I. PROBLEM STATEMENT AND NEED FOR ACTION

On December 4, 2000, President Clinton issued Executive Order (EO) 13178 establishing the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve (Reserve). President Clinton subsequently revised portions of EO 13178 and completed establishment of the Reserve in EO 13196. The Reserve is managed by the National Marine Sanctuary Program which is within the National Oceanic and Atmospheric Administration (NOAA). Pursuant to the EOs and the National Marine Sanctuaries Act (16 U.S.C. 1433, 1434), NOAA is initiating the process to designate the Reserve as a National Marine Sanctuary. The National Marine Sanctuaries Act (NMSA) delegates the development and recommendation of fishing regulations in sanctuaries to Regional Fishery Management Councils.

The Western Pacific Regional Fishery Management Council is now considering a range of alternatives for these fishing regulations. This document summarizes the alternatives currently under consideration, as well as describing the NWHI environment, and the anticipated impacts of the alternatives on fishery participants and support industries, Hawaii's broader communities, and the nation as a whole. This document is a summary of a comprehensive analytical document that is being prepared for review by the Council at its 126th meeting. At that public meeting (to be held March 14-17, 2005 in Honolulu, Hawaii) the Council is expected to review the full analysis, public comments, and other relevant information and to take final action to select a preferred alternative for fishery regulations for the proposed NWHI sanctuary. Notice of the Council's public hearings was provided through local newspapers, the Council's newsletter, a mass mailing of informational flyers, the Council's website and through other venues. Notice of the Council's 126th meeting and intent to take final action will be published in the Federal Register as well as local newspapers.

II. RESPONSIBLE AGENCIES

The Western Pacific Regional Fishery Management Council (Council or WPRFMC) was established by the Magnuson Fishery Conservation and Management Act of 1976 (Public Law 94-265; 16 U.C.S. 1801 *et. seq*.) to develop fishery management plans (FMPs) for fisheries operating in the U.S. Exclusive Economic Zone (EEZ) around American Samoa, Guam, Hawaii, the Commonwealth of the Northern Mariana Islands (CNMI) 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 U.S. Coast Guard in cooperation with state agencies.

[1] Howland, Baker, Wake and, Jarvis Islands, Kingman Reef and Johnston, Midway and Palmyra Atolls.

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III. ALTERNATIVES FOR FISHERY MANAGEMENT IN THE PROPOSED NWHI NATIONAL MARINE SANCTUARY

This section describes the alternatives currently being considered for NWHI fishery regulations. The seven alternatives represent an ongoing discussion concerning this issue and have been chosen to illustrate a wide spectrum of management alternatives ranging from doing nothing to closing virtually all NWHI fisheries.

Alternative 1A: FMP Status Quo (No Action A)

Under this alternative, NWHI federal fisheries would be conducted according to the existing management measures of the following Fishery Management Plans developed and implemented for the NWHI by the Western Pacific Regional Fishery Management Council and the National Marine Fisheries Service (NMFS). In general, these measures apply within federal waters 3-200 miles from shore, as waters 0-3 miles from shore are managed by the Fish and Wildlife Service and Hawaii's Department of Land and Natural Resources. Please see section 660 of Title 50 of the Code of Federal Regulations for a complete description of the following federal fishery regulations.

Bottomfish and Seamount Groundfish FMP

The NWHI bottomfish fishery is divided into two sections, the more northern Ho'omalu Zone and the southerly Mau Zone. Each zone is managed under a limited entry program with no more than 7 vessels allowed in the Ho'omalu Zone and no more than 10 allowed in the Mau Zone. Bottom trawling, nets, poison, explosives and other destructive gears are prohibited. Vessels can be no more than 60 ft in length and vessel captains must attend protected species workshops and carry federal observers if requested by NMFS. Fishing for armorhead is prohibited on the Hancock Seamount while stocks recover from the impacts of foreign fishing prior to the implementation of the Magnuson-Stevens Fishery Conservation and Management Act.

Crustaceans FMP

A similar limited entry program is in place for the NWHI lobster fishery, with no more than 15 vessels allowed in the NWHI. The fishery is further limited by an annual harvest guideline. Because the majority of fishing occurs around Necker Island, Maro Reef, and Gardner Pinnacles, this harvest guideline is divided into four fishing areas (the fourth is "all other areas"). No harvest guideline has been issued by NMFS for this fishery since 1999, due to uncertainties in the model results. This model calculates the exploitable biomass in each fishing area, managers then determine the annual harvest based on a given risk of overfishing ratio. Through 1999 this ratio indicated that an annual harvest of 13% of the exploitable population was associated with a 10% risk of overfishing, and these were the harvest and risk levels that were chosen. When the new model is released by NMFS it may contain a different risk ratio and managers may have to choose a new harvest level to maintain the 10% risk level. Fishery participants must use specified traps designed to allow small lobsters to escape, as well as to prevent monk seal entanglement. Federal observers are carried on every vessel and no lobster fishing is permitted within 20 miles of Laysan Island or within 10 fathoms of all other NWHI.

Precious Corals FMP

The precious corals FMP utilizes a combination of minimum sizes, quotas and other measures to manage potential NWHI harvests of these deep-water species (none have occurred since the Council began managing the fishery in 1983). There are several known beds of precious corals in the NWHI and the use of non-selective gear (such as dredges or tangle nets) is prohibited in all areas.

Coral Reef Ecosystems FMP

This FMP was developed to manage coral reef ecosystem associated species but was only partially implemented by NMFS. Those measures that would apply to the NWHI were disapproved as potentially in conflict with the NWHI Reserve established by President Clinton as a precursor to sanctuary designation.

Pelagics FMP

Longlining within 50 miles of the NWHI is prohibited but other types of pelagic fishing (trolling, handlining) are allowed. Drift gillnets and shark finning are prohibited.

Alternative 1B: Reserve Status Quo (No Action B)

Under this alternative, NWHI fisheries would be conducted according to the existing management measures of the above Fishery Management Plans as well as the following non-regulatory measures in place for waters between 3 and 50 miles from emergent NWHI lands which were established by Executive Order 13178 and subsequently amended by Executive Order 13196 as follow:

Executive Order 13178

Sec. 7. *Protection and Conservation Measures.* The conservation measures in this section apply

throughout the Reserve.
(a) (1) *Commercial Fishing.* All currently existing commercial Federal fishing permits and current levels of fishing effort and take, as determined by the Secretary and pursuant to regulations in effect on the date of this order, shall be capped as follows:
(A) No commercial fishing may occur in Reserve Preservation Areas pursuant to section 8 of this order;
(B) There shall be no increase in the number of permits of any particular type of fishing (such as for bottomfishing) beyond the number of permits of that type in effect the year preceding the date of this order;
(C) 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, as determined by the Secretary, provided that the Secretary shall equitably divide the aggregate level into individual levels per permit, and further provided that the Secretary may make a one-time reasonable increase to the total aggregate to allow for the use of two Native Hawaiian bottomfishing permits;
(D) There shall be no permits issued for any particular type of fishing for which there were no permits issued in the year preceding the date of this order; and
(E) The type of fishing gear used by any permit holder may not be changed except with the permission of the Secretary, as provided under paragraph 3 of this section.
(2) *Recreational Fishing.* All currently existing (preceding the date of this order) levels of recreational fishing effort, as determined by the Secretary and pursuant to regulations in effect on the day of this order, shall be capped (i.e., no increase of take levels or levels of fishing effort, species targeted, or change in gear types) throughout the Reserve. However, fishing is further restricted as provided in section 8 of this order.
(3) The Secretary, after consultation with the Secretary of the Interior and Governor of the State of Hawaii, and after public review and comment and consideration of any advice or recommendations of the Reserve Council and Western Pacific Regional Fishery Management Council, may further restrict the fishing activities under subparagraphs (a)(1) and (a)(2) of this section if necessary to protect Reserve resources, or may authorize or require alternate gear types if such gear would offer equal or greater protection for Reserve resources.
(b) In addition to the conservation measures in paragraph (a) of this section, the following activities are prohibited throughout the Reserve:
(1) Exploring for, developing, or producing oil, gas, or minerals;
(2) Having a vessel anchored on any living or dead coral with an anchor, an anchor chain, or an anchor rope when visibility is such that the seabed can be seen;
(3) Drilling into, dredging, or otherwise altering the seabed; or constructing, placing, or abandoning any structure, material, or other matter on the seabed, except as an incidental result of anchoring vessels;
(4) Discharging or depositing any material or other matter into the Reserve, or discharging or depositing any material or other matter outside the Reserve that subsequently enters the Reserve and injures any resource of the Reserve, except fish parts (i.e., chumming material or bait) used in and during authorized fishing operations, or discharges incidental to vessel use such as deck wash, approved marine sanitation device effluent, cooling water, and engine exhaust; and
(5) Removal, moving, taking, harvesting, or damaging any living or nonliving

Reserve resources, except as provided under paragraph (a) of this section and sections 8(a) and 9 of this order.

c) The Secretary may conduct, or authorize by permit the activities listed in subparagraphs (b)(3)-(5) of this section to the extent that they are necessary for research, monitoring, education, or management activities that further the Management Principles of section 4 of this order.

Sec. 8. *Reserve Preservation Areas.*

(a) To further protect Reserve resources, the following areas are hereby established as Reserve Preservation Areas until some or all are made permanent after adequate public review and comment, within which all activities referred to in paragraph (b) of this section are prohibited.

(1) From the seaward boundary of Hawaii State waters and submerged lands to a mean depth of 100 fathoms (fm) around:

(A) Nihoa Island, provided that bottomfishing in accordance with the requirements of section 7(a)(1) of this order shall be allowed to continue seaward of a mean depth of 10fm, unless and until the Secretary determines otherwise after adequate public review and comment;

(B) Necker Island, provided that bottomfishing in accordance with the requirements of section 7(a)(1) of this order shall be allowed to continue seaward of a mean depth of 20fm, unless and until the Secretary determines otherwise after adequate public review and comment;

(C) French Frigate Shoals;

(D) Gardner Pinnacles, provided that bottomfishing in accordance with the requirements of section 7(a)(1) of this order shall be allowed to continue seaward of a mean depth of 10fm, unless and until the Secretary determines otherwise after adequate public review and comment;

(E) Maro Reef, provided that bottomfishing in accordance with the requirements of section 7(a)(1) of this order shall be allowed to continue seaward of a mean depth of 20fm, unless and until the Secretary determines otherwise after adequate public review and comment;

(F) Laysan Island, provided that bottomfishing in accordance with the requirements of section 7(a)(1) of this order shall be allowed to continue seaward of a mean depth of 50fm, unless and until the Secretary determines otherwise after adequate public review and comment;

(G) Lisianski Island, provided that bottomfishing in accordance with the requirements of section 7(a)(1) of this order shall be allowed to continue seaward of a mean depth of 50fm, unless and until the Secretary determines otherwise after adequate public review and comment;

(H) Pearl and Hermes Atoll; and

(I) Kure Island.

(2) Twelve nautical miles around the approximate geographical centers of:

(A) The first bank immediately east of French Frigate Shoals;

(B) Southeast Brooks Bank, which is the first bank immediately west of French Frigate Shoals, provided that the closure area shall not be closer than approximately 3nm of the next bank immediately west;

(C) St. Rogatien Bank, provided that the closure area shall not be closer than approximately 3nm of the next bank immediately east, provided further that bottomfishing in accordance with the requirements of section 7(a)(1) of this order shall be allowed to continue, unless and until the Secretary determines otherwise after adequate public review and comment;

(D) The first bank west of St. Rogatien Bank, east of Gardner Pinnacles;

(E) Raita Bank; and

(F) Pioneer Bank, provided that bottomfishing in accordance with the requirements of section

7(a)(1) of this order shall be allowed to continue, unlessand until the Secretary determines otherwise after adequate public review and comment.
(b) Activities Prohibited Within Reserve Preservation Areas.
(1) In addition to the conservation measures in section 7 of this order, which are applicable to the entire Reserve, the following activities are prohibited within the Reserve Preservation Areas listed in paragraph (a) of this section, except as expressly otherwise stated in this paragraph and sections (8)(a) and 9 of this order:
(A) Commercial and recreational fishing;
(B) Anchoring in any area that contains available mooring buoys, or anchoring outside an available anchoring area when such area has been designated by the Secretary;
(C) Any type of touching or taking of living or dead coral;
(D) Discharging or depositing any material or other matter except cooling water or engine exhaust; and
(E) Such other activities that the Secretary identifies after adequate public review and comment, and after consideration of any advice and recommendations of the Reserve Council.
(2) Notwithstanding the prohibitions in this paragraph, the Secretary may conduct, or authorize by permit, research, monitoring, education, or management activities within any Reserve Preservation Area that further the Management Principles of section 4 of this order.
(3) The Reserve Preservation Areas in this section are approximated using fathoms. The Secretary will develop straight line boundaries based on longitude and latitude coordinates to encompass each Reserve Preservation Area, to provide for clarity and ease of identification. The Secretary may make technical modifications to any such boundaries.
Sec. 9. *Native Hawaiian Uses.* Native Hawaiian noncommercial subsistence, cultural, or religious uses may continue, to the extent consistent with existing law, within the Reserve and Reserve Preservation Areas identified under section 8 of this order. The Secretary shall work with Native Hawaiian interests to identify those areas where such Native Hawaiian uses of the Reserve's resources may be conducted without injury to the Reserve's coral reef ecosystem and related marine resources and species, and may revise the areas where such activities may occur after public review and comment, and consideration of any advice and recommendations of the Reserve Council.

Executive Order 13196
Sec. 3. *Amendments to Sections 7 of Executive Order 13178.*
1. Section 7(a)(1) of Executive Order 13178 is hereby amended by revising the first sentence to read as follows:
''Commercial Fishing. All currently existing commercial Federal fishing permits and current levels of fishing effort and take, which also includes the non-permitted level of trolling for pelagic species by currently permitted bottom fishers, as determined by the Secretary and pursuant to regulations in effect on December 4, 2000, shall be capped as follows:''
2. Section 7(a)(1)(C) of Executive Order 13178 is hereby revised to read as follows:
''(C) 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 as follows:
(1) Bottomfishing—the annual aggregate level for each permitted bottomfisher shall be that permittee's individual average taken over the 5 years preceding December 4, 2000, as

determined by the Secretary, provided that the Secretary, in furtherance of the principles of the reserve, may make a onetime reasonable increase to the total aggregate to allow for the use of two Native Hawaiian bottomfishing permits;
(2) All other commercial fishing—the annual aggregate level shall be the permittee's individual take in the year preceding December 4, 2000, as determined by the Secretary.''
3. A new section 7(a)(1)(F) is hereby added to Executive Order 13178 and reads as follows:
''(F) Trolling for pelagic species shall be capped based on reported landings for the year preceding December 4, 2000.''
4. Section 7(b)(4) is revised to read as follows:
''(4) Discharging or depositing any material or other matter into the Reserve, or discharging or depositing any material or other matter outside the Reserve that subsequently enters the Reserve and injures any resource of the Reserve, except:
(A) fish parts (i.e., chumming materia or bait) used in and during fishing operations authorized under this order;
(B) biodegradable effluent incident to vessel use and generated by a marine sanitation device in accordance with section 312 of the Federal Water Pollution Control Act, as amended;
(C) water generated by routine vessel operations (e.g., deck wash down and graywater as defined in section 312 of the Federal Water Pollution Control Act), excluding oily wastes from bilge pumping; or (D) cooling water from vessels or engine exhaust; and''.
Sec. 4. *Amendments to Sections 8 of Executive Order 13178.*
1. Section 8 of Executive Order 13178 is modified by substituting ''provided that commercial bottomfishing and commercial and recreational trolling for pelagic species in accordance with the requirements of sections 7(a)(1) and 7(a)(2) of this order, respectively,'' for ''provided that bottomfishing in accordance with the requirements of section 7(a)(1)'' everywhere the latter phrase appears in section 8.
2. Section 8(a)(1)(A) is modified by substituting ''a mean depth of 25 fm'' for ''a mean depth of 10fm.''
3. Section 8(a)(1)(B) is modified by substituting ''a mean depth of 25 fm''for ''a mean depth of 20fm.''
4. Section 8(a)(1)(D) is modified by substituting ''a mean depth of 25 fm'' for ''a mean depth of 10fm.''
5. Section 8(a)(1)(E) is modified by substituting ''a mean depth of 25 fm'' for ''a mean depth of 20fm.''
6. Section 8(a)(1)(G) is modified by substituting ''a mean depth of 25 fm'' for ''a mean depth of 50fm.''
7. Section 8(a)(1)(I) is revised to read ''Kure Atoll.''
8. Sections 8(a)(2)(D) and (E) are hereby deleted and a new section 8(a)(3) is hereby substituted as follows:
''(3) Twelve nautical miles around the approximate geographical centers of
(A) The first bank west of St. Rogation Bank, east of Gardner Pinnacles, provided that commercial bottomfishing and commercial and recreational trolling for pelagic species in accordance with the requirements of sections 7(a)(1) and 7(a)(2) of this order, shall be allowed to continue for a period of 5 years from the date of this order; and
(B) Raita Bank, provided that commercial bottomfishing and commercial and recreational

trolling for pelagic species in accordance with the requirements of sections 7(a)(1) and 7(a)(2) of this order, shall be allowed to continue for a period of 5 years from the date of this order; and (C) Provided that both banks described above in (3)(A) and (3)(B) shall only continue to allow commercial bottomfishing and commercial and recreational trolling for pelagic species after the 5-year time period if it is determined that continuation of such activities will have no adverse impact on the resources of these banks.''

Alternative 2: Council Recommendations to Date

Under this alternative, NWHI fisheries would be subject to the regulatory measures now in place under the Council's FMPs, as modified by the following additional measures that have been recommended by the Council but not processed or implemented by NMFS:

Bottomfish FMP

A) Modify current NWHI limited entry permit renewal requirements by suspending the use-or-lose permit renewal landing requirements effective December 4, 2000;
B) Establish a procedure for issuance of new Mau Zone limited access permits based on historical participation in the NWHI and MHI bottomfish fisheries;
C) Reserve two or more NWHI limited entry permits for members of a Western Pacific Community Development Program.
D) Establish no-take marine protected areas out to 10 fm around all NWHI and out to 50 fm around Laysan Island, French Frigate Shoals, and the northern half of Midway.

Precious Corals FMP

A) Revise the boundaries of Brooks Bank;
B) At Brooks Bank, revise harvest quota for pink coral to 200 kg and suspend the harvest quota for gold coral;
C) Classify FFS-Gold Pinnacles Bed as Conditional Bed, prohibit harvest of all precious corals in bed;
D) Remove 1,000 kg quota for Exploratory Areas;
E) Prohibit harvest of more than 1,000 kg at any one permit area;
F) Prohibit repeat harvesting of a site in subsequent permit years until upgraded to Conditional Bed;
G) If using one submersible, harvest can only be every second legal coral tree. If using two submersibles, harvest can only be every third legal coral tree. Video and audio records and mothership bridge records must be submitted;
H) Prohibit harvest of more than 1,000 kg of gold coral in a permit year in an Exploratory Area;
I) Establish minimum harvest size for gold coral at 1.5 inches base diameter and height between 4 and 6 ft;
J) Prohibit harvest of gold coral in NWHI;
K)Prohibit harvest within one bed diameter of one known bed.;
L) Require observers (if requested by NMFS and in consultation with the Council);
M) Establish a series of no-take MPAs around NWHI (10 fm all NWHI, 50 fm Laysan, French

Frigate Shoals, and northern half of Midway);
N) Establish a NWHI precious corals mega-refugia (see Figure 1)

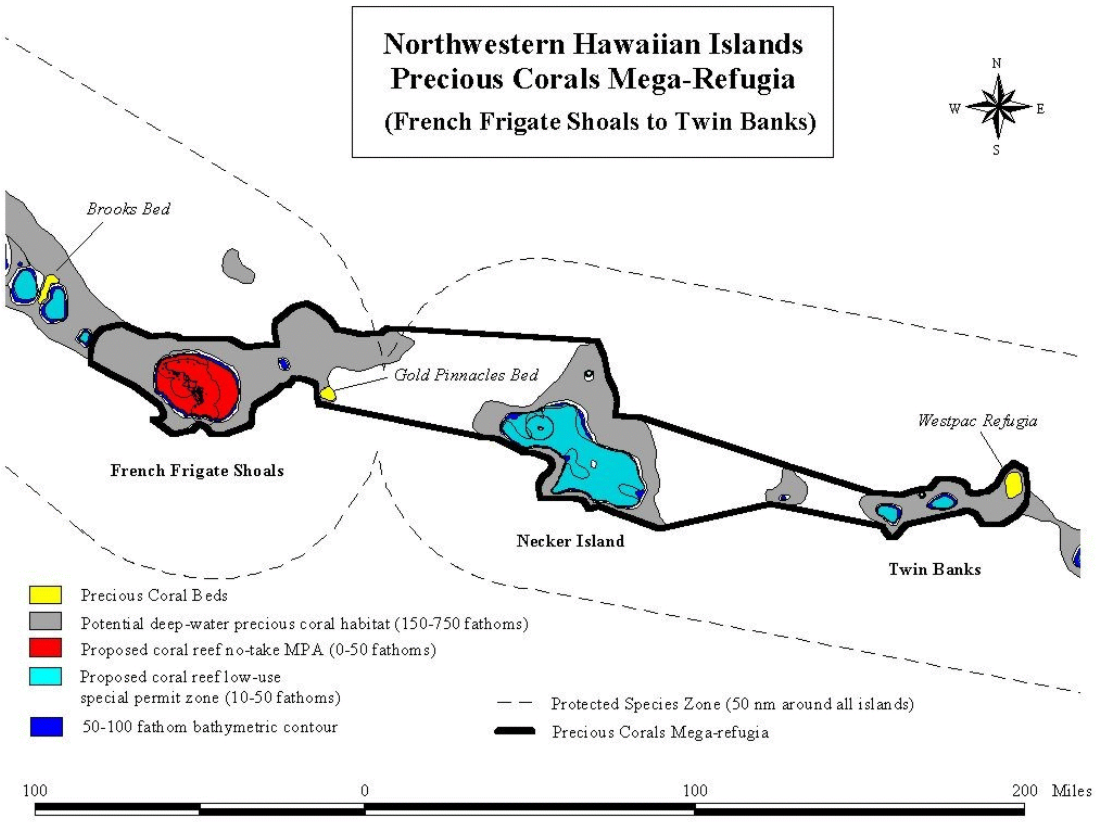


Figure 1. Proposed NWHI Precious Corals Mega Refugia

Crustaceans, Coral Reef Ecosystems and Pelagics FMPs

A) Implement No-take MPAs in federal waters within the 10 fm contour around all NWHI with the exception of Laysan, French Frigate Shoals, and the northern half of Midway where No-take MPAs would be established within the 50 fm contour.

B) Implement Low-use MPAs in federal waters within the 50 fm contour around all NWHI (except where No-take MPAs exist). Any fishing for coral reef ecosystem associated species within this area would require a special permit issued by NMFS on a case-by-case basis

Alternative 3: Precautionary Modification 1

Under this alternative, NWHI fisheries would be subject to the regulatory measures now in place under the Council's FMPs as modified by the measures described in Alternative 2, plus the implementation of two additional no-take MPAs in federal waters as illustrated in Figure 2. No fishing of any type would be allowed within these areas.

