to the existence of fishing communities in Hawaii. Under the preferred alternative, it is more likely that future impact assessments would simply apply the findings made here – that each of the seven inhabited islands of the State of Hawaii is a fishing community. Whether this effect would be positive or adverse is difficult to say.

Although it is recognized that the preferred alternative could have effects on fishing communities that are different than those of no-action alternative, as described above, and that those differences could have effects on other aspects of the environment, as described below, it is emphasized that any such effects – positive or adverse – are likely to be small.

7.1 Socioeconomic Impacts

The preferred alternative would have no direct impact on the fisheries managed under the four FMPs, including the economic performance of the fisheries, the markets and consumers associated with the fisheries, or fishing communities that are reliant on fisheries resources. However, the preferred alternative would likely result in adequate consideration being given to the interests of fishing communities sooner than would the no-action alternative, and thus have a slightly greater likelihood than the no-action alternative of resulting in a management regime that will achieve the sustained participation of fishing communities and the minimization of adverse effects on fishing communities.

Since the interests of fishing communities in Hawaii are, in most cases, strongly correlated with the viability of the fisheries, it is unlikely that the preferred alternative would have any adverse impacts on fishery economic performance or markets and consumers – and certainly not on fishing communities themselves.

7.2 Impacts on Target and Non-Target Fish Stocks

The preferred alternative would have no direct impact on the target or non-target fish stocks. However, the preferred alternative would likely result in adequate consideration being given to the interests of fishing communities sooner than would the no-action alternative, and thus have a slightly greater likelihood than the no-action alternative of resulting in a management regime that will achieve the sustained participation of fishing communities and the minimization of adverse effects on fishing communities. Since the sustained participation of fishing communities in Hawaii is, in most cases, strongly correlated with the viability of the stocks exploited by the fisheries (because any decisions stemming from consideration of the importance of fishery resources to fishing communities are likely to favor the maintenance of relatively large target stock sizes, such as sizes equal to or larger than those capable of producing maximum sustainable yield), it is unlikely that the preferred alternative would have any adverse impacts on fish stocks. Furthermore, National Standard 8 and the National Standard Guidelines require that deliberations regarding the importance of fishery resources to affected communities not compromise the achievement of conservation requirements and goals of the FMPs, which apply to non-target stocks as well as target stocks. In other words, in management deliberations, the conservation of fish stocks would likely be put before the sustained participation and economic needs of the fishing communities identified in the preferred alternative.

7.3 Impacts on Ocean and Coastal Habitat and Essential Fish Habitat

Neither of the alternatives would have any effect related to the condition of marine or coastal habitats, so neither would likely lead to substantial physical, chemical, or biological alterations of essential fish habitat (EFH) or habitat areas of particular concern (HAPC) for species managed under the Pelagics, Bottomfish and Seamount Groundfish, Precious Corals, or Crustaceans Western Pacific Fishery Management Plans. EFH and HAPC for these species groups have been designated as presented in Table 19. For the same reason, none of the alternatives is expected to cause substantial damage to ocean or coastal habitats.

Table 20. Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPC) for species managed under the FMPs for the Pelagics, Bottomfish and Seamount Groundfish, Precious Corals, and Crustaceans Fisheries of the Western Pacific Region

SPECIES GROUP (FMP)	EFH (juveniles and adults)	EFH (eggs and larvae)	HAPC
Pelagics	water column down to 1,000m	water column down to 200m	water column down to 1,000m that lies above seamounts and banks
Bottomfish	water column and bottom down to 400m	water column down to 400m	all escarpments and slopes between 40-280 m, and three known areas of juvenile opakapaka habitat (2 off Oahu and 1 off Molokai)
Seamount Groundfish	(adults only:) water column and bottom from 80 to 600 m, bounded by 29° - 35° N and 171° E - 179° W	(including juveniles:) epipelagic zone (0 to ~200m), bounded by 29° - 35° N and 171° E – 179° W	
Precious Corals	Keahole, Makapu'u, Kaena, Wespac, Brooks, and 180 Fathom gold/red coral beds, and Miloli'i, S. Kauai and Au'au Channel black coral beds	not applicable	Makapu'u, Westpac, and Brooks Bank beds, and the Au'au Channel
Crustaceans	bottom habitat from shoreline to a depth of 100m	water column down to 150m	all banks within the Northwestern Hawaiian Islands with summits less than 30m

All areas are bounded by the shoreline and the outer boundary of the EEZ unless indicated otherwise.

