



PROPOSED NORTHWESTERN HAWAIIAN ISLANDS NATIONAL MARINE SANCTUARY



**Advice and Recommendations on Development of
Draft Fishing Regulations Under the
National Marine Sanctuaries Act Section 304(a)(5)**

September 20, 2004



EXECUTIVE SUMMARY

The National Marine Sanctuary Program of the National Oceanic and Atmospheric Administration is in the process of designating the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve as a national marine sanctuary. In accordance with Section 304(a)(5) of the National Marine Sanctuaries Act, the National Marine Sanctuary Program is providing the Western Pacific Regional Fishery Management Council the opportunity to prepare draft fishing regulations consistent with the purposes and policies of the National Marine Sanctuaries Act and Goals and Objectives Statement of the proposed sanctuary. Advice and recommendations, developed by the National Marine Sanctuary Program to assist the Western Pacific Regional Fishery Council in drafting these fishing regulations, include: the Goals and Objectives Statement for the proposed sanctuary (Attachment A), model fishing regulations for the fishing alternative considered most consistent with the Goals and Objectives Statement (Attachment B), results of the fishing alternatives analysis (Attachment C), and resource and use statistics used to evaluate these fishing alternatives (Attachment D).

Goals and Objectives Statement

The Goals and Objectives Statement for the proposed sanctuary is provided in Attachment A. The Goals and Objectives Statement describes the vision, mission, and management principles, and goals and objectives for the proposed sanctuary. This statement was finalized based on the advice of the Reserve Advisory Council, partner agencies and programs, the public, and analysis of information and data on various resources over the course of approximately one year beginning in July of 2003. Of the seven management goals identified, management goal 7 relates specifically to fishing. The Goals and Objectives Statement, together with the policies and purposes of the National Marine Sanctuaries Act served as the basis for the analysis of fishing alternatives and development of model fishing regulations.

Model Regulations

Model regulations for the proposed sanctuary are provided in Attachment B. They are based on the fishing alternative 3, which is considered most consistent with the National Marine Sanctuaries Act and the Goals and Objectives Statement for the proposed sanctuary. Fishing alternative 3 is one of seven fishing alternatives evaluated in Attachment C.

Fishing Alternatives Analysis

The fishing alternatives analysis is provided in Attachment C. This analysis involved the development of a range of fishing alternatives with zoning options, including alternatives provided by the Reserve Advisory Council and Western Pacific Regional Fishery Management Council, and are characterized by varying degrees of restrictions on type and location of fishing activities. A resource assessment and a series of screening processes were conducted to evaluate the fishing alternatives and zoning options. Based on this analysis, the National Marine Sanctuary Program identified fishing alternative 3 as the most consistent with the purposes and



policies of the National Marine Sanctuaries Act and the Goals and Objectives Statement for the proposed sanctuary.

Fishing Alternative Considered Most Consistent with the National Marine Sanctuaries Act and Goals and Objective Statement for the Proposed Sanctuary

Fishing alternative 3 (described in Attachment C) addresses ecosystem protection mandates of the National Marine Sanctuaries Act, while minimizing socioeconomic and cultural impacts. Fishing activity prohibitions and restrictions contained in fishing alternative 3 are summarized below.

Fishing activities prohibited sanctuary-wide include:

- Pelagic longlining
- Precious coral fishing
- Coral reef species fishing
- Non-subsistence crustacean fishing

Fishing activities allowed by permit but restricted through zoning and other means include:

- Commercial bottomfish/pelagic trolling fishing
- Commercial pelagic trolling
- Recreational catch and keep fishing
- Recreational catch and release fishing
- Sustenance fishing
- Native Hawaiian cultural and subsistence uses

Zoning employs the use of Sanctuary Preservation Areas and Ecological Reserves as described below:

- Sanctuary Preservation Areas are areas of the proposed sanctuary that encompass discrete, biologically important areas within which uses are subject to conditions, restrictions and prohibitions, including access restrictions, to avoid concentrations of uses that could result in declines in species populations or habitat, to reduce conflicts between uses, to protect areas that are critical for sustaining important marine species or habitats, or to provide opportunities for scientific research.
 - Sanctuary Preservation Areas are the most restrictive zone.
 - All commercial and recreational fishing is prohibited within the boundaries of Sanctuary Preservation Areas.
 - Sanctuary Preservations Areas cover 13,999 square kilometers or 4 percent of the total proposed sanctuary area and are based largely on existing Reserve Preservation Area boundaries modified as deemed appropriate.



- Ecological Reserves are areas of the proposed sanctuary consisting of contiguous, diverse habitats within which uses are subject to conditions, restrictions and prohibitions, including access restrictions, intended to minimize human influences, to provide natural spawning, nursery, and permanent residence areas for the replenishment and genetic protection of marine life, and also to protect and preserve natural assemblages of habitats and species within the sanctuary.
 - All commercial fishing is prohibited in ecological reserves.
 - Two ecological reserves are proposed covering French Frigate Shoals and surrounding banks and all marine waters surrounding Lisianski Island and atolls and banks to the northwest.
 - Together, Ecological Reserves cover an area 166,488 sq km or 47 percent of the total proposed sanctuary and provide an important level of protection to French Frigate Shoals and the Northwestern atolls in the chain from Lisianski Island to the Kure Atoll. French Frigate Shoals and Pearl and Hermes Atoll, were ranked the two highest areas in terms of ecological value.

The combination of Ecological Reserves and Sanctuary Preservation Areas provide significant protection for highly sensitive and vulnerable resource areas.