Alternative 4: Precautionary Modification 2

Under this alternative, NWHI fisheries would be subject to the regulatory measures now in place under the Council's FMPs as modified by the measures described in Alternative 2, plus the implementation of two additional no-take MPAs in federal waters as illustrated in Figure 3. No fishing of any type would be allowed within these areas.

Alternative 5: National Marine Sanctuary Program Recommendation

Under this alternative, NWHI fisheries would be subject to the regulatory measures now in place under the Council's FMPs, as modified by the following NMSP recommendations.

The proposed sanctuary shall include submerged lands and waters of the NWHI, extending approximately 1,200 nautical miles (nm) long and 100 nm wide. The outer boundary of the Reserve would be expanded at the most northwestern extent (northwest of Kure Atoll) to include newly identified precious coral beds and monk seal foraging areas. This alternative prohibits precious coral and crustacean harvest, and pelagic longlining, but provides for limited commercial bottomfish/pelagic trolling, commercial pelagic trolling, various forms of recreational fishing, and limited Native Hawaiian cultural and subsistence uses through a permitting process. However, none of these uses could be conducted without establishing a plan to determine the ecosystem-related impacts of the fishing activities and how to avoid them. This alternative would require the development of a task force consisting of representatives from partner agencies and relevant institutions to work together to establish appropriate ecological benchmarks to measure the impact of fishing on the ecosystems of the NWHI. The task force would develop an annual aggregate level of harvest not to exceed catch levels for commercial bottomfish/pelagic trolling and commercial pelagic trolling based on recorded landings for each fisherman operating from December 4, 1999 to December 4, 2000. During the time between sanctuary designation and the implementation of new fishery management measures based on ecological benchmarks, the sanctuary would manage fishing activities based on species specific individual fishing caps.

In addition to fishing caps, this alternative includes two Ecological Reserves (ER) and several Sanctuary Preservation Areas (SPA). One of the ERs would be established west of longitude 173.5˚ W, to include the area surrounding Lisianski Island and extending northwest throughout the remainder of the proposed sanctuary to 179.7˚ W longitude. The other ER would bracket French Frigate Shoals between longitude 165˚ and 167.5˚ W. All commercial fishing would be prohibited within the ERs. However, limited amounts of certain types of recreational and/or sustenance fishing would be allowed in each. All commercial, recreational, and sustenance fishing would be prohibited inside an SPA with the exception of the SPA located around Midway Atoll pursuant to Midway National Wildlife Refuge regulations. Sustenance fishing would be allowed by permit outside of the SPAs. The SPAs would extend out to 75 fathoms around Lisianski and Laysan Islands, and Maro Reef, and out to 100 fathoms around Kure and Pearl and Hermes Atolls. In addition, SPAs would be created out to 3 miles around Gardner Pinnacles, Midway Atoll, Necker Island, and Nihoa Island, and out to 12 miles around French Frigate Shoals and surrounding banks from the unnamed bank northwest of St.Rogatien Bank to French Frigate Shoals and the unnamed bank northeast of French Frigate Shoals. All of the SPAs would include state waters (see Figure 4).

Figure 2. Map of Alternative 3 (Precautionary Modification 1)

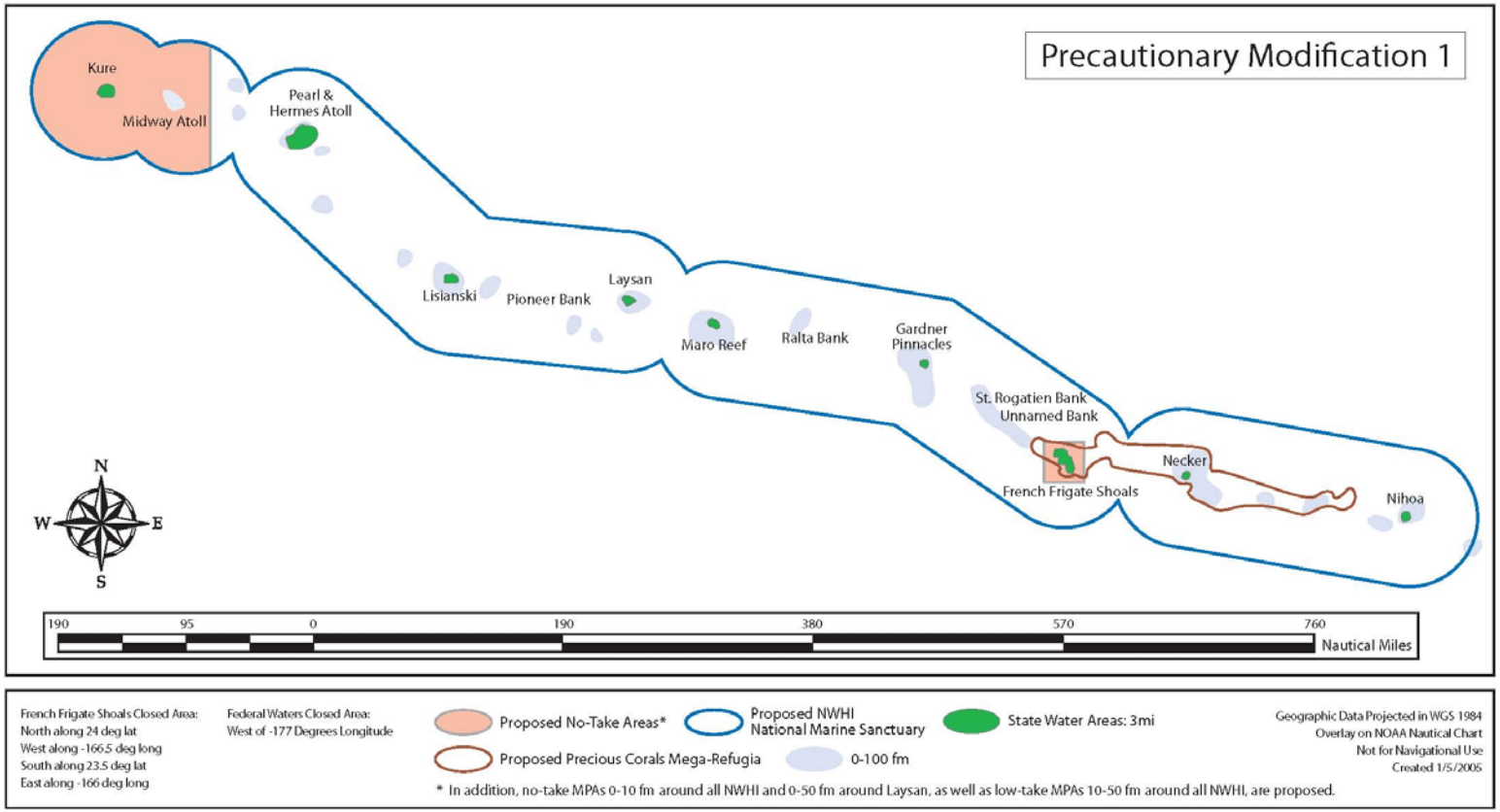


Figure 3. Map of Alternative 4 (Precautionary Modification 2)

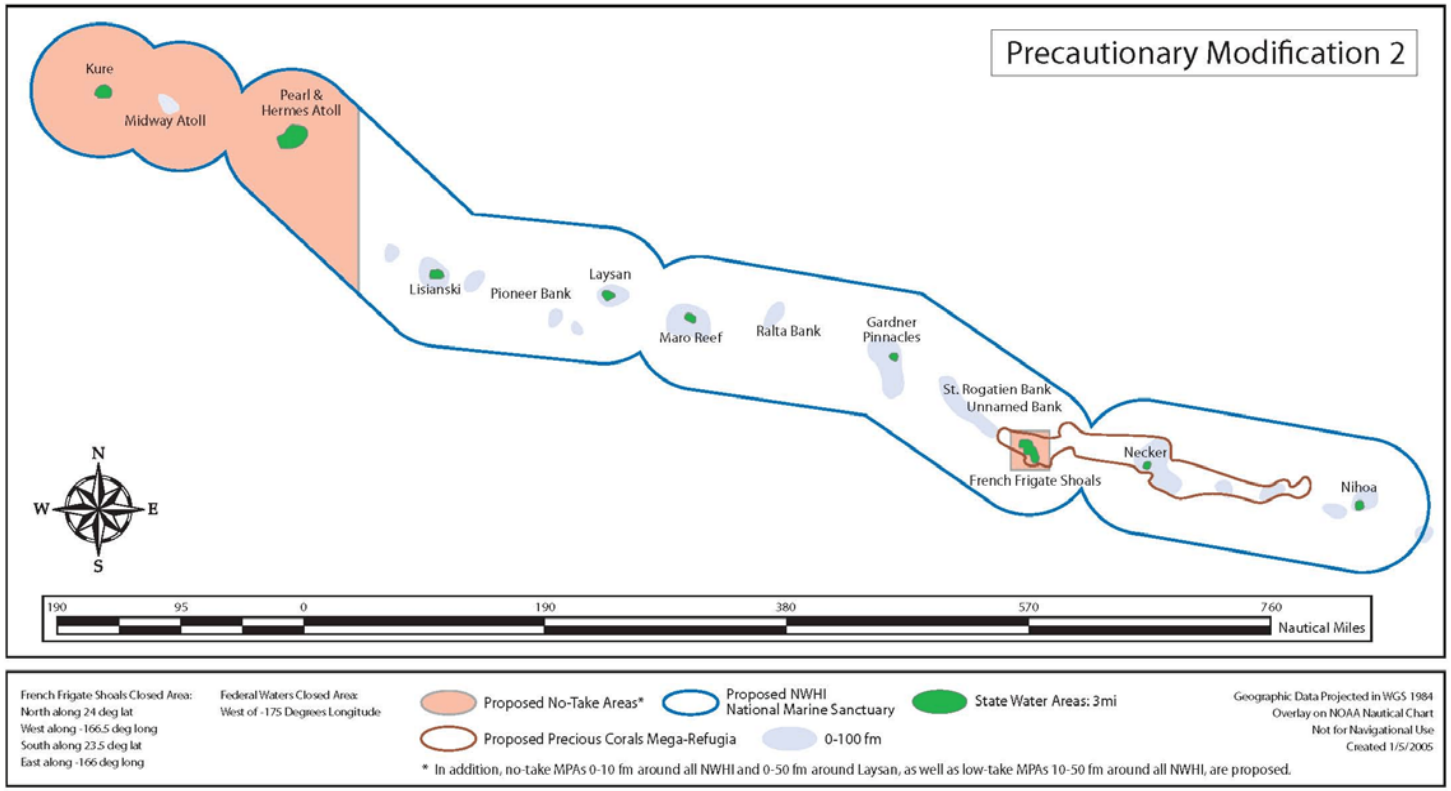
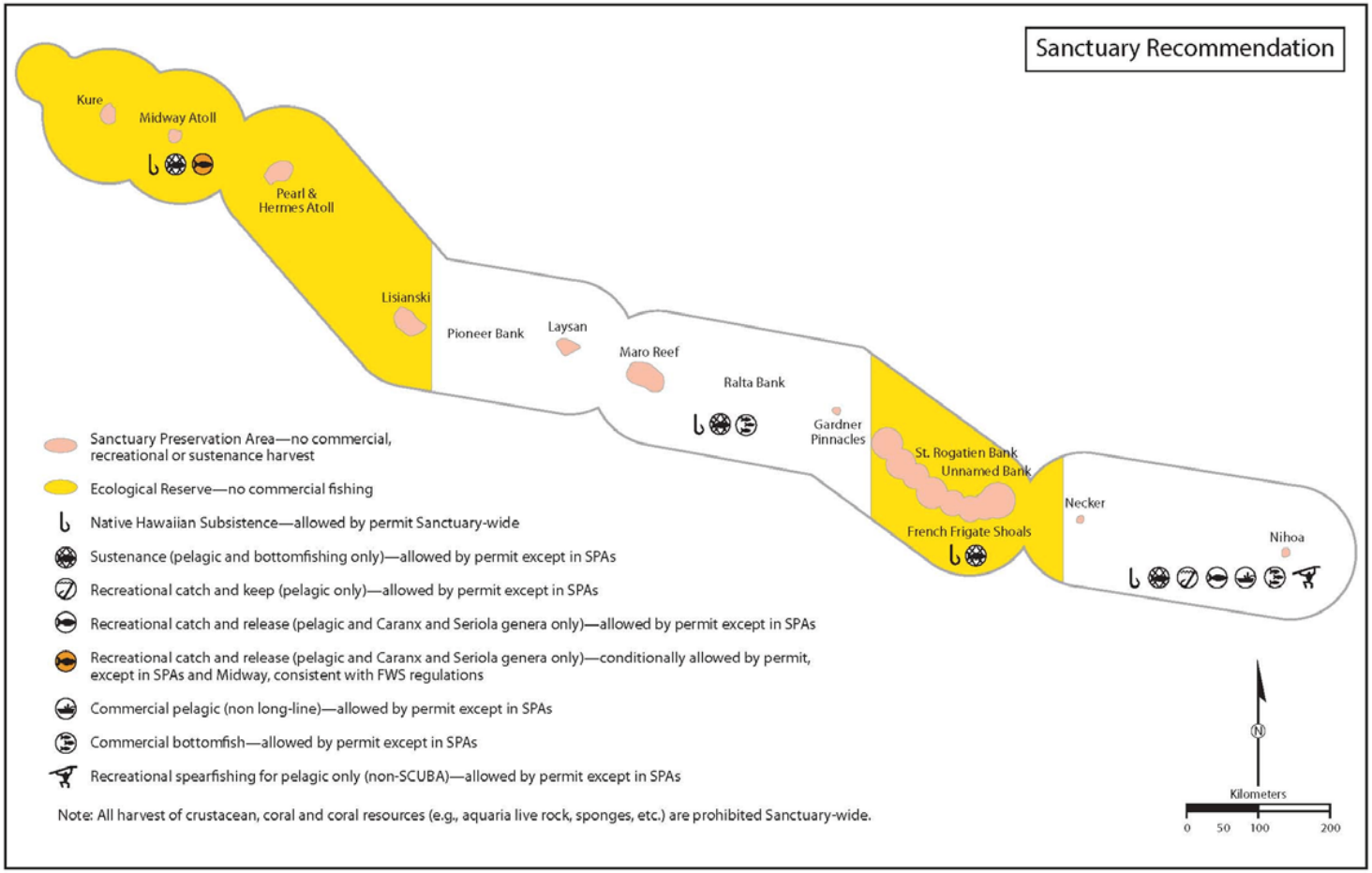


Figure 4. Map of Alternative 5 (NMSP Recommendation)



Alternative 6: Close all Federal Waters to Bottomfishing

Under this alternative, NWHI fisheries would be subject to the regulatory measures now in place under the Council's FMPs as modified by the measures described in Alternative 2, plus a prohibition on any targeting of bottomfish or seamount groundfish in federal waters around the Northwestern and Main Hawaiian Islands (MHI).

These alternatives are summarized in Table 1.

Table 1. Summary of Alternatives Currently Being Considered

FMP	Alternative 1A FMP Status Quo	Alternative 1B Reserve Status Quo	Alternative 2 Council Recommend-ations to Date	Alternative 3 Precautionary Modification 1 (less restrictive)	Alternative 4 Precautionary Modification 2 (more restrictive)	Alternative 5 NMSP Recommend-ation	Alternative 6 Prohibit all Bottomfishing
Bottomfish	Limited entry, maximum vessel sizes etc.	FMP plus: sanctuary preservation area closures, caps	FMP plus: Suspend use/lose Allow MZ entry No-take/Low-use MPAs	FMP plus: Suspend use/lose Allow MZ entry No-take/Low-use MPAs New No-take MPAs	FMP plus: Suspend use/lose Allow MZ entry No-take/Low-use MPAs New No-take MPAs	FMP plus: Caps w/ratios Ecological and sanctuary preservation area closures	Close fishery
Crustaceans	LE, harvest guidelines, etc.	Close fishery	FMP when science allows FMP plus: No-take/Low-use MPAs	FMP when science allows plus: No-take/Low-use MPAs New No-take MPAs	FMP when science allows plus: No-take/Low-use MPAs New No-take MPAs	Close fishery	FMP when science allows FMP plus: No-take/Low-use MPAs
Precious Corals	Bed, size quotas etc.	Close fishery	FMP plus: Mega-refugia, no gold etc No-take/Low-use MPAs	FMP plus: Mega-refugia, no gold etc., No-take/Low-use MPAs New No-take MPAs	FMP plus: Mega-refugia, no gold etc., No-take/Low-use MPAs New No-take MPAs	Close fishery	FMP plus: Mega-refugia, no gold etc No-take/Low-use MPAs
Coral Reef Ecosystems	None	Close fishery	FMP:No-take/Low-use MPAs etc.	FMP: No-take/Low-use MPAs etc. New No-take MPAs	FMP: No-take/Low-use MPAs, etc. New No-take MPAs	Close fishery	FMP: No-take/Low-use MPAs etc.
Pelagics	Protected species zone	Some fishing, sanctuary preservation area closures	FMP plus: Low use/no take MPAs	FMP plus: No-take/Low-use MPAs, etc. New No-take MPAs	FMP plus: No-take/Low-use MPAs, etc. New No-take MPAs	Some fishing, sanctuary preservation area closures	FMP plus: No-take/Low-use MPAs

IV. AFFECTED ENVIRONMENT

This section describes components of the environment related to marine resources found in the NWHI. Where possible, trends in the condition of resources, ecosystems and human communities have been identified. This information provides the baseline and historical context needed to evaluate potential environmental consequences of each of the alternatives considered in this analysis.

Oceanographic Environment

In the central North Pacific Ocean, roughly 2,500 miles southwest of North America, lies the Hawaiian Archipelago. This 137-island chain stretches 1,523 miles from Kure Atoll in the northwest to the island of Hawaii in the southwest. The archipelago's position in the Pacific Ocean means its within the North Pacific subtropical current (rotating clockwise). The general result is that the MHI experience weak mean currents flowing from east to west, while the NWHI are subject to a weak mean current flowing from west to east. Imbedded in these mean flows are an abundance of mesoscale eddies created from a mixture of wind, current, and sea floor interactions. The eddies, which can rotate either clockwise or counter clockwise, have important biological impacts. For example, eddies create vertical fluxes, with regions of divergence (upwelling) where the thermocline shoals and deep nutrients are pumped into surface waters enhancing phytoplankton production, and also regions of convergence (downwelling) where the thermocline deepens. Sea surface temperatures around the Hawaiian Archipelago experience seasonal variability, but generally vary between 18°-26° C (68°-78° F) with the colder waters occurring more often in the NWHI.

The Hawaiian Archipelago is subject to large storms and high wave energy produced from weather systems generated off the Aluetian Islands and other areas of the North Pacific. Such storms and waves can have a major affect on the nearshore environment. For example, a major storm in the NWHI can break off pieces of corasl, move underwater boulders, shift sands around, and erode islands. Such large perturbations in the shallow benthic habitat that result from the action of winter storms and swells are common in the NWHI.

Also due the their position in the North Pacific, the NWHI act as a sink for a multitude of marine debris originating from Pacific-rim countries. Perhaps the most damaging type of this debris is in the form of derelict fishing gear such as nets and rope that are carried by ocean currents from North Pacific trawl fisheries. Other types of debris include materials made from rubber and plastics (e.g. lighters). Marine debris can also impact the nearshore environment of the NWHI. It can choke and break coral reefs, entangle marine life, and act as vector for invasive species. Since 1998, NMFS has led a multi-agency cleanup effort to remove derelict fishing nets and other debris from the NWHI. In recently years, the effort has removed over 100 tons of marine debris per year. The amount of marine debris accumulating each year in NWHI is unknown, but is thought to be substantial.

Description of NWHI Stocks

The following is a general description of the life history, distribution, and habitat characteristics of managed stocks in the NWHI.

Bottomfish and Seamount Groundfish Stocks

Hawaii's bottomfish fisheries target an assemblage of species from the taxonomic groups Lutjanidae (Snappers), Serranidae (Groupers), Carangidae (Jacks), and Lethrinidae (Emperors). The seamount groundfish fishery (inactive) targeted the armorhead *(Pseudopentaceros richardsoni*) and the alfonsin (*Beryx splendens*).

Life History, Habitat and Distribution

For many deepwater bottomfish species, spawning generally occurs over a protracted period, and peaks from July to September. The eggs hatch in 3 to 4 days, and the planktonic larval phase is thought to last at least 25 days (Leis 1987). Research indicates that larval exchange may occur throughout the Hawaiian archipelago, but conclusive data is lacking. Preliminary genetic work corroborates the notion of single archipelago-wide stocks of bottomfish.

Little is known of the life history of the juvenile fish after settling out of the plankton, but most likely juveniles utilize nursery grounds well away from the adult habitat (Parrish 1989). Most of the target species have a relatively high age at maturity, long life span, and slow growth rate.

Generally, deepwater bottomfish inhabit the deep slopes of island coasts and banks at depths of 100 to 400 m.[2] Throughout their spatial and depth range, deepwater snappers are typically distributed in a clumped pattern, and are often associated with underwater headlands and areas of high relief. Although deepwater snappers are generally thought of as top level carnivores, several snapper species in the Pacific are known to incorporate significant amounts of zooplankton in their diets (Haight et al. 1993a).

Status of the Stocks

The Bottomfish and Seamount Groundfish FMP established a 20% spawning potential ratio (SPR) as the critical threshold that defines recruitment overfishing. SPR is the ratio of the equilibrium spawning biomass per recruit for a given value of fishing mortality to the equilibrium of spawning biomass per recruit in the absence of fishing. Under the FMP, an SPR value under 20% indicates that a particular stock is likely to be experiencing overfishing and therefore in jeopardy of being overfished. For the species for which values can be calculated (*ehu, onaga, hapu`upu`u, opakapaka, uku*) 2003 SPR values range from a low of 31% for *onaga* to a high of 50% for *hapuupuu* when viewed on an archipelago-wide basis (Figure 5).

[2] *Uku* is a targeted BMUS, often caught at shallower depths than deepwater snappers using trolling methods rather than bottomfish fishing gear.

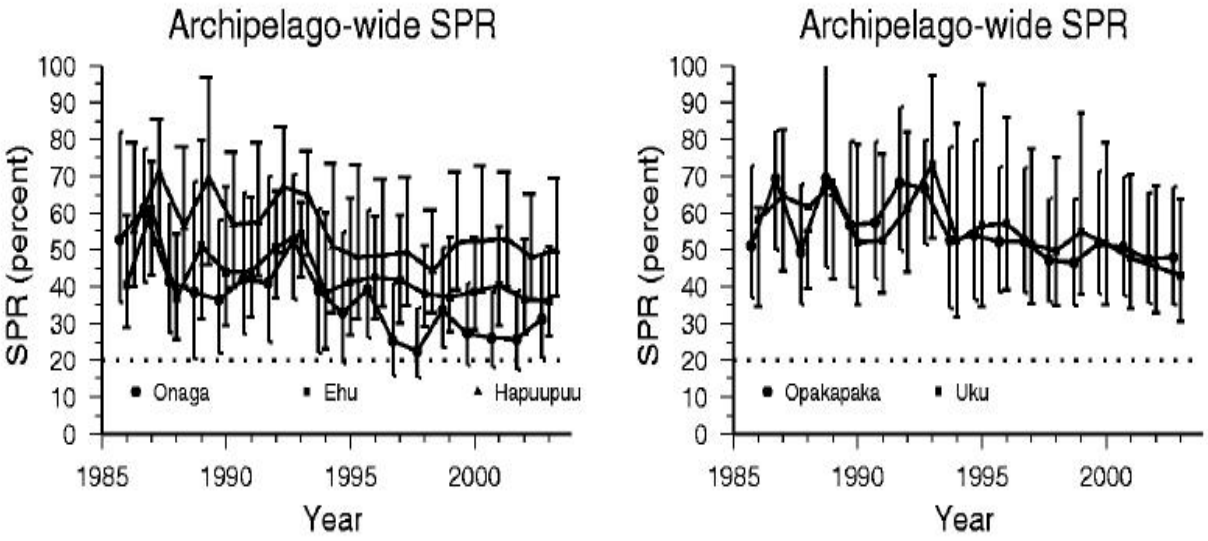


Figure 5. Archipelago-wide SPR values for targeted bottomfish species
(Source: WPFMC 2004)

On a archipelagic basis, targeted bottomfish stocks are generally healthy. However, MHI bottomfish stocks are showing signs of stress and overfishing. In the MHI, targeted bottomfish species are showing a yellow light condition due to a drop in CPUE below 50% of original values. 2003 SPR values for *onaga* and *opakapaka* in the MHI are 9% and 21%, respectively. 2003 SPR values for *Hapuupuu* is 29%, and 26% for both *ehu* and *uku*.