7.4 Impacts on Public Health and Safety

Neither of the alternatives would have any effect related to public health or safety, so neither would be likely to have any adverse impacts on public health or safety.

7.5 Impacts on Protected Species

Neither of the alternatives would have any effect related to the condition of any species protected under the Endangered Species Act, Marine Mammal Protection Act, or Migratory Bird Treaty Act, so neither would be unlikely to have any adverse impact on protected species or their critical habitat.

7.6 Impacts on Biodiversity and Ecosystem Function

Neither of the alternatives would have any effect related to biodiversity or ecosystem function, so neither would be likely to have any adverse impacts on biodiversity or ecosystem function.

7.7 Cumulative Impacts

The preferred alternative is unlikely to have any adverse cumulative effects.

7.8 Areas of Controversy

The objectives of this management action and the measures contained in the alternatives do not appear to have generated any public concern, controversy, or opposition.

7.9 Reasons for Selecting the Preferred Alternative

Alternative 2 would likely result in adequate consideration being given to the interests of fishing communities sooner than would the no-action alternative, and thus have a slightly greater likelihood than the no-action alternative of resulting in a management regime that will achieve the sustained participation of fishing communities and the minimization of adverse effects on fishing communities. It is unlikely that Alternative 2 would result in any adverse socioeconomic impacts, adverse impacts on fish stocks, habitats, public health and safety, protected species, or biodiversity or ecosystem function, or adverse cumulative impacts. For these reasons, Alternative 2 is the preferred alternative.

8. Consistency With National Standards for Fishery Conservation and Management

Section 301 of the MSA establishes ten national standards for fishery conservation and management. FMPs and their associated regulations must be consistent with the National Standards. The degree of consistency of the measures proposed in the preferred alternative is discussed below.

(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.*

The provisions in these amendments will have no effect on the prevention of overfishing or the achievement of optimum yield. National Standard 8 and the National Standard Guidelines require that deliberations regarding the importance of fishery resources to affected communities not compromise the achievement of conservation requirements and goals of the FMPs.

(2) *Conservation and management measures shall be based on the best scientific information available.*

The determinations made in these amendments are based on examination of the best social and economic 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.*

The provisions in these amendments will have no effect on how individual stocks of fish are managed.

(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.*

The provisions in these amendments do not discriminate between residents of different states and do not allocate, assign, or affect the allocation or assignment of fishing privileges. The National Standard Guidelines specify that National Standard 8 does not constitute a basis for allocating resources to a specific fishing community nor for providing preferential treatment based on residence in a fishing community.

(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.*

The provisions in these amendments have no effect on efficiency in the utilization of fishery resources.

(6) *Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources and catches.*

The provisions in these amendments have taken into account variations among, and contingencies in, fisheries, fishery resources and catches. That fishing communities in Hawaii were found to be relatively dispersed reflects in part the highly dynamic nature of fisheries in Hawaii.

(7) *Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.*

The provisions in these amendments bring no new costs and do not duplicate any existing measures.

(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.*

The identification of fishing communities in these amendments are findings that will be used to ensure that conservation and management measures take into account the importance of fishery resources to fishing communities in order to provide for their sustained participation and to minimize adverse economic impacts on them.

(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.

The provisions in these amendments have no effect on bycatch or bycatch mortality.

(10) Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

The provisions in these amendments have no effect on the safety of human life at sea.

9. Relationship to Other Applicable Laws and Provisions of the Magnuson-Stevens Act

9.1 National Environmental Policy Act (NEPA)

This document has been prepared in accordance with the requirements of the National Environmental Policy Act (NEPA) of 1969 to assess the impacts on the human environment that may result from the proposed action. It contains the elements consistent with an Environmental Assessment (EA), including an assessment of the likely impacts of several alternative measures. This serves as a determination of the need for an Environmental Impact Statement. NEPA requires preparation of an Environmental Impact Statement if the EA does not support a finding of no significant impact.

The purpose and need for action is described in Section 3 of this document. Descriptions of the affected environment for the Bottomfish, Pelagics, Crustaceans, and Precious Corals fisheries are provided in Section 5. A discussion of the alternatives considered is in Section 6. A discussion of the likely impacts of the alternatives is in Section 7. Previously approved sections of Amendment 6 to the Bottomfish FMP, Amendment 8 to the Pelagics FMP, Amendment 10 to the Crustaceans FMP, and Amendment 4 to the Precious Corals FMP provide further details on essential fish habitat and habitat areas of particular concern.