Bottomfish resources in the NWHI remain relatively healthy. 2003 CPUE on a per trip basis increased 46.2% from 2002 in the Mau Zone and dropped 19.9% in the Hoomalu zone. On a per day basis, CPUE values are up 16% in the Mau zone and up 18.9% in the Hoomalu. Analysis of SPR and percent immature in the catch show no localized depletion problems to date for any BMUS species in either zone of the NWHI.

Armorhead stocks outside of the US EEZ experienced a short pulse in recruitment in 1992 which did not carry over into 1993. The 1993 SPR values at Southeast Hancock Seamount are the highest recorded since 1986, but at 2.5%, they still indicate a collapsed fishery, a result of foreign fishing prior to management by the Council.

Crustacean Stocks

The crustacean fisheries Hawaii primarily target lobster species of the taxonomic groups Palinuridae (spiny lobster) and Scyllaridae (slipper lobster). The majority of the lobster catch in the 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.

Life History, Habitat, and Distribution

The spawning period of *P. marginatus* in the NWHI extends over a broad period from early spring to late summer. Ovigerous females are found predominantly in the northern portion of the NWHI during early summer and in the central portion during late summer. But in the MHI around O‘ahu, spawning occurs throughout the year, peaking during May-August . The eggs are carried externally and hatch after 30-40 days. Fecundity is positively correlated with body size, and it is estimated that the largest ovigerous females can carry over 1 million eggs (Honda 1984). After hatching, the larvae (phyllosoma) are planktonic for up to 12 months (Polovina and Moffitt 1995) undergoing metamorphosis through 11 discrete larval stages (Johnson 1968).

Female lobsters of the genus Scyllarides have never been observed with spermatophora similar to those found in Panulirus, suggesting fertilization may be internal. Of 1,090 slipper lobster females collected during the NWHI lobster surveys, none had a spermatophoric mass although 33% were ovigerous (Uchida and Uchiyama 1986). Research at PIFSC on reproduction in NWHI lobsters has focused primarily on spiny lobster; therefore, reproduction parameters for Sycllarides spp. in the NWHI are not well known. Analysis of recent research survey data indicates ovigerous female *S. squammosus* are found during the months of March through September. Peak spawning appears to occur from April to June (Haight unpubl. data).

Adult and juvenile Hawaiian spiny lobster occur throughout the NWHI from Nihoa Island to Kure Atoll at depths of 4-174 m .Slipper lobsters are also found throughout the NWHI at depths of 13-137 m (Uchida and Uchiyama 1986). In Hawaii, adult spiny and slipper lobsters are typically found on rocky substrates and coral reefs, and in well-protected areas such as crevices and depressions.

Within the Hawaiian Archipelago, lobster abundance, size, and species ratio varies widely between 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. Because adult lobster are benthic and the islands and banks in the archipelago are separated by water depths of over 1000 m, each individual sub-population of lobster is effectively isolated from the sub-populations at other banks and islands in the Hawaiian Archipelago. The total lobster population in the archipelago therefore exists as a series of isolated spawning populations which all contribute to the total larval pool. The function of each island or bank as a source or sink for population production is an important factor in the

understanding of the dynamics of the population as a whole. Unfortunately, these aspects of lobster population biology are not well known.

Status of the Stocks

The Crustaceans FMP also defines overfishing using SPR values and the 20% critical threshold. In 1997, when the last SPR values were calculated for this fishery, the SPR values were 74 %, well above the 0.20 overfished threshold. However, the productivity of lobster stocks appears to have substantially decreased from the level when the fishery began. For example, NMFS research surveys at Necker Island indicate more than 80% drop in mature spiny lobster CPUE, from 4.2 to 0.5 between 1988 and 1999. Changes in environmental conditions compounded by fishery harvest are believed to have contributed to this decline. Since 2000, NMFS has closed the NWHI commercial lobster fishery as a precautionary measure in response to data suggesting low recruitment in the fishery.

Precious Coral Stocks

Precious corals found in the Hawaiian Archipelago include pink corals (*Corallium spp.)*, bamboo corals (*Narella spp.*,), gold corals (*Lepidisis spp.*), and black corals *(Antipathes spp.*).

Life History, Habitat, and Distribution

Precious corals are generally slow growing and are characterized by low rates of mortality and recruitment. In general, 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 the water column. Because precious corals are filter feeders, most species thrive in areas swept by strong to moderate currents. Although precious corals are known to grow on a variety of hard substrate, they are most abundant on substrates of shell sandstone, limestone, or basaltic rock with a limestone veneer.

To date, beds of pink, gold and/or bamboo corals have been found eight locations in the EEZ around Hawai‘i. 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 O‘ahu. There are also three known major black coral beds in the archipelago, in addition to several minor beds. Most of these are located in Hawai‘i’s state waters (0-3 nm). However the largest (the Au‘au Channel Bed) extends into federal waters of the EEZ (Figure 6).

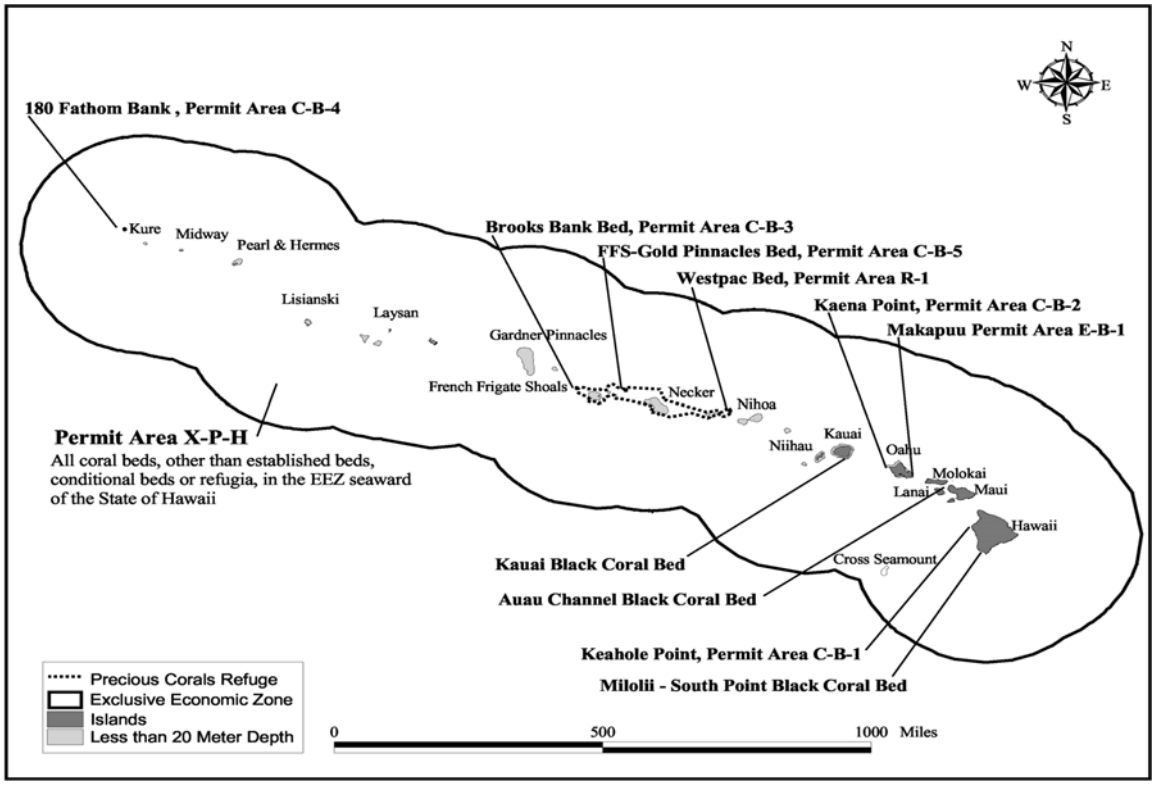


Figure 6. Hawaii's Known Precious Coral Beds

Status of the Stocks

Within the EEZ, Makapu‘u Bed has experienced the greatest level of legal exploitation and scientific research and thus is the source of much of the available information about the region's precious corals. Between 1973 and 1978, a manned submersible was used to harvest 5,953 kg of pink coral and 2,097 kg of gold coral from the Makapu‘u Bed. A survey of the bed in 1997 showed that the recovery of pink coral has increased from 74% of the virgin biomass in 1978, to 90% in 1997. This finding supports the supposition that recruitment of pink coral is unaffected

by harvesting and independent of the density of the standing stock. The survey also found that gold coral stocks at the Makapu‘u Bed may have experienced little or no recruitment. During the 1997 survey only two or three colonies of gold coral were observed. It is uncertain, however, if the current scarcity of gold coral colonies at the bed was caused by the 1973-1978 harvests.

Since 1980, virtually all of the black coral harvested around the Hawaiian Islands has been taken from the Au‘au Channel Bed. According to a 1998 assessment of the Au‘au Channel Bed, the age frequency distributions of sample populations in 1975 and 1998 are very similar (Grigg 1998a). This suggests that harvesting during the intervening years has had no significant effect on recruitment. However, the population may be facing pressure from a source other than direct harvest. The recent discovery (2001) of an invasive non-native soft coral (*Carijoa riisei* or snowflake coral) in the Au’au Channel Bed may potentially effect black coral recruitment in the area. Snowflake coral has been observed smothering, killing, and competing for space with 70% black corals at depth of 70-110 m in the Au’au Channel (HURL 2004). Most black coral is harvested at depths of 70 m or less as this is the limit of SCUBA gear.

Coral Reef Ecosystem Associated Stocks

Coral reef ecosystems are arguably the oldest and most diverse and complex ecosystems on earth. Coral reefs are carbonate rock structures at or near sea level that support populations of scleractinian or reef-building corals. The symbiotic relationship between the animal coral polyps and algal cells known as zooxanthellae is a key feature of reef building corals. Incorporated into the coral tissue, these photosynthesizing zooxanthellae provide much of the polyp’s nutritional needs, primarily in the form of carbohydrates.

NWHI Coral Reef Communities

The structure of reef communities is usually defined in terms of the diversity and relative abundances of species characteristic of a habitat type. Commonly, only a few species compose over half the abundance, while hundreds of others are present in low numbers. Coral species richness tends to be higher in the NWHI, where the genus *Acropora*, not found in the MHI, is present. A peak in coral species diversity occurs in the middle of the Hawaiian Archipelago at FFS and Maro Reef (Grigg 1983). Many reefs in the NWHI are comprised of calcareous algae (Green 1997). In general, fish species diversity appears to be lower in the NWHI than in the MHI. Although the inshore fish assemblages of the two regions are similar, fish size, density and biomass is higher in the NWHI. Fish communities in the NWHI are dominated by apex predators (sharks and jacks), whereas those in the MHI are not (Friedlander and DeMartini 2002). Some fish species are common in parts of the NWHI that are rare elsewhere in the archipelago (Green 1997).

Life History, Habitat, and Distribution

The life of a coral reef fish includes several stages. Typically, spawning occurs in the vicinity of the reef and is characterized by frequent repetition throughout a protracted time of the year, a diverse array of behavioral patterns, and extremely high fecundity. The eggs of many species are

fertilized externally and dispersed directly into the pelagic environment as plankton. Recruitment of coral reef species is limited by high mortality of eggs and larvae, and also by competition for space to settle out on coral reefs. It appears that many tropical reef fishes grow rapidly to near-adult size, and then often grow relatively little over a protracted adult life span; they are thus relatively long-lived and can reproduce for many years.

Reefs are typically patchworks of hard and sediment bottoms. A reef provides a variety of environmental niches, or combination of resources. The wide variety of survival strategies employed by coral reef organisms allows different species to exploit some combination of resources better than their competitors. The ecosystem is dynamic, however. If conditions change, a very specialized species may not be able to survive the rigors of the new environment or may be forced out by another species more adept at using the available resources, including space, food, light, water motion, and temperature.

Status of the Stocks

Based on information gathered from recent research surveys, the NWHI coral reef ecosystem and fishery stocks have been declared pristine . Commercial fishing for coral reef species has not occurred since the 1940's (ulua fishery), and recreational fishing has occurred on a limited basis on Midway. Overall, the coral reef fishery stocks in the NWHI are in a healthy condition, but likely experience variation in relative abundance and production due inter-annual and long-term ecostysem variability.

Pelagic Stocks

Fishing for pelagic species within proposed NWHI namational marine sancutary boundary is done primarily by bottomfish limited-entry permit holders trolling to and from bottomfish grounds. Typically, ahi, mahi mahi, and ono are targeted. In the southern end of the NWHI, a small-scale tuna handline fishery based out of Kauai also exists. Regulations promulgated under the Pelagics FMP prohibit Hawaii-based longline vessels from fishing within 50 nm of the NWHI. The extent of recreational or subsistence pelagic fishing is unknown, but is thought to be minimal.

Life History, Habitat, and Distribution

A general characteristic of all tuna other targeted pelagic fish is high fecundity, with females spawning several million eggs per year. All of the major market species of tuna spawn in warm waters. Tropical tuna species spawn over wide areas, whereas bluefin have discrete spawning grounds in one or two relatively restricted areas. Age and size at first maturity are variable, from 1.5 years (45 cm) for skipjack to 12 years (147 cm) for southern bluefin. Billfish spawning generally occurs in warm tropical and subtropical waters throughout the year, with some seasonally at higher latitudes (FAO, 2001).

For tropical tuna species, the absolute levels of recruitment tend to be high, with relatively low variability among years (e.g., in a 3:1 ratio between the highest and lowest recruitments). For

the temperate tuna species, the absolute recruitment levels tend to be lower. Long-term changes, such as cyclical (decadal) fluctuations and semi-cyclical (El Nino Southern Oscillation events), due to environmental effects, have been often shown to influence the recruitment of both tropical and temperature tuna species (FAO, 2001).

Adult skipjack and yellowfin tuna, and blue marlin prefer warm surface layers, where the water is well mixed by surface winds and is relatively uniform in temperature and salinity. Other fish such as albacore, bigeye tuna, striped marlin and swordfish, prefer cooler, more temperate waters, often meaning higher latitudes or greater depths.

Large-scale oceanographic events (such as *El Niño*) change the characteristics of water temperature and productivity across the Pacific, and these events have a significant effect on the habitat range and movements of pelagic species. Tunas are commonly most concentrated near islands and seamounts that create divergences and convergences which concentrate forage species, also near upwelling zones along ocean current boundaries, and along gradients in temperature, oxygen and salinity. Swordfish and numerous other pelagic species tend to concentrate along food-rich temperature fronts between cold, upwelled water and warmer oceanic water masses

The population dynamics of pelagic species differ significantly and affect their harvest potentials. For example, skipjack tuna are short lived and fast growing, with high natural mortality and a large standing stock size. These characteristics enable high catches to be sustained. Yellowfin tuna are also fast growing but longer lived than skipjack, with a moderate natural mortality rate and smaller standing stock. These characteristics are also conducive to large sustainable catches, but not as large as skipjack. A reliable bigeye tuna assessment is hindered by inadequate knowledge of stock structure and basic biological parameters, such as growth and mortality rates. Bigeye are possibly longer lived and have a lower natural mortality rate than yellowfin, thus their resilience to fishing may be less than for yellowfin. Albacore are slow growing and long lived relative to the three tropical and sub-tropical tuna species, therefore their fisheries potential may be more restricted than the other species (WPRFC, 2000).

Status of the Stocks

The skipjack population remains in a healthy condition despite large catches by the purse seine fishery operating near the equatorial pacific. Recruitment continues to be high and the total biomass of skipjack appears to be on the increase (Sibert, 2001).

Yellowfin biomass has dropped steadily since 1997 but remains above the historical lows of the early 1970s. The results of the Pacific-wide analysis using MULTIFAN-CL2 show a long-term decrease in bigeye recruitment and biomass since the 1960s. The widespread use of drifting FADs in the western and eastern Pacific has increased fishing mortality by purse seine fleets on juvenile bigeye. Any major increases in the level of fishing mortality on both yellowfin a bigeye would significantly affect their relative abundance.

Most studies suggest that Pacific billfish stocks are healthy but there is considerable uncertainty because of the quality of data and differences in the methods used to evaluate the trends. Blue marlin stocks, however, may currently be fully exploited and facing high fishing mortality from various fisheries in the Central and Western Pacific.

Protected Species

Protected species include those species listed as endangered or threatened under the Endangered Species Act (ESA), all marine mammals, listed or not, as they are protected under the Marine Mammal Protection Act (MMPA), and seabirds, listed or not, as they are protected under the Migratory Bird Treaty Act (MBTA). Appropriate information on the species' life history, habitat and distribution, and other factors necessary to its survival, is included to provide background for analyses in other sections of this document.

Marine Mammals

Protected marine mammals fall into two categories: species listed under the ESA and those species which are not listed, but otherwise protected under the MMPA. Cetaceans and pinnipeds are discussed separately in the sections below.

Listed Cetaceans

The six species of cetaceans listed under the ESA that occur within the Hawaiian Archipelago are found in the Table 2. Although these whales may be found within the proposed sanctuary boundaries, there are no reported or observed interactions with the fisheries which may operate within the proposed NWHI sanctuary.

Table 2. ESA listed Cetacea of the Hawaiian Archipelago

Common Name	Scientific Name
Blue whale	*Balaenoptera musculus*
Fin whale	*Balaenoptera physalus*
Humpback whale	*Megaptera novaeangliae*
Sei whale	*Balaenoptera borealis*
Sperm whale	*Physeter macrocephalus*
Right whale	*Eubalaena glacialis*

Other Cetaceans

Species of whales that are not listed under the ESA but are protected under the MMPA and occur around the Hawaiian Archipelago are listed in the following table.

Table 3. Non-ESA listed Ceatacea of the Hawaiian Archipelago

Common Name	Scientific Name	Common Name	Scientific Name
Blainsville beaked whale	*(Mesoplodon densirostris*)	Pygmy sperm whale	*Kogia breviceps*
Bottlenose dolphin	(*Tursiops truncatus)*	Risso's dolphin	*Grampus griseus*
Bryde's whale	(*Balaenoptera edeni*)	Rough-toothed dolphin	*Steno bredanensis*
Cuvier's beaked whale	*Ziphius cavirostris*	Short-finned pilot whale	*Globicephala macrorhynchus*
Dwarf sperm whale	*Kogia simus*	Spinner dolphin	*Stenella longirostris*
False killer whale	*Pseudorca crassidens*	Spotted dolphin	*Stenella attenuata*
Killer whale	*Orcinus orca*	Striped dolphin	*Stenella coeruleoalba*
Melon-headed whale	*Peponocephala electra*	Pacific white-sided dolphin	*Lagenorhynchus obliquidens*
Pygmy killer whale	*Feresa attenuata*	Minke whale	*Balaenoptera acutorostrata*
Fraser's dolphin	*Lagenodelphis hosei*	Dall's porpoise	*Phocoenoides dalli*
Longman's beaked whale	*Indopacetus pacificus*		

From the list above, only the bottlenose dolphin (*Tursiops truncatus*) has been documented to interact with a NWHI fishery (Bottomfish). Bottlenose dolphins have been observed stealing hooked fish off of bottomfish lines, the extent of such interactions are not known and are believed to be low. The relative impact of the bottomfish fishery on the behavior or foraging success of bottlenose dolphins is unknown, but thought to be minimal.

Although the other species listed above may be found within the action area and could interact with NWHI fisheries, no reported or observed incidental takes of these species have ever been reported or observed.

Listed Pinniped: The Hawaiian Monk Seal

In 1976, the Hawaiian monk seal was listed as endangered under the ESA following a 50% decline in beach counts from the late 1950s to the mid-1970s . It was also designated a depleted species in 1976 under the MMPA, and its population status is considered to be below sustainable

levels. The Hawaiian monk seal is the most endangered pinniped in U.S. waters and is second only to the northern right whale as the nation's most endangered marine mammal. The Hawaiian monk seal is also the only endangered marine mammal that exists wholly within the jurisdiction of the United States.

Biology and Distribution

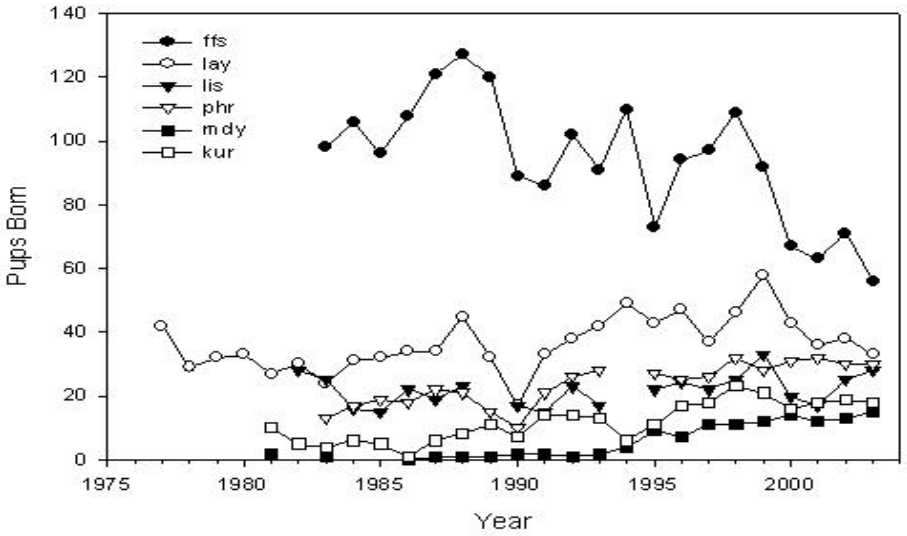
Monk seals are phocids, and are one of the most primitive genera of seals. They are brown to silver in color, depending upon age and molt status, and can weigh up to 270 kg. Adult females are slightly larger than adult males. Monk seals are solitary, and it is thought they can live up to 30 years. Females reach breeding age at about 5 to 10 years of age, depending on their condition, and can give birth about once every year. An estimated 40-80% of adult females give birth in a given year (NMFS unpub. data. 2001). After birth, pups nurse for 5-6 weeks, during which time the mother rarely, if at all, leaves the pup to feed. At weaning, the mother leaves and the pup must subsequently forage independently. Newly weaned pups tend to stay in the reef shallows, entering into more diverse and deeper waters to forage as they gain experience. Monk seals may stay on land up to about two weeks during their annual molt. Hawaiian monk seals are nonmigratory, but recent studies show their home ranges may be extensive (Abernathy and Siniff 1998). Counts of individuals on shore compared with enumerated subpopulations at some of the NWHI indicate that Hawaiian monk seals spend about one-third of their time on land and about two thirds in the water (Forney et al. 2000).

The Hawaiian monk seal breeds only in the Hawaiian Archipelago, with most monk seals inhabiting the remote, largely uninhabited atolls and surrounding waters of the NWHI. More than 90 percent of all pups are born at six major breeding colonies located at FFS, Laysan Island, Pearl and Hermes Reef, Lisianski Island, Kure Atoll and Midway Atoll. A few births also occur annually at Necker, Nihoa, and Niʻihau Islands and in the main Hawaiian Islands. NMFS researchers have also observed Hawaiian monk seals at Gardner Pinnacles and Maro Reef. Although Hawaiian monk seals occasionally move between islands, females generally return to their natal colony to pup. Since 1990, there has been an apparent increase in the number of Hawaiian monk seal sightings and births in the main Hawaiian Islands (HMSRT 1999; Johanos 2000). For example, in 2001 there were 12 known births of monk seals in the MHI and in 2003 there were 10. A 2001 aerial survey determined a minimum abundance of 52 seals in the MHI (Baker and Johanos, in press).

Hawaiian monk seals feed on a wide variety of teleosts (e.g. eels), cephalopods (e.g. octopus) and crustaceans (lobsters), indicating that they are highly opportunistic feeders (Rice 1964; MacDonald 1982; Goodman-Lowe 1998). Research to identify prey species using several methods including collection of potential prey items and blubber samples for fatty acid analysis; Crittercam[3] recording of foraging behavior; correlation of dive/depth/location profiles with potential prey species habitat; and analysis of Hawaiian monk seal scat and spew samples for

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

ident ifiable hard parts of prey, has indic ated that mon ks seals forage on a wide variety of orga nisms and at vario us depths and dista nces from shor e.



Stat us and Trends

The minimum population estimate for monk seals is 1,378 individuals (NMFS, Draft 2003 Stock Assessment Report). The PIFSC estimates the population to be 1300 to 1400 individuals (NMFS, 2003). Figure 7 illustrates the long-term trends in total non-pup population sizes at each of the NWHI colonies.

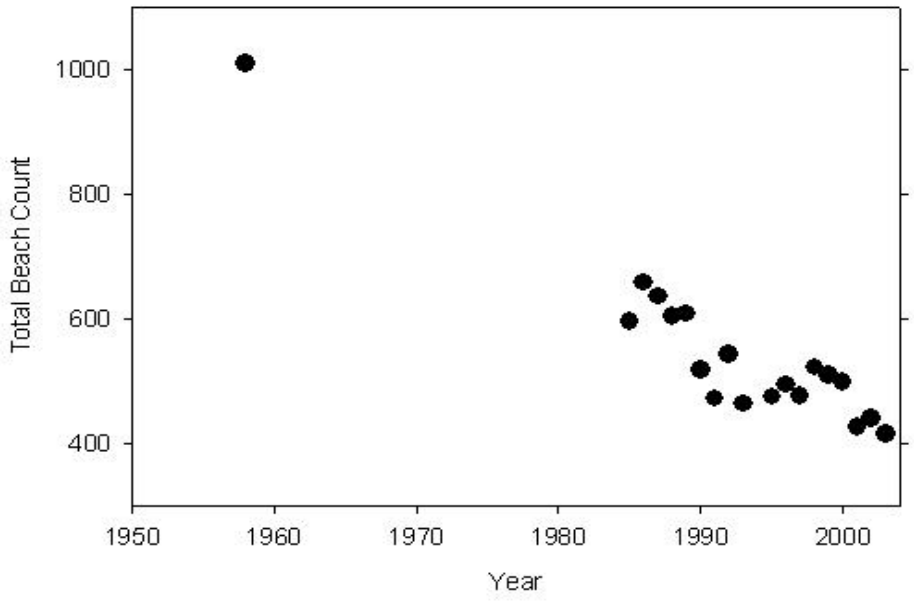
Figure 7. Historical Trend in Beach Counts (non-pups) of the Six Main Reproductive Subpopulations of Hawaiian Monk Seals (Source: PIFSC 2003)

Various surveys of the islands and atolls in the NWHI that support the main monk seal breeding subpopulations indicate that the NWHI non-pup population (juveniles, sub-adults and adults) declined 60% between the years 1958 and 1999.

The overall population decline is primarily attributable to low reproductive recruitment and high juvenile mortality at the largest of the subpopulations (FFS). At this site, the average beach count of animals older than pups is now less than half the count in 1989. In the late 1990's, poor survival of pups resulted in a relative paucity of young seals, so that further decline was expected for this subpopulation as adults die and there are few immature seals to replace them. The recent trend in mean beach counts for births can be found in Figure 8.

Figure 8. Mean beach counts of pups born at the major NWHI breeding areas
(Source: PIFSC 2003)

However, pup survival may be improving at FFS and the other major subpopulations as Figure 9 indicates. Over the last decade, the causes of the survival for these age classes at FFS have been related to poor condition from starvation, shark predation, and male aggression. A decrease in prey availability may be the result of decadal scale fluctuations in productivity and corresponding or other changes in local carrying capacity for seals at FFS or a combination of factors (Craig and Ragen 1999; Polovina et al. 1994; Polovina and Haight 1999). While other subpopulations of monk seals in the Northwestern Hawaiian Islands are stable, increasing or declining slightly, the overall population status is being driven by the FFS population, which comprises about 25% of the total monk seal population



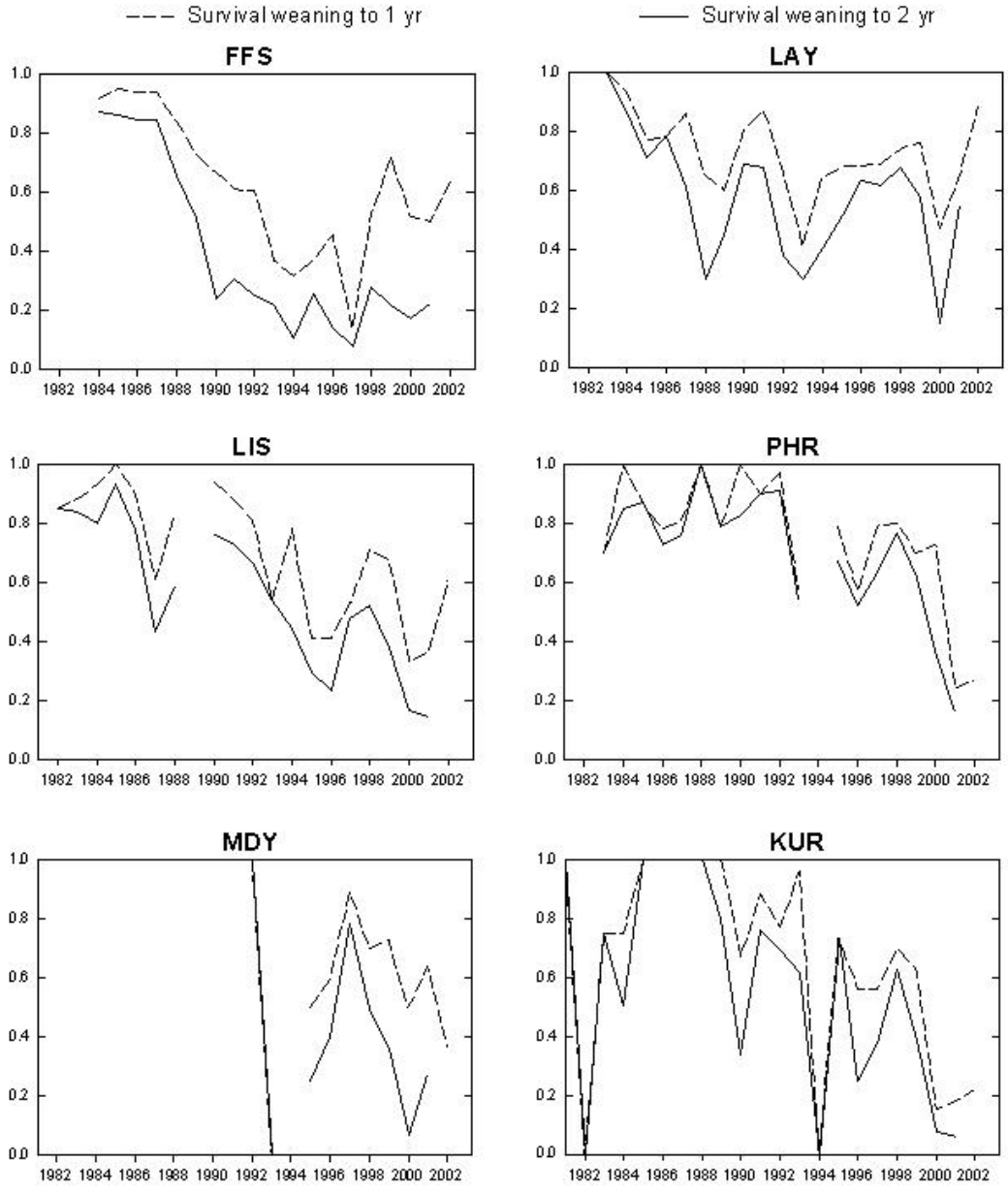


Figure 9. Survival of Hawaiian monk seals from weaning to age 1 and weaning to age 2 yr at the major NWHI breeding areas (Source: PIFSC 2003)

Factors Influencing Monk Seal Population Size

During the past four decades the Hawaiian monk seal population has been affected by human and natural factors. Natural factors have included shark predation, disease, attacks by aggressive adult male Hawaiian monk seals on females and immature seals of both sexes (called "mobbing"), and reduced prey availability. Human factors have included various types of interactions with humans, their structures, contaminants, marine debris, fishing operations and vessel traffic. At each colony, differing combinations of these factors likely have contributed to local trends in abundance.

Sea Turtles

All sea turtles are designated as either threatened or endangered under the Endangered Species Act. The five species of sea turtles known to be present in Hawaii are: the leatherback (*Dermochelys coriacea*), the olive ridley (*Lepidochelys olivacea*), the hawksbill *(Eretmochelys imbricata*), the loggerhead (*Caretta caretta*), and the green turtle (*Chelonia mydas*). However, only the green sea turtle nests in the NWHI.

Seabirds

The NWHI are estimated to be home for around14 million seabirds and provide important nesting habitat for around 5.5 million breeding pairs (USFW 2004). The only ESA-listed seabird found in NWHI is the Short-tailed albatross (*Phoebastria albatrus*), which a few individuals visit Midway each year. Other seabirds found in the NWHI are protected under the Migratory Bird Treaty Act. Such species include, but not limited to, the Black-footed albatross (*Phoebastria nigripes*), the Laysan albatross (*Phoebastria immutabilis*), the Masked booby (*Sula dactylatra*), Brown booby (*Sula leucogaster*), Red-footed booby (*Sula sula,*), Wedge-tailed shearwater (*Puffinus pacificus*), and the Christmas shearwater (*Puffinus nativitatis*). Greater than 95 % of the world's Laysan and Black-footed albatross nest in the NWHI. Population trends for most seabird species in the NWHI are stable or increasing, but there is concern for the albatross species. Threats to NWHI seabirds include introduced and invasive species, contaminants, marine debris, oil pollution, climate change, and fishery interactions (on the high seas).

HAWAII'S FISHING SECTORS

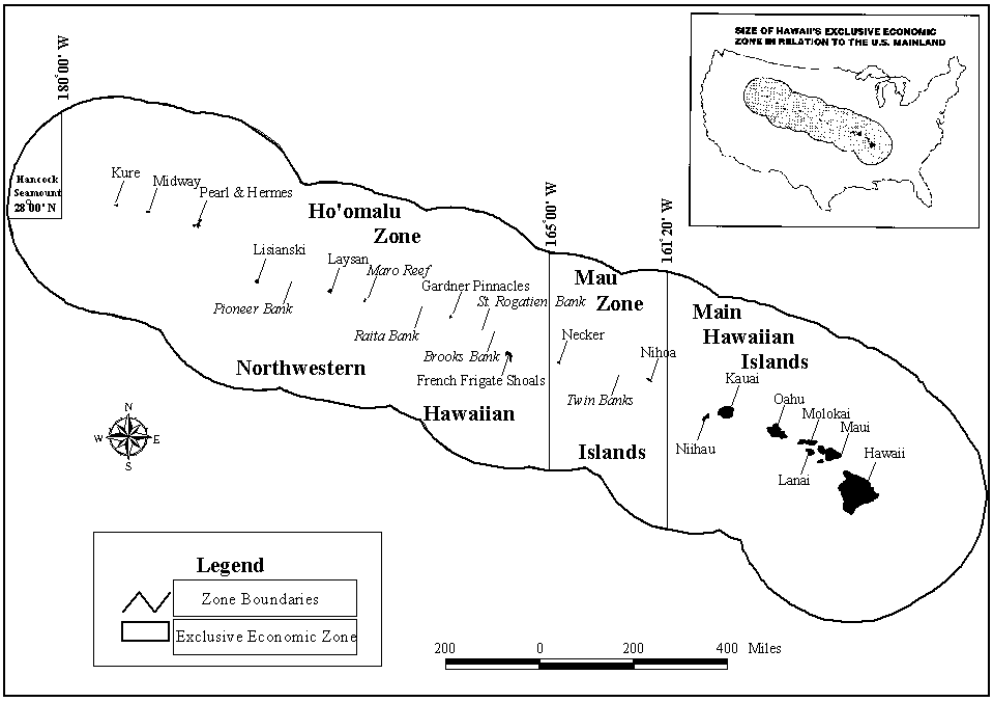
Bottomfish and Seamount Groundfish Fishery

Bottomfish fishing was a part of the economy and culture of the indigenous people of Hawai‘i long before European explorers first visited the islands. Descriptions of traditional fishing practices indicate that Native Hawaiians harvested the same deep-sea bottomfish species as the modern fishery and used some of the same specialized gear and techniques employed today.

The deep-slope bottomfish fishery in Hawai‘i concentrates on species of eteline snappers (e.g. *opakapaka*), carangids (e.g. jacks), and a single species of grouper (*hapuupuu*) concentrated at

depths of 30-150 fm. The fishery can be divided into two geographical areas (Figure 10): the inhabited main Hawaiian Islands (MHI) with their surrounding reefs and offshore banks; and the Northwestern Hawaiian Islands (NWHI), a 1,200 nm chain of largely uninhabited islets, reefs and shoals. In the MHI approximately 80% of the bottomfish habitat lies in state waters. Bottomfish fishing grounds within federal waters around the MHI include Middle Bank, most of Penguin Bank and approximately 45 nm of 100-fathom bottomfish habitat in the Maui-Lānaʻi-Molokaʻi complex. For management purposes the NWHI fishery has been separated into the Mau Zone, closer to the MHI, and the Hoʻomalu Zone.

Figure 10. Hawaii's NWHI Bottomfish Management Subareas



Participation

In the small boat fishery around the MHI the distinction between "recreational" and "commercial" fishermen is extremely tenuous, with most fishermen selling fish to cover fishing trip expenses. In a given year, the number vessels used to target bottomfish in MHI varies between 250-500 vessels. Seasonal price variability often causes part-time commercial fishermen to concentrate their bottomfish fishing effort during December, when they can take advantage of the year-end holiday demand for red snappers.

In contrast to the MHI fishery, bottomfish fishing in the NWHI is conducted solely by part-time and full-time commercial fishermen. The vessels venturing into the NWHI tend to be larger than those fishing around the MHI, as the distance to fishing grounds is greater. Participation in the NWHI bottomfish fishery is controlled through limited access programs in each of the two

management zones, the Hoʻomalu Zone to the west of 165°00' W and the Mau Zone between 165°00' W and 161°20' W (Figure 10). These zones were established to reduce the risk of biological overfishing and to improve the economic health and stability of the bottomfish fishery in the NWHI. The programs provide for a limited number of fishing permits to be issued each calendar year. Permits may not be sold, leased, or chartered. Based on the biological, economic, and social characteristics of the bottomfish fisheries in the two zones, the long-term target fleet sizes for the Hoʻomalu and Mau Zones have been determined by the Council to be seven vessels and 10 vessels, respectively. In 2004, four vessels fished in the Hoomalu zone, and 5 vessels fished in the Mau Zone. All of these vessels are independent, owner-operator fishing operations.

Harvests and Markets

Based on recent (1998-2002) harvest data, commercial bottomfish catches in the MHI fishery represent approximately 60 percent of the total commercial bottomfish harvest in Hawaiʻi (WPRFMC 2004). The annual bottomfish harvest in the MHI has been fairly stable for the past 10 years (Figure 11).

The Mau Zone 2002 average landings per trip increased by about 500 lb, (Figure 11) or 54% over 2001. Most of the major BMUS landings increased substantially, with only *ehu* and *butaguchi* landings categories decreasing (WPRFMC 2004). Trip lengths varied by vessel and trip strategy/target. Most of the trips incorporated some trolling activity.

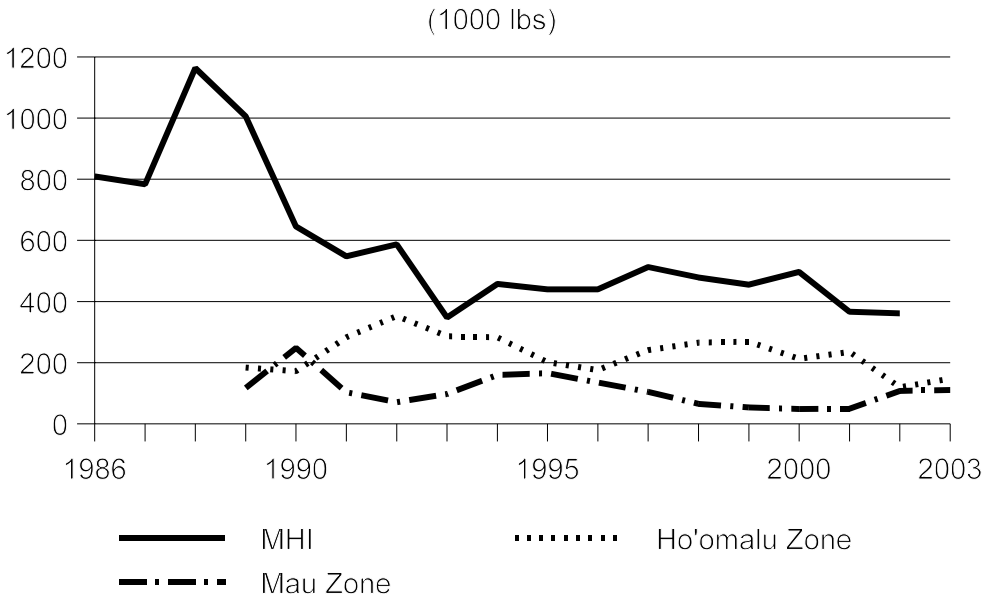


Figure 11. Trends in MHI and NWHI bottomfish landings (Source: WPFMC 2004)

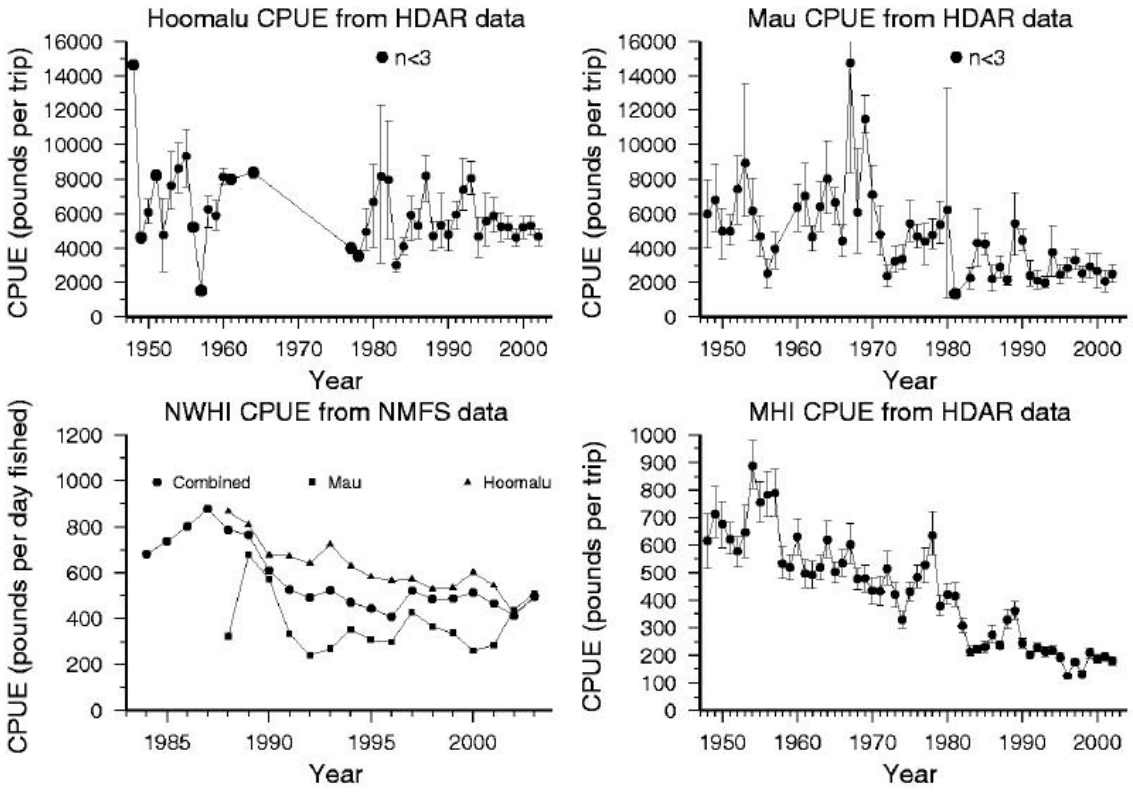


Figure 12. Trends in CPUE values for Hawaii bottomfish fisheries (Source: WPFMC 2004)

The Hoʻomalu Zone 2002 BMUS landings per trip fell by 19%, as one highliner vessel dropped out of the fleet. Up until 2002 the Hoʻomalu Zone fleet had very stable participation and landings for the previous 7-8 years.

Figure shows the trends in catch per unit effort (CPUE) for the respective fisheries. Decreases in MHI CPUE to about 30% of early CPUE values signify a strong yellow light condition for the stocks targeted by the MHI fishery. In the Mau zone CPUE has changed from earliest values to 54% and 118% for trip based and daily based CPUE respectively. For the Hoomalu zone these values are 58% and 56 % respectively. These values indicate healthy stocks in both NWHI zones (Figure 12).