9.1.1 Conclusions and Determination (Finding of No Significant Impact)

a. The preferred alternative is not expected to result in any adverse socioeconomic impacts in the bottomfish and seamount groundfish fisheries, pelagic fisheries, crustaceans fisheries, or precious corals fisheries of the Western Pacific Region in terms of economic performance, markets and consumers, or fishing communities, as it will facilitate the informed consideration of the social and economic interests of fishery participants and fishing communities when formulating management actions (Section 7.1).

b. The preferred alternative is not expected to jeopardize the sustainability of any target or non-target fish stocks, as it will do no more than facilitate the informed consideration of the interests and needs of fishing communities. To the extent that the sustained participation of fishing communities is dependent on the sustainability of fish stocks, safeguarding the interests of fishing communities will help to safeguard fish stocks. Further, the MSA mandates that the conservation of fish stocks – including bycatch species – be put before the sustained participation and economic needs of fishing communities (Section 7.2).

c. The preferred alternative is not expected to cause substantial damage to ocean and coastal habitats or essential fish habitat as defined under the Magnuson-Stevens Act and identified in FMPs, as it is not likely to lead to substantial physical, chemical, or biological alterations of these habitats (Section 7.3).

d. The preferred alternative is not expected to have a substantial adverse impact on public health or safety, as it is not likely to affect any public health or safety aspect of the fisheries or their associated economic sectors (Section 7.4).

e. The preferred alternative is not expected to adversely affect any species protected under the Endangered Species Act or their critical habitat or any species protected under the Marine Mammal Protection Act or the Migratory Bird Treat Act, as it will do no more than facilitate the informed consideration of the interests and needs of fishing communities (Section 7.5).

f. The preferred alternative is not expected to have a substantial impact on biodiversity or ecosystem function within the affected area, as it will do no more than facilitate the informed consideration of the interests and needs of fishing communities (Section 7.6).

g. The preferred alternative is not expected to result in any cumulative adverse effects (Section 7.7).

h. The preferred alternative is not controversial, as it does not appear to have generated any public concern or opposition (Section 7.8).

Based on the information contained in the Environmental Assessment and other sections of this document, I have determined that the preferred alternative, which would amend the Fishery Management Plans for the Bottomfish and Seamount Groundfish Fisheries, Pelagics Fisheries, Crustaceans Fisheries, and Precious Corals Fisheries of the Western Pacific Region to include determinations that each of the seven inhabited islands of the State of Hawaii is a fishing community, is consistent with existing national environmental policies and objectives set forth in sections 101(a) and 101(b) of the National Environmental Policy Act and will not have a significant impact on the quality of the human environment. As described in section 5.03.c of NOAA Administrative Order 216-6, a Finding of No Significant Impact is supported and appropriate for the preferred alternative. Therefore, preparation of an Environmental Impact Statement for the preferred alternative is not required by Section 102(c) of the National Environmental Policy Act or its implementing regulations.

____________________________________ ______________

William T. Hogarth Date
NOAA Assistant Administrator for Fisheries

9.2 Regulatory Impact Review (RIR)

Executive Order 12866 requires that long-term national net costs and benefits of significant regulatory actions be assessed through the preparation of a Regulatory Impact Review (RIR). None of the alternatives in these amendments proposes any regulatory changes, so an RIR is not required. If in the future regulatory action is proposed that is related to the identification of fishing communities, the necessary RIR will be completed.

9.3 Regulatory Flexibility Act (RFA)

The Regulatory Flexibility Act (RFA), 5 U.S.C. 601 *et seq*., requires government agencies to assess the impact of their proposed regulations on small entities, including small businesses, small non-profit organizations, and small governments. None of the alternatives in these amendments proposes any regulatory changes, so an RFA analysis is not required. If in the future regulatory action is proposed that is related to the identification of fishing communities, the necessary RFA analyses will be completed.

9.4 Coastal Zone Management Act (CZMA)

The CZMA requires a determination that a FMP or amendment has no effect on the land or water uses or natural resources of the coast zone, or is consistent to the maximum extent practicable with an affected state's approved coastal zone management program. A copy of the proposed amendments will be submitted to the appropriate state agency in Hawaii for review and concurrence with a determination made by the Council that the amendments are consistent, to the maximum extent practicable, with the state's coastal zone management program.