Bycatch

The NWHI bottomfish fishery is strictly a commercial fishery in the NWHI, while the MHI bottomfish fishery is a mixed commercial, recreational and subsistence fishery. Although these fisheries use the same gear and operational methods, the motivation of the fishermen is different

between the commercial operators and recreational or subsistence fishermen. This results in different bycatch characteristics. The NWHI commercial fishermen seek the highest economic return on their catch and therefore may discard lower valued species, especially early in a trip, thereby conserving both ice and hold space. Recreational or subsistence fishermen, on the other hand, are more inclined to retain a greater variety of species for home consumption or distribution to relatives and friends. For this reason, the bycatch of the NWHI commercial fleet is likely larger than that of the MHI fishery. In addition, because Hawai‘i has no permit, logbook, or catch reporting system for non-commercial marine fishermen, there are no data on bycatch by this sector. Data on bycatch in the NWHI commercial fishery is available from the logbook program, from limited observer data, and from NMFS research cruises in the NWHI.

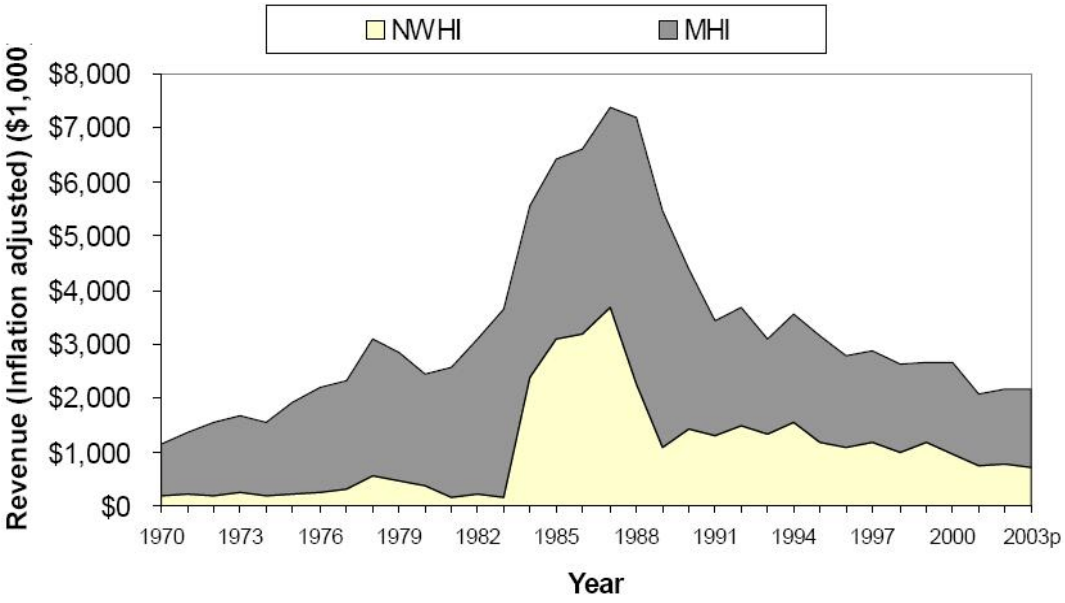


Figure 13. Hawaii bottomfish landings revenue (inflation adjusted) by area: NWHI vs. MHI, 1970 - present (Source: WPFMC 2004)

Bottomfish gear types and fishing strategies are highly selective for desired species and sizes. Measures that serve to further reduce bycatch in the botomfish fishery include prohibitions on the use of bottom trawls, bottom gillnets, explosives and poisons.

In the Mau and Hoʻomalu Zone operations, typically 100% of the sharks and kāhala are discarded. Also in these zones, butaguchi, ʻōmilu, kalekale, and white ulua are discarded at various percentages.

Economic Performance

Inflation-adjusted gross revenue in the MHI bottomfish fishery grew steadily in the 1980s (Figure; as a result of increases in both real prices and landings (WPRFMC 2003). However, between 1988 and 1993, revenue in the MHI fishery decreased sharply as both MHI bottomfish prices and landings declined. In recent (1995-2000) years, the annual ex-vessel value of bottomfish landings in the MHI fishery has averaged about $1.7M.(Figure 13).

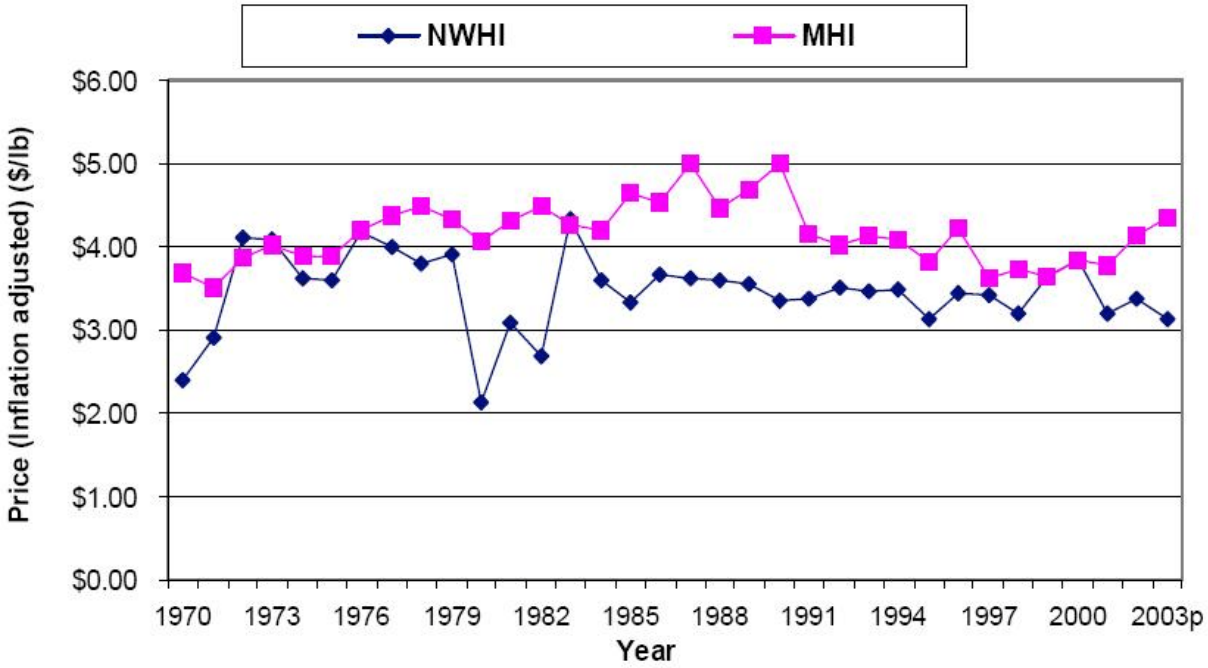
The inflation-adjusted gross revenue in the NWHI fishery grew dramatically in the mid-1980s and then declined as landings fell. Inflation-adjusted revenue in 2002 was only 20% of the 1987 peak. In recent years, the annual ex-vessel value of bottomfish landings in the NWHI fishery has averaged about $1M (Figure 13).

Historically, bottomfish caught in the main Hawaiian Islands tended to have higher aggregate prices, reflecting both species composition and greater freshness. However, the MHI price declined in general in 1990s, while NWHI price was relatively steady during the same period. This relative lowering of the MHI bottomfish prices may have reflected the softness of the upscale part of the Hawaii market. As a result, it brought the prices of the two areas to a similar range in 1999, and slightly converge in 2000 as NWHI price was $3.76 and MHI was $3.75.

In 2001, the prices from both areas drops, but to a greater degree for bottomfish caught in the Northwestern Hawaiian Islands. In 2002, the prices from both areas increased slightly, but in a greater degree for the MHI price. In 2003, the MHI price continued the increase trend from 2002, while the NWHI price fell slightly. As a result, the MHI price was higher substantially, $1.22 per pound, than NWHI in 2003 (Figure 14).

Onaga and opakapaka comprise the largest valued landings in each area for most years (ignoring the highly fluctuating landings of uku); NWHI ex-vessel prices were $4.53 and $4.79 per pound respectively in 2003 while MHI were $5.89 and $5.01, respectively. However, the NWHI landings are comprised of a higher percentage of these higher priced species compared to the MHI, so the difference in price for individual species by area is ironed out by the different species compositions between the two areas.

Figure 14. Average price/lb for BMUS landed in NWHI and MHI bottomfish fisheries
(Source: WPFMC 2004)



Markets

A market for locally caught bottomfish was well-established in Hawai‘i by the late nineteenth century. Today, fresh bottomfish continues to be an important seafood for Hawai‘i residents and visitors. Nearly all bottomfish caught in the NWHI fishery are sold through the Honolulu fish auction (United Fishing Agency, Ltd.).

Bottomfish caught in the MHI fishery are sold in a wide variety of market outlets (Haight et al. 1993b). Some are marketed through the fish auction in Honolulu and intermediary buyers on all islands. Sales of MHI bottomfish also occur through less formal market channels. For example, local restaurants, hotels, grocery stores and individual consumers are important buyers for some fishermen. In addition to being sold, MHI bottomfish are consumed by fishermen and their families, given to friends and relatives as gifts, and bartered in exchange for various goods and services.

Historically, the demand for bottomfish in Hawai‘i has been largely limited to fresh fish. Until the market for frozen bottomfish develops, participants in the NWHI fishery will be caught in the same on-going dilemma – they must stay out long enough to cover trip expenses, but keep the trips short enough to deliver a readily saleable, high-quality product. In the past, bottomfish catches from the MHI have tended to command higher aggregate prices because bottomfish caught around the MHI are iced for only one to two days before being landed, whereas NWHI fresh catches may be packed in ice for ten days or more.

Catches of bottomfish around the MHI typically consist of plate-sized fish preferred by household consumers in Hawai‘i and by restaurants where fish are often served with the head on. Bottomfish caught around the NWHI tend to be the medium to large fish (over 5 pounds) preferred for the restaurant fillet market. Because the percent yield of edible material is high, handling costs per unit weight are lower and more uniform portions can be cut from the larger fish.

.According to U.S. Customs data for the Port of Honolulu, 801,000 pounds of snapper were imported in 2003 worth $2.26 million ($2.82 per pound). This amounts exceeded domestic supply and thus was a significant factor in ex-vessel prices. Tonga and Australia were the largest sources of fresh snapper, with Fiji and New Zealand also being major sources. Not only has the quantity of foreign-caught fresh fish increased during the last few years, but the number of countries exporting fresh fish to Hawai‘i has also increased. A decade ago, for example, fresh snapper was exported to Hawai‘i mainly from within the South Pacific region. In recent years Tonga and Australia were the largest sources of imported fresh snapper, with Fiji and New Zealand also being major sources, and Viet Nam, Chad and Madagascar as minor sources.

Crustacean Fishery

Ula (lobster) was a traditional source of food for Native Hawaiians and was sometimes used in early religious ceremonies (Titcomb 1978). After the arrival of Europeans in Hawai‘i, the lobster fishery became by far the most productive of Hawai‘i’s commercial shellfish fisheries. For example, it was reported that the MHI commercial lobster catch in1901 was 131,200 lbs (Cobb 1902). By the early 1950s, the commercial catch of spine lobsters (*P. penicillatus*) around the MHI had dropped by 75 to 85% (Shomura 1987).

It was not until the late-1970s that the development of the NWHI lobster fishery was fully realized. NMFS, U.S. Fish and Wildlife Service, Hawaii Division of Aquatic Resources, and University of Hawaii’s Sea Grant Program joined in a cooperative agreement to conduct a five-year assessment of the biotic resources of the NWHI. The survey reported that Of these study Necker Island and Maro Reef had sufficiently large stocks for commercial exploitation (Uchida and Tagami 1984).

Shortly after the survey began several commercial vessels began lobster trapping operations. 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). In the mid-1980s, the NWHI lobster fishery was Hawai‘i’s single most lucrative fishery (Pooley 1993b).

Trapping activity fell 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).

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 1999b). 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. Since 2000, NMFS has not issued harvest guidelines for the NWHI lobster fishery due to uncertainty in their lobster stock assessment model and resultant concerns about the potential for overfishing.

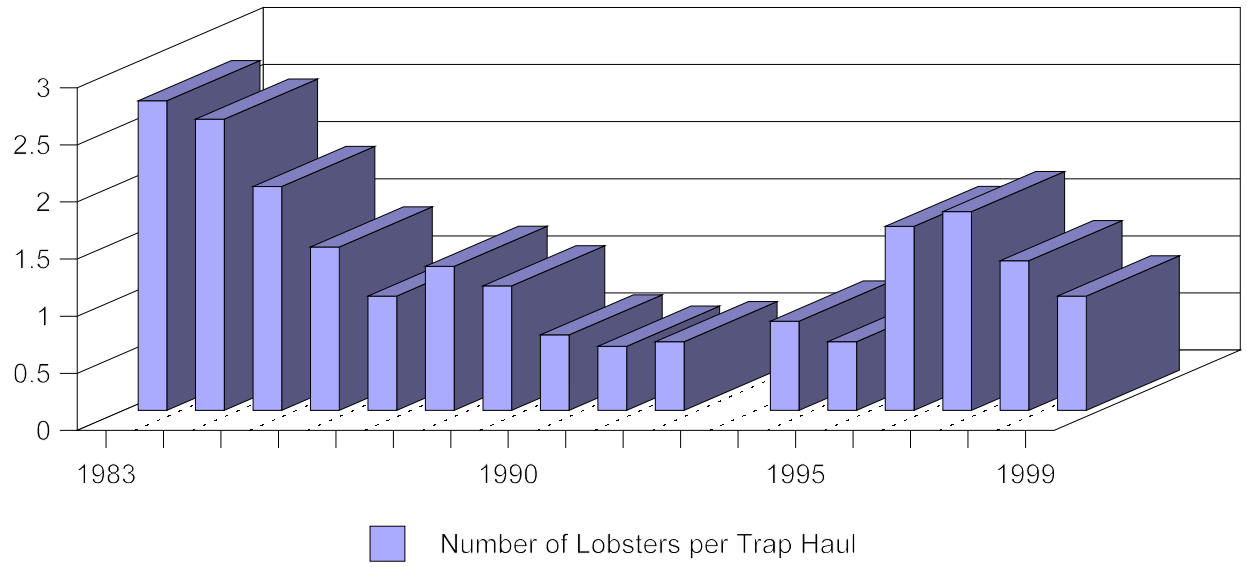
Fishing methods and use patterns

By 1999 all participants in the NWHI lobster fishery use a plastic dome-shaped, single-chambered traps with two entrance funnels located on opposite sides. All traps are required to have escape vents to allow unwanted organisms attracted to bait not to be captured. 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 were sold as a frozen tail product, however, from 1996 to 1998, the fleet also landed a significant quantity of live lobsters.

Harvest

Between 1985 and 1991, total landings showed an overall downward trend (Figure 15). Since 1992, landings have been largely determined by a harvest quota. The CPUE expressed as number of lobsters caught per trap haul showed an overall decrease between 1983 and 1991 (Figure 16). There was an increase in CPUE in 1996 and 1997, followed by another decline. It is uncertain, because of the lack of catch size data, if the increased CPUE in 1996 and 1997 resulted from the 1995 implementation of Amendment 9, which instituted the “retain-all” policy.

Figure15. Historical landings from NWHI lobster fishery, 1983-1999 (Source: PIFSC 2003)

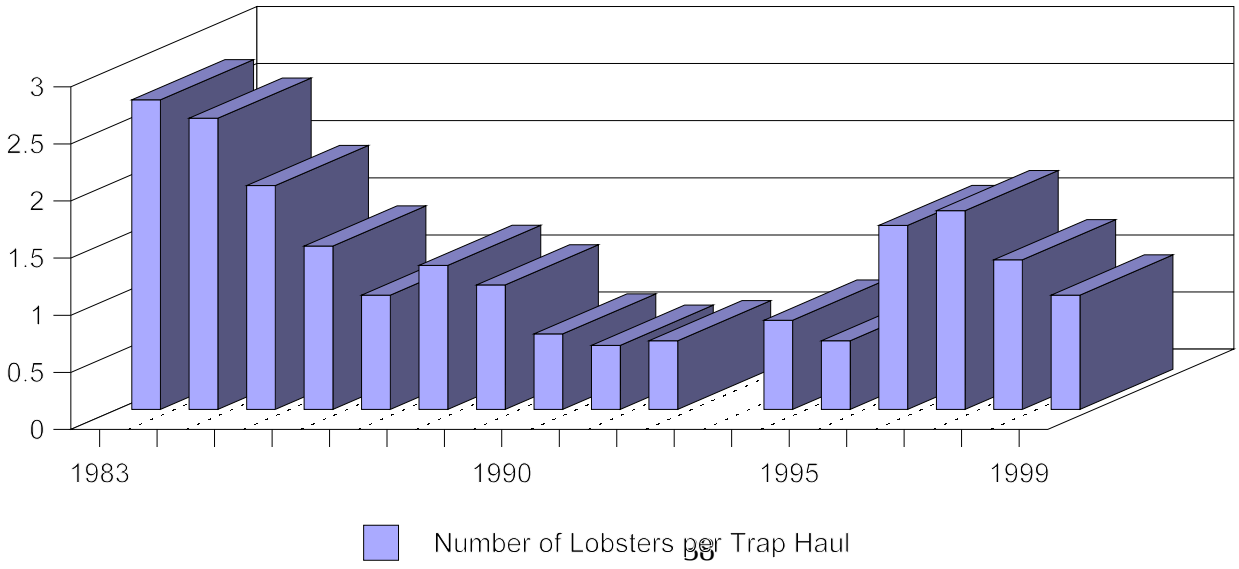


Byc

atch and non-target species

Non-targeted species account for a small percentage of the total catch in the NWHI lobster fishery. This due to the requirement that all lobster traps fished in the NWHI be equipped with escape vents. Of the organisms which are caught incidentally, hermit crabs make up the largest component followed by moray eels and bony fishes.

Figure16. Catch Per Unit Effort in the NWHI Lobster Fishery, 1983-1999
(Source: PIFSC 2002)



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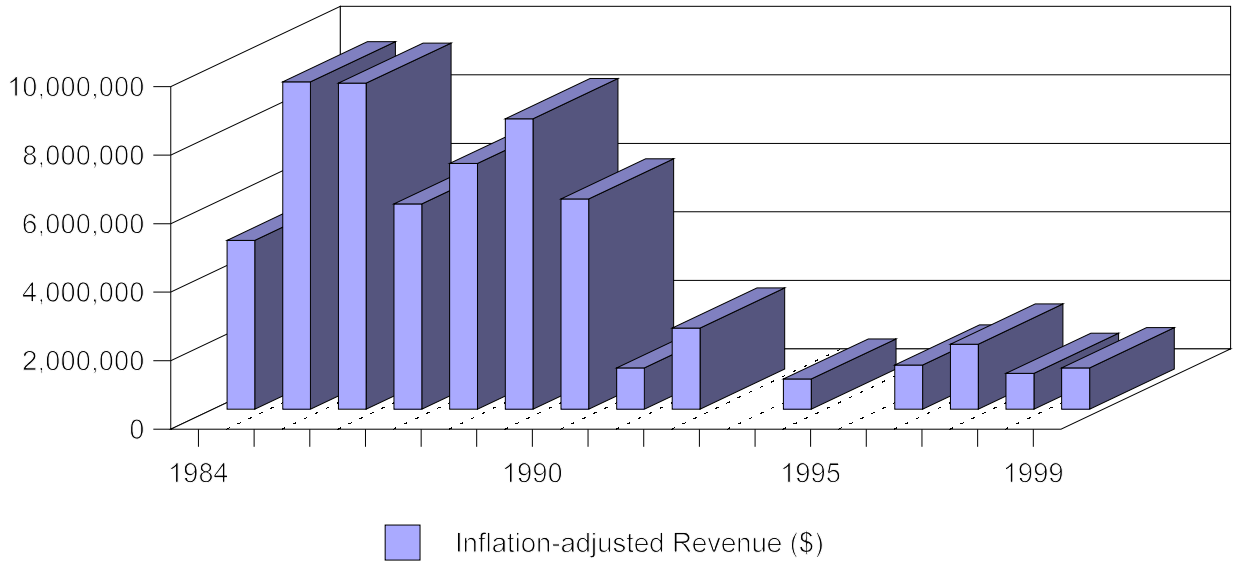
The average gross revenue per trap declined sharply due to the overall decrease in CPUE and the higher catches of slipper lobsters which have a smaller average size and lower ex-vessel value in comparison to spiny lobsters (Figure 16) (Kawamoto and Pooley 2000).

Figure 16. Inflation adjusted Revenue from the NWHI Lobster Fishery, 1983-1999
(Source: PIFSC 2002)



Markets

The traditional way of marketing lobsters in Hawaii was selling them live in local markets (HDAR 1979). In 1978, however, a Hawai‘i-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 1993). 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 2000). Typically, seafood wholesalers and retailers prefer predictable and reliable supply sources. However, NWHI lobster have 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 from 41,023 lbs in 1990 to 3,866 lbs in 1999 (NMFS Fisheries Statistics and Economics Division). 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 lbs (NMFS Fisheries Statistics and Economics Division.)

Precious Corals Fishery

Most of the information in this section pertains only to the black coral fishery occurring in Au'au Channel off Maui, as currently, it is the only fishery harvesting precious corals management unit species in the EEZ (with majority of harvest occurring in State of Hawaii waters). In 1988, the domestic fishing vessel *Kilauea* used a tangle net dredge (now prohibited) to harvest beds at Hancock Seamount. Their catch, however, consisted mostly of dead or low quality pink coral, and the operation was soon discontinued.

In the mid 1980's, a company in Hawai'i experimented with manned submersibles equipped with spotlights, cameras and a variety of maneuverable tools. They were 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 (Carleton 1987). While this type of operation is 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 2001, American Marines Services Group received federal permits to harvest deep-water precious corals using submersibles at the Makapuu Bed and in the Hawaii Exploratory Area. The company did not renew its permit, and the harvest levels from its operation can not be reported here because of NOAA's data confidentiality policy.

Black Coral Harvest

Between 1990 and 1997, the annual harvest of black coral in Hawaii varied from a low of 864 lb to a high of 6,017 lb, with a yearly average of 3,084 lb. As noted above, the harvest of black coral has occurred mainly in State of Hawaii waters. Table 4 provides historical landings and value of the black corals harvest between 1990-1997. Landings and value of the black corals recently harvested in Hawaii cannot be presented due to State of Hawaii confidentially policy.

Bycatch

The Precious Corals FMP only allows the harvest of MUS using selective gear, i.e with submersible or by hand. The use of tangle-nets and dredging is prohibited. For this reason, the precious corals fisheries in Hawaii have little to no bycatch.

Table 4. Volume and Value of Black Coral Landings in Hawaii (1990-97)
(Source: Hawaii Division of Aquatic Resources)

YEAR	HARVESTED (LB)	SOLD (LB)	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

Markets

The naming of black coral as the Hawaii state "gem" in 1987 increased consumer interest in this precious coral (Grigg 1993). However, the quantity of black coral required by jewelry manufactures in Hawaii has dropped considerably because the jewelry items produced are smaller and of higher quality and because modern cutting procedures have become much more efficient (Carleton 1987). In addition, inexpensive black coral imported from the Philippines and elsewhere fills the demand for low quality, high volume jewelry products. Maui Divers of Hawaii, Inc., the leading manufacturer and retailer of precious corals jewelry in Hawaii, buys exclusively black coral harvested in the state.

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 corals jewelry have relied on local stockpiles of gold coral and imports of pink coral from foreign suppliers. Prices for precious corals have gradually increased, and specimens of the highest quality pink coral currently sell 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 pers. comm. 2000 Maui Divers of Hawaii, Inc., Honolulu). The precious corals jewelry

industry in Hawaii has been estimated to be worth about $25 million at the retail level (Grigg 1993).

Coral Reef Fishery

Surveys of the NWHI demonstrate that coral reefs are in good condition with high standing stocks of many reef fish. Nearshore coral reefs receive little human use because of their remoteness, exposure to harsh seasonal ocean conditions, and their protected status as part of a national wildlife refuge. Most of the shallow reefs of the NWHI lie within the boundaries of the State of Hawaii, where access and resource use are controlled by special permit.

There is a long history of fishing in the NWHI. Iverson *et al*. (1989) found ample evidence of fishing by the ancient Hawaiians as far northwest as Necker Island. Starting in the 1920s, a handful of commercial boats ventured into the NWHI to fish for shallow and deepwater bottomfish, spiny lobsters, and other reef and inshore species. Black-lipped pearl oysters at Pearl and Hermes Reef in the NWHI were overfished in the late 1920s and recent surveys show that stocks have not recovered to pre-exploitation levels. From the late 1940s to the late 1950s, there was a fishery for *akule, ulua,* and reef fish around French Frigate Shoals and Nihoa Island.

Currently, there are no coral reef fisheries operating in the NWHI. Occasional visitors, including federal government personnel and contract workers at Midway Atoll may fish recreationally and for subsistence, but the amount of fish caught is unknown.

Bycatch

All gears used to catch coral reef species are essentially artisanal in nature. Catch rates are minimal, usually only a few pounds per man-hour or other unit of effort. Large catches thus depend on fishing methods employing a lot of people, such as driven-in-net fishing or group spear fishing. Because of the characteristics of gear and methods, in most cases coral reef fishing generates very little bycatch .

Pelagic Fishery

The total volume of pelagic fish caught annually from the NWHI by the commercial pelagic handline and troll fishery amounts about 450,000 lbs (Reginald Kokubun, Hawaii Division of Aquatic Resources, pers comm.), comprising principally yellowfin tuna and wahoo. Total pelagic fish catches in Hawaii, from commercial and recreational fishing amount to about 33 million lbs, of which the NWHI amount to about 1.4%. Yellowfin biomass in the Central and Western Pacific is currently estimated to lie between 1.5 and 3.1 million mt (Hampton et al, 2004). The total volume of yellowfin caught annually from the NWHI by the commercial mixed handline and troll fishery amounts about 170,000 lbs (77 mt) (Reginald Kokubun, Hawaii Division of Aquatic Resources, pers comm.), or 0.003-0.005% of the biomass.

Little is known about the scale of recreational fishing activities in the NWHI. A charter vessel operation was maintained at Midway Atoll by an eco-tourism operator, but this activity terminated in 2002. Some long range charter operators may be interested in fishing in the NWHI

(David Itano, University of Hawaii pers comm.) where competition for pelagic fish is several orders of magnitude lower than in the Main Hawaiian Islands.

Bycatch

There is little byctach in the NWHI troll and handline fisheries because these gears and bait methods practiced are highly selective. Additionally, non-target species caught in these fisheries are often marketable and thus, would not be discarded.

HAWAII'S ECONOMY

The largest contributors to Hawaii's economy are tourism, federal defense spending and, to a lesser extent, agriculture. Tourism is by far the leading industry in Hawai‘i in terms of generating jobs and contributing to gross state product.

Fishing Related Economic Activities

The harvest and processing of fishery resources play a minor role in Hawai‘i's economy. 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 only 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).

Hawai‘i's commercial fishing sector includes a wide array of fisheries. The Hawai‘i longline fishery is by far the most important economically, accounting for 73 percent of the estimated ex-vessel value of the total commercial fish landings in the state in 1999 (Table 5). As shown table, the NWHI and MHI bottomfish fisheries account for a relatively small share of the landings and value of the state's commercial fisheries.

Table 5. Volume and Value of Commercial Fish Landings in Hawai‘i by Fishery, 1999

FISHERY	POUNDS LANDED (1,000s)	PERCENT OF TOTAL POUNDS LANDED	EX-VESSEL VALUE ($1,000s)	PERCENT OF TOTAL EX-VESSEL VALUE
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%

An assessment of current contributions of the bottomfish fishery to the economy can be obtained using the Type II output, income and employment multipliers calculated by Sharma et al. (1999) for Hawai‘i’s (non-longline) commercial, charter and recreational fishing sectors. Applying these multipliers to an approximation of the final demand in each of the sectors involved in bottomfish fishing, it is estimated that this fishing activity contributes $10.78 million of output (production) and $2.51 million of household income to the state economy and creates the equivalent of 113 full-time jobs (Table 6).[4]

Table 6. Estimated Output, Household Income and Employment Generated by Bottomfish Fishing Activity in Hawai‘i

[4]Several input-output models other than the one used here are available to study economic impacts. The model developed by Sharma et al. (1999) is based on data collected in Hawai‘i over a number of years, and is believed to be the best available for analyzing Hawai‘i’s fisheries. It should be noted, however, that different practitioners may apply a model in different ways.

FISHERY	SALES ($)	FINAL DEMAND ($)	OUTPUT ($)	HOUSEHOLD INCOME ($)	EMPLOYMENT (JOBS)[1]
NWHI bottomfish fishery					
Commercial vessels[2]	$1,096,200	$580,986	$1,382,747	$482,218	25
MHI bottomfish fishery					
Commercial vessels[2]	$1,625,800	$861,674	$2,050,784	$715,189	36
Charter vessels[3]	$305,664	$293,437	$760,002	$269,962	14
Recreational vessels[4]		$2,827,096	$6,587,134	$1,046,026	38
Total			$10,780,667	$2,513,431	113

[1] Calculated as full-time jobs. The input-output model assumes that fishing accounts for 20% of the employment time of part-time commercial fishermen (Sharma et al. 1999).
[2] Average annual sales estimate for 1994-1998 from WPRFMC (1999a).
[3] Sales estimate based on the following assumptions: 199 active vessels; average annual sales of $76,800 per vessel from charter fees and mount commissions; and 2% of total sales attributed to bottomfish fishing trips (Hamilton 1998).
[4] Expenditure estimates based on the following assumptions (Hamilton and Huffman 1997; Pan et al. 1999):

Although commercial fishing contribute little to Hawaii's overall economy, it has been part of Hawaii's identity 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.

Social Aspects of Fish Harvest

Archaeological evidence indicates that seafood was part of the customary diet of the earliest human inhabitants of the Hawaiian Islands (Goto 1986). Today, per capita seafood consumption in Hawai'i is still at least twice as high as the national average (Shomura 1987). The ethnic identification of Hawai'i's *kama 'āina* (long-time residents) with particular species has continued to the present day. The large variety of fish typically offered in Hawai'i's seafood markets reflects the diversity of ethnic groups in Hawai'i and their individual preferences, traditions, holidays and celebrations.

The sharing of fish among members of the extended family and community is also an early tradition of the indigenous people of Hawai'i, one that has continued today amongst Hawaii's diverse ethnic population. The social responsibility to distribute fish and other resources among relatives and friends remains a salient feature of the lives of many fishermen in Hawaii. 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*).

Given the historical significance of commercial fishing in Hawai‘i, 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 Hawai‘i’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 Hawai‘i.

NATIVE HAWAIIAN COMMUNITY

People of Native Hawaiian ancestry comprise about 21% of Hawai‘i’s current population (DBEDT 1999). Native Hawaiians have long been among the most economically disadvantaged ethnic or racial group in Hawai‘i in terms of standard of living, degree of unemployment, dependence on transfer payments and limited alternative employment opportunities.

For centuries Native Hawaiians relied on seafood as their principle source of protein. However, the availability of many traditional seafoods has been significantly diminished. Overfishing and ecological degradation of inshore areas by pollution has had a pronounced negative impact on Native Hawaiian marine subsistence practices. Nonetheless, the social importance of fishing and available marine resources remains vital to the continuation and perpetuation of Hawaiian culture.

V. ANTICIPATED IMPACTS OF THE ALTERNATIVES

This section presents the anticipated direct impacts of the above alternatives on the NWHI marine environment and fisheries, as well as their indirect impacts on the region and nation.

Anticipated Impacts on Target and Non-target Stocks

Obviously all alternatives that result in the harvesting of marine species will immediately reduce that species’ abundance in the NWHI. However the critical issue for managers is whether that reduction will have an adverse population or ecosystem impacts. As described in Section IV, in general NWHI fisheries have extremely low levels of bycatch (discards).

Impacts of Alternative 1A on Target and Non-target Stocks

Under Alternative 1A (FMP Status Quo), fishery impacts to target and non-target stocks are anticipated to remain unchanged. Fisheries would continue to be managed under their respective fishery management plans and would be expected to retain their current resiliency and natural condition. Fisheries would continue to be managed under limited entry and harvest quota systems as described in Section III. Target and non-target stocks and the NWHI ecosystem would be anticipated to remain in the “pristine” condition observed in 2002 following more than a decade of active fishery management by the WPRFMC.

Impacts of Alternative 1B on Target and Non-target Stocks

Under Alternative 1B (Reserve Status Quo), short-run fishery impacts on target and non-target stocks are anticipated to remain largely unchanged. Bottomfish landings would be capped to those made in 2000 through a series of fathom-based area closures around most NWHI, as well as the imposition of non-transferable vessel quotas. In the short-run the vessel quotas are likely to result in some level of discarding, as species targeting is difficult and participants may be motivated to discard less valuable species in favor of higher valued fish. However the fact that 2000 landings were well below MSY for this fishery means that it is unlikely that these discards will have an adverse impact on species populations or the NWHI ecosystem. The implementation of area closures may result in local depletions of some species as fishery participants will be forced to concentrate their effort in smaller available open areas. In the long-run, the non-transferable nature of the vessel quotas means as fishery participants age and leave the fishery, there will be no new entrants to take their place and the fishery will close. This will remove all potential federal fishery impacts on NWHI bottomfish target and non-target stocks. It is unlikely to have an impact on their (currently positive) population trajectory or the (currently pristine) NWHI ecosystem. Similarly it is unlikely to have an impact on the MHI populations or ecosystem as evidence of mixing between the NWHI and MHI is limited. However, if significant mixing does occur, the robust NWHI stocks should already be contributing to the MHI stocks. The degree to which this would increase under Alternative 1B is unknown but believed to be low. These positive impacts would be anticipated to be potentially offset by increases in MHI bottomfishing effort as a result of NWHI vessels relocating to the MHI, as well as MHI vessels increasing landings to fill the market void left by the closure of the NWHI fishery.

Alternative 1B would also close the NWHI crustacean, precious corals, and coral reef ecosystem fisheries. As described for bottomfish above, this will remove all potential federal fishery impacts on target and non-target stocks and may have some positive effects on MHI stocks if significant mixing with NWHI stocks does occur. Again, if it does occur, the currently unfished NWHI stocks should already be contributing significantly to the MHI stocks. The degree to which this would increase under Alternative 1B is unknown but believed to be low. Offsetting increases in MHI effort are unlikely as these NWHI fisheries are currently inactive.

Alternative 1B would allow some pelagic trolling to occur within limited areas by individuals who could demonstrate use in the year 2000. Landings would be limited to each individual's 2000 catch. In the short-term this will allow these individuals to continue fishing, in the long-term they will age and leave the fishery. There will be no new entrants to take their place and this fishery will close.Because this is such a small fishery, impacts on pelagic stocks will be insignificant whether it is open or closed.

Impacts of Alternative 2 on Target and Non-target Stocks

Under Alternative 2, no-take and low-use MPAs recommended under the Coral Reef Ecosystems FMP would prohibit or restrict fishing in federal waters within 50 fm of all NWHI. Although marine resources are currently pristine, these measures are anticipated to provide precautionary protection to coral reef resources from potential damage due to fishing activities.

Additional recommended bottomfish management measures could have a range of effects on bottomfish landings as dropping the “use-it-or-lose-it” limited entry permit provisions could result in a reduction of effort, while allowing new Mau Zone permits through the establishment of new entry criteria or through the Community Development Program could slightly increase effort and landings. However the NWHI limited entry program for the bottomfish fishery will continue to be utilized to keep effort and landings below MSY and fishery target levels.

Alternative 2 does not contain any additional recommended management measures specifically for the NWHI crustaceans fishery. This fishery is already subject to 10 fathom no-take areas around each of the NWHI, thus the impacts of Alternative 2 would be largely the same as those for Alternative 1A.

Alternative 2's recommended mega-refugia and other additional measures for precious corals would significantly increase NWHI waters in which the harvest of precious corals is prohibited. It would also prohibit the harvest of gold coral throughout the NWHI, and replace the existing exploratory area quota with a system designed to allow further exploration under carefully monitored conditions. The imposition of no-take and low-use MPAs around the NWHI would be unlikely to impact precious coral harvests as this fishery targets deep-water corals not found in these areas.

In addition to the no-take MPAs that would affect all fisheries, Alternative 2 would implement low-use MPAs in federal waters around all NWHI. Under this aspect of the Coral Reef Ecosystems FMP, any targeting of coral reef resources within low-use MPAs would require a special permit issued on a case-by-case basis by NMFS. This will allow managers to carefully monitor (and reject where necessary) all harvests of these species.

Alternative 2 does not contain any additional recommended management measures specifically for the NWHI pelagic fishery. The imposition of no-take and low-use MPAs around the NWHI would be unlikely to impact pelagic harvests as this fishery targets deep-water species not found in these areas. Thus the impacts of Alternative 2 would be largely the same as those for Alternative 1A.

Impacts of Alternative 3 on Target and Non-target Stocks

Alternative 3 (Precautionary Modification 1) would create two additional no-take MPAs in federal waters around the NWHI in which all fishing would be prohibited. These would be in addition to the measures discussed in Alternative 2.

Impacts on bottomfish, crustaceans, precious corals, and coral reef and pelagic species under Alternative 3 are anticipated to be mixed. On the one hand the large new no-take MPAs may result in local depletions of some species as fishery participants will be forced to concentrate their effort in smaller available open areas. On the other hand potential federal fishery impacts on stocks in closed areas would be eliminated. However the NWHI bottomfish and crustaceans limited entry, harvest guidelines, precious coral quotas and minimum sizes, and coral reef ecosystem special permits will be utilized to keep effort and landings below MSY and fishery specific sustainable target levels.

Impacts of Alternative 4 on Target and Non-target Stocks

Alternative 4 (Precautionary Modification 2) would create two additional no-take MPAs in federal waters around the NWHI in which all fishing would be prohibited. The northern of these two additional no-take MPAs would be significantly larger than under Alternative 3. These would be in addition to the measures discussed in Alternative 2.

In general, anticipated impacts on bottomfish, crustaceans, precious corals, and coral reef and pelagic species under Alternative 4 would the same mixed results as those described for Alternative 3. Due to the larger size of the additional no-take MPAs, these impacts would be larger than under Alternative 3.

Impacts of Alternative 5 on Target and Non-target Stocks

Alternative 5 (NMSP Recommendation) would apply to both state and federal waters and would prohibit harvests of precious corals and crustaceans as well as continuing the current prohibition on pelagic longlining. It would allow limited commercial bottomfish/pelagic trolling, commercial pelagic trolling, various forms of recreational fishing, and limited Native Hawaiian cultural and subsistence uses through a permitting process. Although marine resources are currently pristine, these measures are anticipated to provide complete precautionary protection to coral reef resources from potential damage due to fishing activities.

Under Alternative 5, harvests of bottomfish would be capped to those made in 2000 through a series of fathom-based area closures around most NWHI, as well as the imposition of non-transferable vessel quotas and a requirement that landings be in species specific ratios. In the short-run the vessel quotas and landing ratio requirements are likely to result in some level of discarding, as species targeting is difficult and limits will be met for some species before others. In this situation, fishery participants are likely to discard those fish for which they are over their quota, while continuing to fish for species for which they are under their quota. However the fact that 2000 landings were well below MSY for this fishery means that it is unlikely that these discards will have an adverse impact on species populations or the NWHI ecosystem. The implementation of area closures may result in local depletions of some species as fishery participants will be forced to concentrate their effort in smaller available open areas.
In the long-run, the non-transferable nature of the vessel quotas means as fishery participants age and leave the fishery, there will be no new entrants to take their place and the fishery will close. This will remove all potential federal fishery impacts on NWHI bottomfish target and non-target stocks. It is unlikely to have an impact on their (currently positive) population trajectory or the (currently pristine) NWHI ecosystem. Similarly it is unlikely to have an impact on the MHI populations or ecosystem as evidence of mixing between the NWHI and MHI is limited. However, if significant mixing does occur, the robust NWHI stocks should already be contributing to the MHI stocks. The degree to which this would increase under Alternative 5 is unknown but believed to be low. These positive impacts would be anticipated to be potentially offset by increases in MHI bottomfishing effort as a result of NWHI vessels relocating to the MHI, as well as MHI vessels increasing landings to fill the market void left by the closure of the NWHI fishery. Both NWHI and MHI bottomfish fishery participants may replace some effort with pelagic trolling as many vessels already participate in both fisheries. Given the long travel

time and relatively low value of trolling catches, it is unlikely that participants will continue or increase NWHI pelagic trolling effort.

Alternative 5 would also close the NWHI crustacean, precious corals, and coral reef ecosystem fisheries. As described for bottomfish above, this will remove all potential federal fishery impacts on target and non-target stocks and may have some positive effects on MHI stocks if significant mixing with NWHI stocks does occur. Again, if it does occur, the currently unfished NWHI stocks should already be contributing significantly to the MHI stocks. The degree to which this would increase under Alternative 5 is unknown but believed to be low. Offsetting increases in MHI effort are unlikely as these NWHI fisheries are currently inactive.

Alternative 5 would allow some NWHI pelagic trolling to occur within limited areas by individuals who could demonstrate use in the year 2000. Landings would be limited to each individual's 2000 catch. In the short-term this will allow these individuals to continue fishing, in the long-term they will age and leave the fishery, there will be no new entrants to take their place and this fishery will close. Because this is such a small fishery, impacts on pelagic stocks will be insignificant whether it is open or closed.

Impacts of Alternative 6 on Target and Non-target Stocks

Alternative 6 (Closure of all Federal waters to Bottomfishing) would prohibit bottomfishing in waters in federal waters around the Main and Northwestern Hawaiian Islands. This would be in addition to the measures discussed (for the other fisheries) in Alternative 2.

Alternative 6 would remove all potential federal fishery impacts on Hawaii's bottomfish target and non-target stocks. It is unlikely to have an impact on the (currently positive) population trajectory of NWHI bottomfish target and non-target stocks. However it is likely to have a positive effect on the population trajectory of some MHI stocks which currently appear to be subject to excess fishing pressure. Similarly, it is unlikely to have an impact on the (currently pristine) NWHI ecosystem but it is likely to have a positive impact on the MHI ecosystem as bottomfish target and non-target populations return and increase their contributions to ecosystem functions.

Alternative 6 would modify the operations of the NWHI crustaceans, precious corals, coral reef, and pelagic fisheries as described in Alternative 2, including no-take and low-use MPAs in which fishing would be prohibited or restricted in federal waters within 50 fm of all NWHI. Although marine resources are currently pristine, these measures are anticipated to provide precautionary protection to coral reef resources from potential damage due to fishing activities.

Bycatch

Bycatch in the NWHI bottomfish fishery is low because of the selective gear and fishing practices used. The amount of mortality of bycatch species in the NWHI bottomfish fishery is unknown, but if bycatch is low, bycatch mortality (in absolute numbers) must also be low. Although bottomfish fishing causes some mortality to bycatch species, the amount is likely to be far less than natural mortality. The cessation of bottomfish fishing in these zones would

eliminate anthropogenic sources of mortality on these species, and allow a return to equilibrium with natural sources of mortality. However, the positive impact of this alternative likely would not be detectible against the background of natural population fluctuations.

Anticipated Impacts on Marine Habitat

NWHI fisheries have had very little impact on marine habitat as they are generally hook-and-line fisheries with little to no contact with the sea floor. The NWHI lobster fishery is a trap fishery and is known to occasionally snag pieces of coral or algae however this is believed to be a relatively rare occurrence as fishery participants attempt to set traps on rubble fields and seek to avoid coral outcroppings. Several fishing vessels have run aground in the NWHI however none were actively fishing at the time. The greatest impacts to NWHI marine habitat are from non-Hawaii marine debris and storms, however neither of these factors will be affected by any of the alternatives.

Impacts of Alternative 1A on Marine Habitat

Under Alternative 1A (FMP Status Quo), fishery impacts to target and non-target stocks are anticipated to remain unchanged. Fisheries would continue to be managed under their respective fishery management plans and marine habitat would be expected to retain its current resiliency and natural condition. Fisheries would continue to be managed under limited entry and harvest quota systems as described in Section III and the NWHI ecosystem would be anticipated to remain in the "pristine" condition observed in 2002 following more than a decade of active fishery management by the WPRFMC.

Impacts of Alternative 1B on Marine Habitat

Under Alternative 1B (Reserve Status Quo), fishery impacts on marine habitat are anticipated to remain unchanged. Bottomfish landings would be capped to those made in 2000 through a series of fathom-based area closures around most NWHI, as well as the imposition of non-transferable vessel quotas. The implementation of area closures may result in local concentrations of effort as fishery participants will be forced to concentrate their effort in smaller available open areas. In the long-run, the non-transferable nature of the vessel quotas means as fishery participants age and leave the fishery, there will be no new entrants to take their place and the fishery will close. This will remove all potential federal bottomfish fishery impacts on NWHI marine habitat. However given the hook-and-line gear used by this fishery it is unlikely that it is currently having any impact, so its closure would provide precautionary protection to marine habitat.

Alternative 1B would also close the NWHI crustacean, precious corals, and coral reef ecosystem fisheries. As described for bottomfish above, this will remove all potential federal fishery impacts on marine habitat. Offsetting increases in MHI effort are unlikely as these NWHI fisheries are currently inactive.

Alternative 1B would allow some NWHI pelagic trolling to occur within limited areas by individuals who could demonstrate use in the year 2000. Landings would be limited to each individual's 2000 catch. In the short-term this will allow these individuals to continue fishing, in

the long-term they will age and leave the fishery, there will be no new entrants to take their place and this fishery will close. Because this is such a small fishery hook-and-line fishery, impacts on marine habitat will be insignificant whether it is open or closed.

Impacts of Alternative 2 on Marine Habitat

Under Alternative 2 (Council Recommendations to Date), no-take and low-use MPAs recommended under the Coral Reef Ecosystems FMP would prohibit or restrict fishing in federal waters within 50 fm of all NWHI. Although marine resources are currently pristine, these measures are anticipated to provide precautionary protection to marine habitat from potential damage due to fishing activities.

Impacts of Alternative 3 on Marine Habitat

Alternative 3 (Precautionary Modification 1) would create two additional no-take MPAs in federal waters around the NWHI in which all fishing would be prohibited. These would be in addition to the measures discussed in Alternative 2.

As with Alternative 1B, given that marine resources are currently pristine this alternative provides precautionary protection to marine habitat from potential damage due to fishing activities.

Impacts of Alternative 4 on Marine Habitat

Alternative 4 (Precautionary Modification 2) would create two additional no-take MPAs in federal waters around the NWHI in which all fishing would be prohibited. The northern of these two additional no-take MPAs would be significantly larger than under Alternative 3. These would be in addition to the measures discussed in Alternative 2.

As compared to Alternative 3, this alternative would provide increased precautionary protection to marine habitat from potential damage due to fishing activities.