9.5 Endangered Species Act (ESA)

Several species listed as endangered or threatened under the Endangered Species Act (ESA) occur in the areas fished by the bottomfish and pelagics fisheries. These include marine mammals, sea turtles and seabirds. The species of concern are:

Marine Mammals	**Status**
Hawaiian monk seal (*Monachus schauinslandi*)	Endangered
Humpback whale (*Megaptera novaeangliae*)	Endangered
Sperm whale (*Physeter macrocephalus*)	Endangered
Northern Pacific right whale (*Eubalaena japonica*)	Endangered
Blue whale (*Balaenoptera musculus*)	Endangered
Fin whale (*Balaenoptera physalus*)	Endangered
Sei whale (*Balaenoptera borealis*)	Endangered
Sea Turtles	
Green turtle (*Chelonia mydas*)	Threatened/Endangered
Hawksbill turtle (*Eretmochelys imbricata*)	Endangered
Leatherback turtle (*Dermochelys coriacea*)	Endangered
Loggerhead turtle (*Caretta caretta*)	Threatened
Olive Ridley turtle (*Lepidochelys olivacea*)	Threatened/Endangered
Seabirds	
Short-tailed albatross (*Phoebastria albatrus*)	Endangered
Newell's shearwater (*Puffinus auricularis newelli*)	Endangered

Endangered species in the affected region and their relationships to the four FMP fisheries are discussed in Sections 5.1.4 (bottomfish), 5.2.5 (pelagics), 5.3.4 (crustaceans), and 5.4.4 (precious corals). Further information is available in recent NEPA documents, including the Final EIS for the pelagics fisheries (NMFS 2001b), the Preliminary Draft EIS for the bottomfish fisheries (WPRFMC 2001b), the Preliminary Draft Supplement EIS for the crustaceans fisheries (WPRFMC 2001d), and the Preliminary Draft EIS for the precious corals fisheries (WPRFMC 2002f). The effects of the bottomfish and pelagics fisheries on the marine mammals and sea turtles listed above are reviewed in recent Biological Opinions issued by NMFS (2002b and 2001a). The likely impacts of each of the two management alternatives on ESA-listed species are discussed below.

Alternative 1 is the no-action alternative. Alternative 2, the preferred alternative, would identify each of the seven inhabited islands of the State of Hawaii as a fishing community.

The only substantial effect of the preferred alternative is that it would likely result in adequate consideration being given to the interests of fishing communities sooner than would the no-action alternative. The preferred alternative would thus have a slightly greater likelihood than the no-action alternative of resulting in a management regime that will achieve the sustained participation of fishing communities and the minimization of adverse effects on fishing communities. It is unlikely that there would be any consequent effects on protected species, so it is unlikely that the preferred alternative would have any adverse impacts on any species protected under the ESA or their critical habitat.

9.6 Marine Mammal Protection Act (MMPA)

All U.S.-managed fisheries in the Western Pacific Region are classified as Category III under Section 118 of the Marine Mammal Protection Action of 1992 (MMPA), meaning that the fisheries were determined by NMFS "to have a remote likelihood of, or no known incidental mortality and serious injury of marine mammals" (50 CFR 229.2). Vessel owners and crew that are engaged only in Category III fisheries may incidentally take marine mammals without registering or receiving an Authorization Certificate under the MMPA, but they are required to: 1) report all incidental mortality and injury of marine mammals to NMFS, 2) immediately return to the sea with minimum of further injury any incidentally taken marine mammal, 3) allow vessel observers if requested by NMFS, and 4) comply with guidelines and prohibitions under the MMPA when deterring marine mammals from gear, catch, and private property (50 CFR 229.5, 229.6, 229.7).

Any species listed as endangered or threatened under the ESA is considered to be depleted under the MMPA, and any incidental take of that species must be authorized under Section 101(a)(5) of the MMPA, subject to a determination by the Secretary of Commerce that any incidental mortality or 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 under the ESA for the species or stock. Such incidental take for the Hawaiian monk seal has not yet been authorized for the bottomfish fisheries, and there is no need for such authorization in any of the fisheries for any other ESA-listed marine mammals.