Impacts of Alternative 5 on Marine Habitat

Alternative 5 (NMSP Recommendation) would apply to both state and federal waters and would prohibit harvests of precious corals and crustaceans as well as continuing the current prohibition on pelagic longlining. It would allow limited commercial bottomfish/pelagic trolling, commercial pelagic trolling, various forms of recreational fishing, and limited Native Hawaiian cultural and subsistence uses through a permitting process. Although marine resources are currently pristine, these measures are anticipated to provide complete precautionary protection to marine habitat from potential damage due to fishing activities.

Impacts of Alternative 6 on Marine Habitat

Alternative 6 (Closure of all Federal waters to Bottomfishing) would prohibit bottomfishing in waters in federal waters around the Main and Northwestern Hawaiian Islands. This would be in addition to the measures discussed (for the other fisheries) in Alternative 2, including no-take and low-use MPAs in which fishing would be prohibited or restricted in federal waters within 50 fm of all NWHI. Although marine resources are currently pristine, these measures are anticipated to provide precautionary protection to marine habitat from potential damage due to fishing activities.

Anticipated Impacts on Protected Species

The factors considered in this section include: 1) the status of the affected populations of species; 2) the level of interactions (removals, injuries or disturbance) attributed each alternative; and, 3) the impact of those levels on affected populations.

Impacts of Alternative 1A on Protected Species

Under Alternative 1A (FMP Status Quo), the impacts of NWHI fisheries on protected species are anticipated to remain unchanged. Fisheries would continue to be managed under their respective fishery management plans, observers would continue to be placed on bottomfish and lobster vessels if requested by NMFS, and physical interactions with protected species would remain at the virtually zero levels observed for these fisheries as described in Section IV. An active NWHI lobster fishery could potentially affect monk seals if lobster are an important part of the diet of monk seals. However given that the Crustaceans FMP only allows the harvest of 13% of each area's exploitable population, it appears unlikely that these removals will jeopardize monk seals or their populations.

Impacts of Alternative 1B on Protected Species

Under Alternative 1B (Reserve Status Quo), fishery impacts on protected species are anticipated to remain unchanged. Bottomfish landings would be capped to those made in 2000 through a series of fathom-based area closures around most NWHI, as well as the imposition of non-transferable vessel quotas. The implementation of area closures may result in local concentrations of effort as fishery participants will be forced to concentrate their effort in smaller available open areas. In the long-run, the non-transferable nature of the vessel quotas means as fishery participants age and leave the fishery, there will be no new entrants to take their place and the fishery will close. This will remove all potential federal bottomfish fishery impacts on NWHI protected species.

Alternative 1B would also close the NWHI crustacean, precious corals, and coral reef ecosystem fisheries. As described for bottomfish above, this will remove all potential federal fishery impacts on protected species. Offsetting increases in MHI effort are unlikely as these NWHI fisheries are currently inactive.

Alternative 1B would allow some NWHI pelagic trolling to occur within limited areas by individuals who could demonstrate use in the year 2000. Landings would be limited to each individual's 2000 catch. In the short-term this will allow these individuals to continue fishing, in

the long-term they will age and leave the fishery, there will be no new entrants to take their place and this fishery will close. Because this is such a small hook-and-line fishery with no known impacts on protected species, impacts on these species will be insignificant whether it is open or closed.

Impacts of Alternative 2 on Protected Species

Under Alternative 2 (Council Recommendations to Date), no-take and low-use MPAs recommended under the Coral Reef Ecosystems FMP would prohibit or restrict fishing in federal waters within 50 fm of all NWHI. Although NWHI fishery interactions with protected species are currently at virtually zero levels, these measures may provide precautionary protection to protected species from adverse impacts due to fishing activities within these areas.

Impacts of Alternative 3 on Protected Species

Alternative 3 (Precautionary Modification 1) would create two additional no-take MPAs in federal waters around the NWHI in which all fishing would be prohibited. These would be in addition to the measures discussed in Alternative 2.

As with Alternative 1B, given that fishery interactions with protected species are currently at virtually zero levels, these measures may provide precautionary protection to protected species from adverse impacts due to fishing activities.

Impacts of Alternative 4 on Protected Species

Alternative 4 (Precautionary Modification 2) would create two additional no-take MPAs in federal waters around the NWHI in which all fishing would be prohibited. The northern of these two additional no-take MPAs would be significantly larger than under Alternative 3. These would be in addition to the measures discussed in Alternative 2.

As compared to Alternative 3, this alternative would provide increased precautionary protection to protected species.

Impacts of Alternative 5 on Protected Species

Alternative 5 (NMSP Recommendation) would apply to both state and federal waters and would prohibit harvests of precious corals and crustaceans as well as continuing the current prohibition on pelagic longlining. It would allow limited commercial bottomfish/pelagic trolling, commercial pelagic trolling, various forms of recreational fishing, and limited Native Hawaiian cultural and subsistence uses through a permitting process. Although NWHI fishery interactions with protected species are currently at virtually zero levels, these measures are anticipated to provide complete precautionary protection to protected species.

Impacts of Alternative 6 on Protected Species

Alternative 6 (Closure of all Federal waters to Bottomfishing) would prohibit bottomfishing in waters in federal waters around the Main and Northwestern Hawaiian Islands. This would be in addition to the measures discussed (for the other fisheries) in Alternative 2.

Given that NWHI fishery interactions with protected species are currently at virtually zero levels, these measures may provide precautionary protection to protected species from adverse impacts due to fishing activities.

Anticipated Impacts on Fisheries and Fishery Participants

Impacts of Alternative 1A on Fisheries and Fishery Participants

Under Alternative 1A (FMP Status Quo), impacts on NWHI fisheries and fishery participants are anticipated to remain unchanged. Fisheries would continue to be managed under their respective fishery management plans and no new measures would be implemented.

Impacts of Alternative 1B on Fisheries and Fishery Participants

Under Alternative 1B (Reserve Status Quo), both short and long-run impacts on fisheries and fishery participants are anticipated to be adverse. Bottomfish landings would be capped to those made in 2000 through a series of fathom-based area closures around most NWHI, as well as the imposition of non-transferable vessel quotas. The implementation of area closures may result in local depletions of some species as fishery participants will be forced to concentrate their effort in smaller available open areas. These local depletions may reduce catch rates and associated fishery revenues. The use of fishing caps and vessel specific quotas will have varying impacts depending on each participant's catch record during 2000. Participants who were active and had higher landings will obviously fare better than those who were relatively inactive during 2000, with some in the latter group potentially being left with too small a quota to make fishing worthwhile. In the long-run, the non-transferable nature of the vessel quotas means as fishery participants age and leave the fishery, there will be no new entrants to take their place and the fishery will close.

Bottomfish fishery participants that will be forced to leave the fishery will face a loss of livelihood and income and are likely to experience feelings of anger and frustration as they believe their fishery to be responsible and highly regulated and having no adverse impacts on NWHI marine resources. Some participants may relocate to fish in the MHI bottomfish fishery but given the stresses on this fishery it may be difficult for them to achieve catch rates or revenues comparable to those in the NWHI. This additional MHI effort may also negatively impact current MHI fishery participants as catch competition may further reduce MHI catch rates. This alternative would also foreclose the opportunity for future harvests of NWHI bottomfish.

Alternative 1B would allow some NWHI pelagic trolling to occur within limited areas by individuals who could demonstrate use in the year 2000. Landings would be limited to each individual's 2000 catch. In the short-term this will allow these individuals to continue fishing, in

the long-term they will age and leave the fishery, there will be no new entrants to take their place and this fishery will close.

Alternative 1B would also close the NWHI crustacean, precious corals, and coral reef ecosystem fisheries. Impacts on historical and potential participants in these fisheries would be similar to those described above for NWHI bottomfish participants. Obviously the loss of potential income from the unfished precious corals and coral reef fisheries will be easier to bear than the loss of historical income from the lobster and pelagic trolling fisheries, however all groups are likely to be angry and frustrated at the closure of fisheries which they believe to be responsible and carefully regulated and unlikely to adversely impact NWHI marine resources. This alternative would also foreclose the opportunity for future harvests of NWHI crustaceans, precious corals, coral reef ecosystem and pelagic resources.

Impacts of Alternative 2 on Fisheries and Fishery Participants

Under Alternative 2 (Council Recommendations to Date), no-take and low-use MPAs recommended under the Coral Reef Ecosystems FMP would prohibit or restrict fishing in federal waters within 50 fm of all NWHI. These restrictions would not be anticipated to have adverse impacts to the bottomfish, precious corals or pelagic fisheries as these fisheries generally occur outside the no-take areas. The crustacean fishery is already subject to this alternative's 10 fm no-take MPA and would thus be unaffected. The potential coral reef fishery would be affected as the MPAs would cover virtually all NWHI federal coral reef areas. Under this alternative, any individual who wanted to fish for coral reef associated species in the NWHI would have to apply to NMFS for a special permit which would be issued on a case-by-case basis and which may be rejected if anticipated to lead to adverse impacts to the coral reef ecosystem. Overall the additional measures that would be implemented under the bottomfish (suspend use-or-lose requirements, new entry criteria, CDP permits) and precious corals (mega-refugia, a prohibition on the harvest of gold corals etc.) FMPs are anticipated to have potentially positive impacts on fishery participants. Suspension of the use-or-lose requirement for annual permit renewal will allow NWHI bottomfish fishery participants to reduce their effort in accordance with markets or other economic or personal conditions without losing their permits. The establishment of new entry criteria for bottomfishing in the Mau Zone will provide managers with a mechanism to maintain effort at target levels through the limited entry program. The issuance of CDP permits will allow managers to allocate some of this available effort to qualified CDP applicants. The creation of a precious corals mega-refugia will reduce harvest opportunities for potential future participants, as will several other measures for precious corals such as and a prohibition on the harvest of gold corals throughout the NWHI. However at the same time this alternative would replace the existing exploratory area quota with a system designed to allow further exploration under carefully monitored conditions which could lead to increased harvests in the future.

Impacts of Alternative 3 on Fisheries and Fishery Participants

Alternative 3 (Precautionary Modification 1) would create two additional no-take MPAs in federal waters around the NWHI in which all fishing would be prohibited. These would be in addition to the measures discussed in Alternative 2. The impacts of the measures resulting from Alternative 2 are described above. The two additional no-take MPAs would be anticipated to

have adverse impacts on fishery participants through the potential for local depletions of some species as fishery participants will be forced to concentrate their effort in smaller available open areas. These local depletions may reduce catch rates and associated fishery revenues.

Impacts of Alternative 4 on Fisheries and Fishery Participants

Alternative 4 (Precautionary Modification 2) would create two additional no-take MPAs in federal waters around the NWHI in which all fishing would be prohibited. The northern of these two additional no-take MPAs would be significantly larger than under Alternative 3. These would be in addition to the measures discussed in Alternative 2. The impacts of the measures resulting from Alternative 2 are described above. The two additional no-take MPAs would be anticipated to have adverse impacts on fishery participants through the potential for local depletions of some species as fishery participants will be forced to concentrate their effort in smaller available open areas. These local depletions may reduce catch rates and associated fishery revenues. Due to the larger size of the additional no-take MPAs, this adverse impact would be larger than under Alternative 3.

Impacts of Alternative 5 on Fisheries and Fishery Participants

Alternative 5 (NMSP Recommendation) would apply to both state and federal waters and would prohibit harvests of precious corals and crustaceans as well as continuing the current prohibition on pelagic longlining. It would allow limited commercial bottomfish/pelagic trolling, commercial pelagic trolling, various forms of recreational fishing, and limited Native Hawaiian cultural and subsistence uses through a permitting process.

Under Alternative 5, commercial harvests of bottomfish would be capped to those made in 2000 through a series of fathom-based area closures around most NWHI, as well as the imposition of non-transferable vessel quotas and a requirement that landings be in species specific ratios. In the short-run the vessel quotas and landing ratio requirements are likely to result in some level of discarding, as species targeting is difficult and limits will be met for some species before others. In this situation, fishery participants are likely to discard those fish for which they are over their quota, while continuing to fish for species for which they are under their quota. However the fact that 2000 landings were well below MSY for this fishery means that it is unlikely that these discards will have an adverse impact on species populations or the NWHI ecosystem. The implementation of area closures may result in local depletions of some species as fishery participants will be forced to concentrate their effort in smaller available open areas. In the long-run, the non-transferable nature of the vessel quotas means as fishery participants age and leave the fishery, there will be no new entrants to take their place and the fishery will close. Bottomfish fishery participants that will be forced to leave the fishery will face a loss of livelihood and income and are likely to experience feelings of anger and frustration as they believe their fishery to be responsible and highly regulated and having no adverse impacts on NWHI marine resources. Some participants may relocate to fish in the MHI bottomfish fishery but given the stresses on this fishery it may be difficult for them to achieve catch rates or revenues comparable to those in the NWHI. This additional MHI effort may also negatively impact current MHI fishery participants as catch competition may further reduce MHI catch rates, and it would foreclose the opportunity for future harvests of NWHI bottomfish.

Alternative 5 would allow some NWHI pelagic trolling to occur within limited areas by individuals who could demonstrate use in the year 2000. Landings would be limited to each individual's 2000 catch. In the short-term this will allow these individuals to continue fishing, in the long-term they will age and leave the fishery, there will be no new entrants to take their place and this fishery will close. Impacts on historical and potential participants in these fisheries would be similar to those described above for NWHI bottomfish participants.

Alternative 5 would also close the NWHI crustacean, precious corals, and coral reef ecosystem fisheries. Impacts on historical and potential participants in these fisheries would be similar to those described above for NWHI bottomfish participants. Obviously the loss of potential income from the unfished precious corals and coral reef fisheries will be easier to bear than the loss of historical income from the lobster and pelagic trolling fisheries, however all groups are likely to be angry and frustrated at the closure of fisheries which they believe to be responsible and carefully regulated and unlikely to adversely impact NWHI marine resources.

This alternative would also foreclose the opportunity for future harvests of NWHI crustaceans, precious corals, coral reef ecosystem and pelagic resources.

Impacts of Alternative 6 on Fisheries and Fishery Participants

Alternative 6 (Closure of all Federal waters to Bottomfishing) would prohibit bottomfishing in waters in federal waters around the Main and Northwestern Hawaiian Islands. This would be in addition to the measures discussed (for the other fisheries) in Alternative 2. The impacts of the measures resulting from Alternative 2 are described above.

NWHI bottomfish fishery participants that will be forced to leave the fishery will face a loss of livelihood and income and are likely to experience feelings of anger and frustration as they believe their fishery to be responsible and highly regulated and having no adverse impacts on NWHI marine resources. MHI participants would also be forced to leave their fishery, and some will share the feelings of anger and frustration of the NWHI fishery. Others are well aware of the stressed stocks around the MHI and would accept a closure or other measures of limited duration to replenish these stocks. However a permanent closure is likely to strike this more informed group as a precautionary measure that lacks a clear objective. This alternative would also foreclose the opportunity for future harvests of NWHI and MHI bottomfish.

Both NWHI and MHI bottomfish fishery participants may replace some effort with pelagic trolling as many vessels already participate in both fisheries. However the caps on NWHI pelagic trolling landings, coupled with the long travel time will likely limit fishing there.

Anticipated Impacts on Fishing Related Economic Activities

All fisheries generate additional economic activities through supplyt industries (e.g. fishing supply shops, fuel stations and boatyards) as well as through distribution and marketing industries (e.g. fish wholesalers and retailers, transportation systems, restaurants and other marketers).

Impacts of Alternative 1A on Fishing Related Economic Activities

Under Alternative 1A (FMP Status Quo), impacts on fishing related economic activities are anticipated to remain unchanged. Fisheries would continue to be managed under their respective fishery management plans and no new measures would be implemented.

Impacts of Alternative 1B on Fishing Related Economic Activities

Under Alternative 1B (Reserve Status Quo), both short and long-run impacts on fishing related economic activities are anticipated to be adverse. Bottomfish landings would be capped to those made in 2000 through a series of fathom-based area closures around most NWHI, as well as the imposition of non-transferable vessel quotas. The implementation of area closures may result in local depletions of some species as fishery participants will be forced to concentrate their effort in smaller available open areas. These local depletions may reduce catch rates and associated fishery landings, thus reducing the amount of product available to wholesalers, retailers and other marketers. This in turn will reduce the revenue realized by these industries. The use of fishing caps and vessel specific quotas will have varying impacts depending on each participant's catch record during 2000. Participants who were active and had higher landings will obviously fare better than those who were relatively inactive during 2000, with some in the latter group potentially being left with too small a quota to make fishing worthwhile. As these vessels leave the fishery, revenues to fishery supply shops, fuel, ice, bait and other vendors will be reduced.

In the long-run, the non-transferable nature of the vessel quotas means as fishery participants age and leave the fishery, there will be no new entrants to take their place and the fishery will close. Again, as these vessels leave the fishery, revenues to fishery supply shops, fuel, ice, bait and other vendors will be reduced as will revenues to wholesalers, retailers and other fish marketers. This alternative would also foreclose the opportunity for future harvests of NWHI bottomfish.

Alternative 1B would allow some NWHI pelagic trolling to occur within limited areas by individuals who could demonstrate use in the year 2000. Landings would be limited to each individual's 2000 catch. In the short-term this will allow these individuals to continue fishing, in the long-term they will age and leave the fishery, there will be no new entrants to take their place and this fishery will close. Impacts on fishery and support industry revenues would be similar to those described above for NWHI bottomfish fishery. This alternative would also foreclose the opportunity for future harvests of NWHI pelagic fish.

Alternative 1B would also close the NWHI crustacean, precious corals, and coral reef ecosystem fisheries. Impacts on support industries for these dormant or unfished fisheries would be foregone future opportunities rather than reductions in current revenues.

Impacts of Alternative 2 on Fishing Related Economic Activities

Under Alternative 2 (Council Recommendations to Date), no-take and low-use MPAs recommended under the Coral Reef Ecosystems FMP would prohibit or restrict fishing in federal

waters within 50 fm of all NWHI. As described above, because these restrictions would not be anticipated to have adverse impacts to the bottomfish, precious corals or pelagic fisheries, they would not be expected to adversely impact these fisheries' current or potential support industries.

Overall the additional measures that would be implemented under the bottomfish (suspend use-or-lose requirements, new entry criteria, CDP permits) and precious corals (mega-refugia, a prohibition on the harvest of gold corals etc.) FMPs are anticipated to have potentially positive impacts on fishing related economic activities. Suspension of the use-or-lose requirement for annual permit renewal will allow NWHI bottomfish fishery participants to reduce their effort in accordance with markets or other economic or personal conditions without losing their permits. This means that effort, and therefore landings, will be available when conditions again become favorable and support industries can continue to service the fishing industry. The establishment of new entry criteria for bottomfishing in the Mau Zone will provide managers with a mechanism to maintain effort at target levels through the limited entry program and will again mean that effort, and therefore landings, remain available at target levels and support industries can continue to service the fishing industry. The issuance of CDP permits will have neutral impacts on support industries as total effort will remain at the target levels established for this fishery.

The creation of a precious corals mega-refugia will reduce harvest opportunities for potential future participants, as will several other measures for precious corals such as and a prohibition on the harvest of gold corals throughout the NWHI. However at the same time this alternative would replace the existing exploratory area quota with a system designed to allow further exploration under carefully monitored conditions which could lead to increased effort and harvests in the future. This would provide increased revenue to potential fishery support industries.

Impacts of Alternative 3 on Fishing Related Economic Activities

Alternative 3 (Precautionary Modification 1) would create two additional no-take MPAs in federal waters around the NWHI in which all fishing would be prohibited. These would be in addition to the measures discussed in Alternative 2. The impacts of the measures resulting from Alternative 2 are described above. The two additional no-take MPAs would be anticipated to have adverse impacts on fishery related economic activities through the potential for local depletions of some species as fishery participants will be forced to concentrate their effort in smaller available open areas. These local depletions may reduce catch rates and associated fishery revenues, thus reducing the amount of product available to wholesalers, retailers and other marketers. This in turn will reduce the revenue realized by these industries.

Impacts of Alternative 4 on Fishing Related Economic Activities

Alternative 4 (Precautionary Modification 2) would create two additional no-take MPAs in federal waters around the NWHI in which all fishing would be prohibited. The northern of these two additional no-take MPAs would be significantly larger than under Alternative 3. These would be in addition to the measures discussed in Alternative 2. The impacts of the measures

resulting from Alternative 2 are described above. The two additional no-take MPAs would be anticipated to have adverse impacts on fishing related economic activities through the potential for local depletions of some species as fishery participants will be forced to concentrate their effort in smaller available open areas. These local depletions may reduce catch rates and associated fishery revenues, thus reducing the amount of product available to wholesalers, retailers and other marketers. This in turn will reduce the revenue realized by these industries.

Due to the larger size of the additional no-take MPAs, this adverse impact would be larger than under Alternative 3.

Impacts of Alternative 5 on Fishing Related Economic Activities

Alternative 5 (NMSP Recommendation) would apply to both state and federal waters and would prohibit harvests of precious corals and crustaceans. It would allow limited commercial bottomfish/pelagic trolling, commercial pelagic trolling, various forms of recreational fishing, and limited Native Hawaiian cultural and subsistence uses through a permitting process.

Bottomfish landings would be capped to those made in 2000 through a series of fathom-based area closures around most NWHI, as well as the imposition of non-transferable vessel quotas and a requirement that landings be in species specific ratios. In this situation, fishery participants are likely to discard those fish for which they are over their quota, while continuing to fish for species for which they are under their quota. However the fact that 2000 landings were well below MSY for this fishery means that it is unlikely that these discards will have an adverse impact on species populations, the NWHI ecosystem or fishery landings. The implementation of area closures may result in local depletions of some species as fishery participants will be forced to concentrate their effort in smaller available open areas. These local depletions may reduce catch rates and associated fishery landings, thus reducing the amount of product available to wholesalers, retailers and other marketers. This in turn will reduce the revenue realized by these industries. The use of fishing caps and vessel specific quotas will have varying impacts depending on each participant's catch record during 2000. Participants who were active and had higher landings will obviously fare better than those who were relatively inactive during 2000, with some in the latter group potentially being left with too small a quota to make fishing worthwhile. As these vessels leave the fishery, revenues to fishery supply shops, fuel, ice, bait and other vendors will be reduced. In addition, reductions in landings will limit the amount of product available to wholesalers, retailers and other marketers and thus reduce their revenue. In the long-run, the non-transferable nature of the vessel quotas means as fishery participants age and leave the fishery, there will be no new entrants to take their place and the fishery will close. Again, as these vessels leave the fishery, revenues to fishery supply shops, fuel, ice, bait and other vendors will be reduced as will revenues to wholesalers, retailers and other fish marketers. This alternative would also foreclose the opportunity for future harvests of NWHI bottomfish.

Alternative 5 would allow some NWHI pelagic trolling to occur within limited areas by individuals who could demonstrate use in the year 2000. Landings would be limited to each individual's 2000 catch. In the short-term this will allow these individuals to continue fishing, in the long-term they will age and leave the fishery, there will be no new entrants to take their place and this fishery will close. Impacts on fishery and support industry revenues would be

similar to those described above for NWHI bottomfish fishery. This alternative would also foreclose the opportunity for future harvests of NWHI pelagic fish.

Alternative 5 would also close the NWHI crustacean, precious corals, and coral reef ecosystem fisheries. Impacts on support industries for these dormant or unfished fisheries would be foregone future opportunities rather than reductions in current revenues.

Impacts of Alternative 6 on Fishing Related Economic Activities

Alternative 6 (Closure of all Federal waters to Bottomfishing) would prohibit bottomfishing in waters in federal waters around the Main and Northwestern Hawaiian Islands. This would be in addition to the measures discussed (for the other fisheries) in Alternative 2. The impacts of the measures resulting from Alternative 2 are described above.

This alternative would remove all NWHI and MHI bottomfish effort and landings and their associated revenues realized by fishing support industries.

Both NWHI and MHI bottomfish fishery participants may replace some effort with pelagic trolling as many vessels already participate in both fisheries. This may replace some lost revenue from the bottomfish fisheries but is unlikely to replace all lost revenue as bottomfish are higher valued than are pelagic troll caught fish.

Anticipated Impacts on Hawaii's Communities

In addition to their economic returns to fishery participants and support industries, Hawaii's fisheries contribute to Hawaii's broader communities as described in Section IV. Under all alternatives impacts on these communities are anticipated to be mixed as reactions to actions such as closing NWHI fisheries will be negative for those who believe the resources are healthy and well managed, and positive for those who believe fishery closures are the best way to manage these resources. In addition, many of Hawaii's residents are largely uninformed about NWHI fisheries and likely won't have any reaction. The proportion of the population in each group is unknown. Alternatives that limit or end the supply of NWHI fishery products to Hawaii will obviously affect consumers of these products who will have to switch to other species or imported fish. For some this will be unimportant, however others value these fish highly, especially for Hawaii's traditional Christmas and New Year celebrations. Reductions or a loss of Hawaii-caught bottomfish such as opakapaka and onaga may also reduce revenues to restaurants that depend on these world-renowned "signature" dishes. Alternatives that limit or reduce fishing effort will correspondingly reduce crew and support industry employment opportunities for Hawaii residents. Alternatives that limit or close NWHI fisheries will negatively impact Hawaii's social and technical fisheries capital, meaning that not only will a way of life be closed off, but the knowledge of how to successfully fish in these remote fisheries will also be lost. Experience in other Pacific island areas has illustrated that this knowledge can be lost in one generation and often cannot be regained.

Anticipated Impacts on Native Hawaiians

Native Hawaiians may be impacted by the alternatives both directly (as fishery participants) and indirectly (as members of the broader community).

Impacts of Alternative 1A on Native Hawaiians

Under Alternative 1A (FMP Status Quo), impacts on Native Hawaiians are anticipated to remain unchanged. Fisheries would continue to be managed under their respective fishery management plans and no new measures would be implemented.

Impacts of Alternative 1B on Native Hawaiians

Under Alternative 1B (Reserve Status Quo), direct impacts on Native Hawaiians are anticipated to be adverse, while indirect impacts will be mixed.

Direct impacts (impacts on current and potential future Native Hawaiian fishery participants) are anticipated to be adverse as this alternative will initially restrict and then prohibit commercial fishing in the NWHI as current permit holders age and leave the fishery. In the short-run this may reduce revenues to the 5-10 Native Hawaiians estimated to be currently participating in the NWHI bottomfish fishery as permit holders, vessel operators or crew members. In the long-run it will preclude their continued participation in the fishery, as well that of any others who might participate in this or other NWHI fisheries in the future.

Native Hawaiian fishery participants that will be forced to leave the fishery will face a loss of livelihood and income and are likely to experience feelings of anger and frustration as they believe their fishery to be responsible and highly regulated and having no adverse impacts on NWHI marine resources. Some participants may relocate to fish in the MHI bottomfish fishery but given the stresses on this fishery it may be difficult for them to achieve catch rates or revenues comparable to those in the NWHI. This additional MHI effort may also negatively impact current MHI fishery participants as catch competition may further reduce MHI catch rates.

Alternative 1B would also close the NWHI crustacean, precious corals, and coral reef ecosystem fisheries. Impacts on historical and potential Native Hawaiian participants in these fisheries would be similar to those described above for the bottomfish fishery. Obviously the loss of potential income from the unfished precious corals and coral reef fisheries will be easier to bear than the loss of historical income from the lobster fishery, however all groups are likely to be angry and frustrated at the closure of fisheries which they believe to be responsible and carefully regulated and unlikely to adversely impact NWHI marine resources. This alternative would also foreclose the opportunity to participate in future harvests of NWHI crustaceans, precious corals and coral reef ecosystem resources.

In addition to the above reactions, some Native Hawaiians are likely to resent being restricted from accessing or fishing in the NWHI as many regard this as their birthright not subject to abrogation. This may include those individuals actually desiring to participate in NWHI fisheries, as well as others in the broader community whose interest is more related to legal and moral issues concerning Native Hawaiian rights in general. Others may be positively impacted

by this alternative if they view it as providing necessary and appropriate protection to NWHI waters and marine resources.

Impacts of Alternative 2 on Native Hawaiians

Under Alternative 2 (Council Recommendations to Date), no-take and low-use MPAs recommended under the Coral Reef Ecosystems FMP would prohibit or restrict fishing in federal waters within 50 fm of all NWHI. As described above, these restrictions would not be anticipated to have adverse impacts to the bottomfish, precious corals or pelagic fisheries or participants (Native Hawaiians and others) as these fisheries generally occur outside the no-take areas. The crustacean fishery is already subject to this alternative's 10 fm no-take MPA and would thus be unaffected. The potential coral reef fishery would be affected as the MPAs would cover virtually all NWHI federal coral reef areas. Under this alternative, any individual who wanted to fish for coral reef associated species in the NWHI would have to apply to NMFS for a special permit which would be issued on a case-by-case basis and which may be rejected if anticipated to lead to adverse impacts to the coral reef ecosystem. Overall the additional measures that would be implemented under the bottomfish (suspend use-or-lose requirements, new entry criteria, CDP permits) and precious corals (mega-refugia, a prohibition on the harvest of gold corals etc.) FMPs are anticipated to have potentially positive impacts on Native Hawaiians. Suspension of the use-or-lose requirement for annual permit renewal will allow NWHI Native Hawaiian bottomfish fishery participants to reduce their effort in accordance with markets or other economic or personal conditions without losing their permits. The establishment of new entry criteria for bottomfishing in the Mau Zone will provide managers with a mechanism to maintain effort at target levels through the limited entry program, this effort would be allocated based on historical participation and could potentially increase Native Hawaiian participation. The issuance of CDP permits will allow managers to allocate some of this available effort to qualified CDP applicants, who by definition must be Native Hawaiians. The creation of a precious corals mega-refugia will reduce harvest opportunities for potential future participants (Native Hawaiians and others), as will several other measures for precious corals such as and a prohibition on the harvest of gold corals throughout the NWHI. However at the same time this alternative would replace the existing exploratory area quota with a system designed to allow further exploration under carefully monitored conditions which could lead to increased harvests in the future.

Impacts of Alternative 3 on Native Hawaiians

Alternative 3 (Precautionary Modification 1) would create two additional no-take MPAs in federal waters around the NWHI in which all fishing would be prohibited. These would be in addition to the measures discussed in Alternative 2. The impacts of the measures resulting from Alternative 2 are described above. The two additional no-take MPAs would be anticipated to have adverse impacts on fishery participants (Native Hawaiians and others), through the potential for local depletions of some species as fishery participants will be forced to concentrate their effort in smaller available open areas. These local depletions may reduce catch rates and associated revenues.

Impacts of Alternative 4 on Native Hawaiians

Alternative 4 (Precautionary Modification 2) would create two additional no-take MPAs in federal waters around the NWHI in which all fishing would be prohibited. The northern of these two additional no-take MPAs would be significantly larger than under Alternative 3. These would be in addition to the measures discussed in Alternative 2. The impacts of the measures resulting from Alternative 2 are described above. The two additional no-take MPAs would be anticipated to have adverse impacts on fishing related economic activities through the potential for local depletions of some species as fishery participants (Native Hawaiians and others), will be forced to concentrate their effort in smaller available open areas. These local depletions may reduce catch rates and associated revenues.

Due to the larger size of the additional no-take MPAs, this adverse impact would be larger than under Alternative 3.

Impacts of Alternative 5 on Native Hawaiians

Under Alternative 5 (NMSP Recommendation) direct impacts on Native Hawaiians are anticipated to be adverse, while indirect impacts will be mixed.

Direct impacts (impacts on current and potential future Native Hawaiian fishery participants) are anticipated to be adverse as this alternative will initially restrict and then prohibit commercial fishing in the NWHI as current permit holders age and leave the fishery. In the short-run this may reduce revenues to the 5-10 Native Hawaiians estimated to be currently participating in the NWHI bottomfish fishery as permit holders, vessel operators or crew members. In the long-run it will preclude their continued participation in the fishery, as well that of any others who might participate in this or other NWHI fisheries in the future.

Native Hawaiian fishery participants that will be forced to leave the fishery will face a loss of livelihood and income and are likely to experience feelings of anger and frustration as they believe their fishery to be responsible and highly regulated and having no adverse impacts on NWHI marine resources. Some participants may relocate to fish in the MHI bottomfish fishery but given the stresses on this fishery it may be difficult for them to achieve catch rates or revenues comparable to those in the NWHI. This additional MHI effort may also negatively impact current MHI fishery participants as catch competition may further reduce MHI catch rates.

Alternative 5 would also close the NWHI crustacean, precious corals, and coral reef ecosystem fisheries. Impacts on historical and potential Native Hawaiian participants in these fisheries would be similar to those described above for the bottomfish fishery. Obviously the loss of potential income from the unfished precious corals and coral reef fisheries will be easier to bear than the loss of historical income from the lobster fishery, however all groups are likely to be angry and frustrated at the closure of fisheries which they believe to be responsible and carefully regulated and unlikely to adversely impact NWHI marine resources. This alternative would also foreclose the opportunity for Native Hawaiians to participate in future harvests of NWHI crustaceans, precious corals and coral reef ecosystem resources.

Under Alternative 5 further access by Native Hawaiians to the NWHI will be limited to subsistence fishing which is defined as the use of marine resources for the purposes of perpetuating traditional knowledge, taking responsibility for the environment, and strengthening cultural and spiritual connections to the NWHI - with resources to be used only for direct personal consumption while in the NWHI. Native Hawaiians living on Niihau or Kauai will be allowed to bring back ocean resources for "customary" community sharing. This may engender frustration and anger in Native Hawaiians living on other islands who may not understand or share the thinking underlying this measure.

In addition to the above reactions, some Native Hawaiians are likely to resent being restricted from accessing or fishing in the NWHI as many regard this as their birthright not subject to abrogation. This may include those individuals actually desiring to participate in NWHI fisheries, as well as others in the broader community whose interest is more related to legal and moral issues concerning Native Hawaiian rights in general. Others may be positively impacted by this alternative if they view it as providing necessary and appropriate protection to NWHI waters and marine resources.

Impacts of Alternative 6 on Native Hawaiians

Alternative 6 (Closure of all Federal waters to Bottomfishing) would prohibit bottomfishing in waters in federal waters around the Main and Northwestern Hawaiian Islands. This would be in addition to the measures discussed (for the other fisheries) in Alternative 2. The impacts of the measures resulting from Alternative 2 are described above. This alternative would remove all NWHI and MHI bottomfish effort and landings and their associated revenues.

Both NWHI and MHI bottomfish fishery participants (Native Hawaiians and others) may replace some effort with pelagic trolling as many vessels already participate in both fisheries. This may replace some lost revenue from the bottomfish fisheries but is unlikely to replace all lost revenue as bottomfish are higher valued than are pelagic troll caught fish.

Native Hawaiian fishery participants that will be forced to leave the NWHI fishery will face a loss of livelihood and income and are likely to experience feelings of anger and frustration as they believe their fishery to be responsible and highly regulated and having no adverse impacts on NWHI marine resources.

Native Hawaiian MHI participants would also be forced to leave their fishery, and some will share the feelings of anger and frustration of the NWHI fishery. Others are well aware of the stressed stocks around the MHI and would accept a closure or other measures of limited duration to replenish these stocks. However a permanent closure is likely to strike this more informed group as a precautionary measure that lacks a clear objective. This alternative would also foreclose the opportunity for future harvests of NWHI and MHI bottomfish by Native Hawaiians.

Both NWHI and MHI bottomfish fishery participants may replace some effort with pelagic trolling as many vessels already participate in both fisheries. Given the long travel time and

relatively low value of trolling catches, it is unlikely that participants will continue or increase NWHI pelagic trolling effort.

In addition to the above reactions, some Native Hawaiians are likely to resent being restricted from accessing the NWHI and MHI bottomfish fisheries as many regard this as their birthright not subject to abrogation. This may include those individuals actually desiring to participate in these fisheries, as well as others in the broader community whose interest is more related to legal and moral issues concerning Native Hawaiian rights in general. Others may be positively impacted by this alternative if they view it as providing necessary and appropriate protection to Hawaii's waters and marine resources.

Anticipated Impacts on the Nation

In addition to their economic returns to fishery participants and support industries, Hawaii's fisheries contribute to the nation's economy and people.

Impacts of Alternative 1A on the Nation

Under Alternative 1A (FMP Status Quo), impacts on the nation are anticipated to remain unchanged. Fisheries would continue to be managed under their respective fishery management plans and no new measures would be implemented.

Impacts of Alternative 1B on the Nation

Under Alternative 1B (Reserve Status Quo), impacts on the nation are anticipated to be mixed as reactions to actions such as closing NWHI fisheries will be negative for those who believe the resources are healthy and well managed, and positive for those who believe fishery closures are the best way to manage these resources. In addition, many of the nation's residents are largely uninformed about NWHI fisheries and likely won't have any reaction. The proportion of the population in each group is unknown. This alternative will limit and eventually end the supply of NWHI fishery products to Hawaii which will obviously affect consumers of these products who will have to switch to other species or imported fish. For some this will be unimportant, however others value these fish highly. Reductions or a loss of Hawaii-caught bottomfish such as opakapaka and onaga may also reduce revenues both in Hawaii and in the continental United States to restaurants that depend on these world-renowned "signature" dishes. At the same time, reductions in fishing effort will correspondingly reduce crew and support industry employment opportunities. The closure of NWHI fisheries will negatively impact the nation's social and technical fisheries capital, meaning that not only will a way of life be closed off, but the knowledge of how to successfully fish in these remote fisheries will also be lost. Experience in other Pacific island areas has illustrated that this knowledge can be lost in one generation and often cannot be regained.

Impacts of Alternative 2 on the Nation

Under Alternative 2 (Council Recommendations to Date), no-take and low-use MPAs recommended under the Coral Reef Ecosystems FMP would prohibit or restrict fishing in federal

waters within 50 fm of all NWHI. Because these restrictions would not be anticipated to have adverse impacts to the bottomfish, precious corals or pelagic fisheries, they would not be expected to impact these fisheries' current or potential support industries or the nation's economy or people.

Overall the additional measures that would be implemented under the bottomfish (suspend use-or-lose requirements, new entry criteria, CDP permits) and precious corals (mega-refugia, a prohibition on the harvest of gold corals etc.) FMPs are anticipated to have potentially positive impacts on the nation's economy. Suspension of the use-or-lose requirement for annual permit renewal will allow NWHI bottomfish fishery participants to reduce their effort in accordance with markets or other economic or personal conditions without losing their permits. This means that effort, and therefore landings, will be available when conditions again become favorable and support industries can continue to service the fishing industry. The establishment of new entry criteria for bottomfishing in the Mau Zone will provide managers with a mechanism to maintain effort at target levels through the limited entry program and will again mean that effort, and therefore landings and revenue, remain available at target levels and support industries can continue to service the fishing industry. The issuance of CDP permits will have neutral impacts on the nation's economy as total effort will remain at the target levels established for this fishery.

The creation of a precious corals mega-refugia will reduce potential future harvests as will several other measures for precious corals such as and a prohibition on the harvest of gold corals throughout the NWHI. However at the same time this alternative would replace the existing exploratory area quota with a system designed to allow further exploration under carefully monitored conditions which could lead to increased effort and harvests in the future. This would provide increased revenue to potential fishery participants, support industries and the nation.

Impacts of Alternative 3 on the Nation

Under Alternative 3 (Precautionary Modification 1), impacts would be similar to those described above for Alternative 2. In addition, the two additional no-take MPAs would be anticipated to have adverse impacts on fishery related economic activities through the potential for local depletions of some species as fishery participants will be forced to concentrate their effort in smaller available open areas. These local depletions may reduce catch rates and associated fishery revenues, thus reducing the amount of product available to wholesalers, retailers and other marketers. This in turn will reduce the revenue realized by these industries. Social impacts on the nation are anticipated to be mixed as reactions to creating NWHI MPAs will be negative for those who believe the resources are healthy and well managed, and positive for those who believe closed areas are the best way to manage these resources.

Impacts of Alternative 4 on the Nation

Alternative 4 (Precautionary Modification 2) would create two additional no-take MPAs in federal waters around the NWHI in which all fishing would be prohibited. The northern of these two additional no-take MPAs would be significantly larger than under Alternative 3. These would be in addition to the measures discussed in Alternative 2. The impacts of the measures resulting from Alternative 2 are described above. The two additional no-take MPAs would be

anticipated to have adverse impacts on fishing related economic activities through the potential for local depletions of some species as fishery participants will be forced to concentrate their effort in smaller available open areas. These local depletions may reduce catch rates and associated fishery revenues, thus reducing the amount of product available to wholesalers, retailers and other marketers. This in turn will reduce the revenue realized by these industries. Due to the larger size of the additional no-take MPAs, this adverse impact would be larger than under Alternative 3.

Social impacts on the nation are anticipated to be mixed as reactions to creating NWHI MPAs fisheries will be negative for those who believe the resources are healthy and well managed, and positive for those who believe closed areas are the best way to manage these resources.

Impacts of Alternative 5 on the Nation

Alternative 5 (NMSP Recommendation) would apply to both state and federal waters and would prohibit harvests of precious corals and crustaceans. It would allow limited commercial bottomfish/pelagic trolling, commercial pelagic trolling, various forms of recreational fishing, and limited Native Hawaiian cultural and subsistence uses through a permitting process.

Bottomfish landings would be capped to those made in 2000 through a series of fathom-based area closures around most NWHI, as well as the imposition of non-transferable vessel quotas and a requirement that landings be in species specific ratios. In this situation, fishery participants are likely to discard those fish for which they are over their quota, while continuing to fish for species for which they are under their quota. However the fact that 2000 landings were well below MSY for this fishery means that it is unlikely that these discards will have an adverse impact on species populations, the NWHI ecosystem or fishery landings. The implementation of area closures may result in local depletions of some species as fishery participants will be forced to concentrate their effort in smaller available open areas. These local depletions may reduce catch rates and associated fishery landings, thus reducing the amount of product available to wholesalers, retailers and other marketers. This in turn will reduce the revenue realized by these industries. The use of fishing caps and vessel specific quotas will have varying impacts depending on each participant's catch record during 2000. Participants who were active and had higher landings will obviously fare better than those who were relatively inactive during 2000, with some in the latter group potentially being left with too small a quota to make fishing worthwhile. As these vessels leave the fishery, revenues to fishery supply shops, fuel, ice, bait and other vendors will be reduced. In addition, reductions in landings will limit the amount of product available to wholesalers, retailers and other marketers and thus reduce their revenue. In the long-run, the non-transferable nature of the vessel quotas means as fishery participants age and leave the fishery, there will be no new entrants to take their place and the fishery will close. Again, as these vessels leave the fishery, revenues to fishery supply shops, fuel, ice, bait and other vendors will be reduced as will revenues to wholesalers, retailers and other fish marketers. This alternative would also foreclose the opportunity for future harvests of NWHI bottomfish.

Alternative 5 would allow some NWHI pelagic trolling to occur within limited areas by individuals who could demonstrate use in the year 2000. Landings would be limited to each individual's 2000 catch. In the short-term this will allow these individuals to continue fishing, in

the long-term they will age and leave the fishery, there will be no new entrants to take their place and this fishery will close. Impacts on fishery and support industry revenues would be similar to those described above for NWHI bottomfish fishery. This alternative would also foreclose the opportunity for future harvests of NWHI pelagic fish.

Alternative 5 would also close the NWHI crustacean, precious corals, and coral reef ecosystem fisheries. Impacts on support industries for these dormant or unfished fisheries would be foregone future opportunities rather than reductions in current revenues.

Impacts on the nation are anticipated to be mixed as reactions to actions such as closing NWHI fisheries will be negative for those who believe the resources are healthy and well managed, and positive for those who believe fishery closures are the best way to manage these resources. In addition, many of the nation's residents are largely uninformed about NWHI fisheries and likely won't have any reaction. The proportion of the population in each group is unknown. This alternative will limit and eventually end the supply of NWHI fishery products to Hawaii which will obviously affect consumers of these products who will have to switch to other species or imported fish. For some this will be unimportant, however others value these fish highly. Reductions or a loss of Hawaii-caught bottomfish such as opakapaka and onaga may also reduce revenues both in Hawaii and in the continental United States to restaurants that depend on these world-renowned "signature" dishes. At the same time, reductions in fishing effort will correspondingly reduce crew and support industry employment opportunities. The closure of NWHI fisheries will negatively impact the nation's social and technical fisheries capital, meaning that not only will a way of life be closed off, but the knowledge of how to successfully fish in these remote fisheries will also be lost. Experience in other Pacific island areas has illustrated that this knowledge can be lost in one generation and often cannot be regained.

Impacts of Alternative 6 on the Nation

Alternative 6 (Closure of all Federal waters to Bottomfishing) would prohibit bottomfishing in waters in federal waters around the Main and Northwestern Hawaiian Islands. This would be in addition to the measures discussed (for the other fisheries) in Alternative 2. The impacts of the measures resulting from Alternative 2 are described above.

This alternative would remove all NWHI and MHI bottomfish effort and landings from federal waters, and their associated revenues realized by fishing support industries.

Impacts on the nation are anticipated to be mixed as reactions to closing Hawaii's bottomfish fisheries will be negative for those who believe the resources are healthy and well managed, and positive for those who believe fishery closures are the best way to manage these resources. In addition, many of the nation's residents are largely uninformed about Hawaii's fisheries and likely won't have any reaction. The proportion of the population in each group is unknown. This alternative will end the supply of Hawaii bottomfish which will obviously affect consumers of these products who will have to switch to other species or imported fish. For some this will be unimportant, however others value these fish highly. The loss of Reductions or a loss of Hawaii-caught bottomfish such as opakapaka and onaga may also reduce revenues both in Hawaii and in the continental United States to restaurants that depend on these world-renowned "signature"

dishes. At the same time, reductions in fishing effort will correspondingly reduce crew and support industry employment opportunities. The closure of Hawaii's bottomfish fisheries will negatively impact the nation's social and technical fisheries capital, meaning that not only will a way of life be closed off, but the knowledge of how to successfully fish in these remote fisheries will also be lost. Experience in other Pacific island areas has illustrated that this knowledge can be lost in one generation and often cannot be regained.

Anticipated Impacts to Other Fisheries

All alternatives that limit or prohibit the use of Hawaii's marine resources will likely result in substitution to other species or sources of fish by consumers. Increased consumption of fish imported from poorly managed, unsustainable, or overfished fisheries will negatively impact these fisheries, as well as their participants, communities, and nations. On the other hand, increased and focused consumption of fish from well managed and sustainable fisheries will provide further economic incentives for such practices.

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