Species of marine mammals that are protected under the MMPA but not listed as threatened or endangered and that occur in the areas where the four FMP fisheries operate include the following:

Pacific white-sided dolphin (*Lagenorhynchus obliquidens*)
Rough-toothed dolphin (*Steno bredanensis*)
Risso's dolphin *(Grampus griseus*)
Bottlenose dolphin (*Tursiops truncatus)*
Spotted dolphin (*Stenella attenuata*)
Spinner dolphin (*Stenella longirostris*)
Striped dolphin (*Stenella coeruleoalba*)
Melon-headed whale (*Peponocephala electra*)
Pygmy killer whale (*Feresa attenuata*)
False killer whale (*Pseudorca crassidens*)
Killer whale (*Orcinus orca*)
Pilot whale *(Globicephala melas*)
Blainsville's beaked whale *(Mesoplodon densirostris*)
Cuvier's beaked whale (*Ziphius cavirostris*)
Pygmy sperm whale (*Kogia breviceps*)
Dwarf sperm whale (*Kogia simus*)
Bryde's whale (*Balaenoptera edeni*)

Marine mammals in the affected region and their relationships to the four FMP fisheries are discussed in Sections 5.1.4 (bottomfish), 5.2.5 (pelagics), 5.3.4 (crustaceans), and 5.4.4 (precious corals). Further information is available in recent NEPA documents, including the Final EIS for the pelagics fisheries (NMFS 2001b), the Preliminary Draft EIS for the bottomfish fisheries (WPRFMC 2001b), the Preliminary Draft Supplement EIS for the crustaceans fisheries (WPRFMC 2001d), and the Preliminary Draft EIS for the precious corals fisheries (WPRFMC 2002f). The likely impacts of each of the two management alternatives on species protected under the MMPA are discussed below.

Alternative 1 is the no-action alternative. Alternative 2, the preferred alternative, would identify each of the seven inhabited islands of the State of Hawaii as a fishing community.

The only substantial effect of the preferred alternative is that it would likely result in adequate consideration being given to the interests of fishing communities sooner than would the no-action alternative. The preferred alternative would thus have a slightly greater likelihood than the no-action alternative of resulting in a management regime that will achieve the sustained participation of fishing communities and the minimization of adverse effects on fishing communities. It is unlikely that there would be any consequent effects on any marine mammal species, so it is unlikely that the preferred alternative would have any adverse impacts on any marine mammal species.

9.7 Executive Order 13089

Executive Order 13089 on Coral Reef Protection directs federal agencies to use their authorities to protect coral reef ecosystems and, to the extent permitted by law, prohibits them from authorizing, funding or carrying out any action that will degrade these ecosystems.

Both of the alternatives considered in these amendments are consistent with the objectives and recommendations of this Executive Order for the following reasons. Some of the affected fisheries operate in, or in close proximity to, coral reef ecosystems, and all of them have the potential to affect coral reef ecosystems through ecosystem links. The preferred alternative would serve to facilitate the informed consideration of the impacts of potential management measures on fishing communities. The preferred alternative is not likely to result in any significant differences in type or intensity of fishing operations in or near coral reef ecosystems than under the no-action alternative. It is therefore unlikely to have the effect of degrading coral reef ecosystems.

9.8 Paperwork Reduction Act (PRA)

The purpose of the Paperwork Reduction Act of 1995 is to minimize the paperwork burden on the public. The Act requires federal agencies to ensure that information collected from the public is needed and is collected in an efficient manner (44 U.S.C. 3501 (1)). Neither of the alternatives considered in these amendments would impose new record keeping or reporting requirements on the public.

9.9 Traditional Indigenous Fishing Practices

The Magnuson-Stevens Act requires the Western Pacific Council to take into account traditional fishing practices in preparing any FMP or amendment. The new provisions in these amendments will not adversely affect traditional indigenous fishing practices in the western Pacific. Because indigenous people and groups are members of the fishing communities identified in the amendments and because the purpose of National Standard 8 is to provide for the sustained participation of fishing communities, these amendments are likely to help ensure the sustained participation of indigenous people and the continued use of traditional fishing practices in the four fisheries.

Section 305(i) of the Magnuson-Stevens Fishery Conservation and Management Act provides for the establishment of a Western Pacific Community Development Program for any fishery under the authority of the Council. This provision results from concern that communities consisting of descendants of indigenous peoples in the Council's area have not been appropriately sharing in the benefits from the area's fisheries. The Council and the Secretary, respectively, have discretion to develop and to approve programs for eligible communities for the purpose of enhancing access to the fisheries under the authority of the Council. The range of acceptable content of these programs will be determined by the Council and the Secretary working together through the FMP process.

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