- Of the 3,867 sq km of shallow water coral habitat, 88 percent is included in Ecological Reserves and Sanctuary Preservation Area zones.
- Of the 13,548 sq km of habitat within 100 fm, 53 percent is included in Ecological Reserve and Sanctuary Preservation Area zones.
- Monk seal foraging ranges are extensive, covering 48,156 sq km, of which 54 percent is included in Ecological Reserve and Sanctuary Preservation Area zones.
- Similarly, 58 percent of the lobster habitat is protected. The foraging range for highly vulnerable juvenile boobies is completely protected in the Ecological Reserve and Sanctuary Preservation Area zones.
- In addition, the outer boundary of the Reserve would be considered for expansion at the most northwestern extent (northwest of Kure Atoll) to include newly identified precious coral beds and monk seal foraging areas.

Fishing alternative 3 incorporates the development of an ecosystem-based management strategy to provide safeguards against uncertainties and to establish new standards that must be met for fishing to continue. The development and implementation of an ecosystem-based management approach to fisheries management requires making a long-term commitment to a multi-species perspective, understanding ecosystem processes, and monitoring the effects that fishing activities have, not only on target species but to all components of the ecosystem.

In order to move toward this management approach, a task force would be formed to develop an ecosystem-based fishery management strategy where limited commercial and recreational fishing will be allowed using ecosystem-based principles to consider impacts to non-target species, trophic interactions, community composition, habitat impacts, and other ecosystem parameters. The task force will include jurisdictional agencies and partner organizations and draw upon all relevant scientific, management and technical expertise.



The ecosystem-based fishery management strategy would address necessary changes to fishery management practices in order to achieve the following:

- Maintenance of the natural character of the ecosystem and ecosystem processes and functions, i.e., ecological integrity with indicators that include maintenance of full age structure of population for all fished species and discards
- Minimal alteration of fished habitats, with indicators that include observations to establish baseline and monitoring to compare fished and unfished areas
- Minimization of interactions with listed species, with indicators that include not exceeding incidental takes or other measures stated in biological opinions prepared pursuant to the Endangered Species Act
- No increase in the aggregate levels of fishing take based on established aggregate take amounts

The task force would identify necessary changes in fisheries management practices and recommend solutions. Some of the changes that must be evaluated will include but are not limited to the following:

- Changing the goal of fishery management from maximizing yield to managing for fish abundance and long-term conservation and protection of coral reef ecosystems in the Northwestern Hawaiian Islands
- Including as fisheries management indicators those that address not only target species but other components of the ecosystem including life history stages of target and non-target species, trophic interactions, community composition, biodiversity, and other measures of ecosystem status
- Increasing the level of “insurance,” especially in the face of uncertainties, by providing thresholds for fisheries and ecosystem indicators upon which management decisions can be made and action taken
- Identifying innovative management and outreach approaches, including cultural and socioeconomic incentives to promote and sustain higher standards for fishing through fisheries cooperative approach among permittees; exploring share-based fishery management systems under specified catch limits; exploring purchase of fishing rights and or vessels and gear in the event a vessel owner chooses to exit the fishery; and identifying alternative uses for fishing vessels consistent with the proposed sanctuary
- Ensuring that heritage, inheritance, and bequest values (future opportunity for sustenance, subsistence, cultural practices) are met and sustained
- Evaluating the effectiveness of marine protected areas as a management tool

The proposed collaborative multi-agency arrangements for strategy development and implementation set the stage for innovative management measures and models that can be applied in the proposed sanctuary and exported to the main Hawaiian Islands and other areas.



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ATTACHMENT A

PROPOSED NORTHWESTERN HAWAIIAN ISLANDS NATIONAL MARINE SANCTUARY

Goals and Objectives Statement

Sanctuary Vision:

That the vast coral reefs, ecosystems, and resources of the Northwestern Hawaiian Islands (NWHI) -- unique in the world -- be healthy and diverse forever.

Sanctuary Mission:

Carry out coordinated and integrated management to achieve the primary purpose of strong and long-term protection of the marine ecosystems in their natural character, as well as the perpetuation of Native Hawaiian cultural practices and the conservation of heritage resources of the Northwestern Hawaiian Islands.

Sanctuary Management Principles:

The sanctuary shall be managed in a manner that:

- 1. Is consistent with the Vision and Mission;*
- 2. Recognizes that the resources of the Northwestern Hawaiian Islands are held as a public trust;*
- 3. Incorporates and integrates best practices, available science, traditional knowledge, and innovative management techniques in order to have a comprehensive approach to both the ecological and social environment;*
- 4. Honors the significance of the region for Native Hawaiians;*
- 5. Enhances public awareness and appreciation of the unique character and marine environments of the NWHI;*
- 6. Errs on the side of resource protection when there is uncertainty in available information on the impacts of an activity;*
- 7. Authorizes only uses consistent with the primary purpose of resource protection and applicable law;*
- 8. Coordinates with federal, state, and local governments, Native Hawaiians, and appropriate organizations;*
- 9. Carries out appropriate and effective enforcement and surveillance and associated public outreach.*



Sanctuary Goals and Objectives:

Goal 1: Protect, preserve, maintain, and where appropriate restore the natural biological communities, including habitats, populations, native species, and ecological processes, of the Sanctuary as a public trust for current and future generations.

Objectives:

- 1a. Develop and implement a comprehensive management plan that integrates best practices, available science, traditional knowledge, and innovative management techniques, and addresses both short-term and long-term resource protection needs.
- 1b. When there is uncertainty in available information regarding the potential impacts of any activity, err on the side of resource protection.
- 1c. Develop and implement the necessary prohibitions, rules, regulations, and penalty schedules to achieve the primary purpose of resource protection and address the needs of the Sanctuary.
- 1d. Develop and implement a surveillance and enforcement program needed to ensure compliance with regulations.
- 1e. Cooperate with regional and global programs encouraging conservation of marine resources.

Goal 2: Provide for comprehensive and coordinated conservation and management that recognizes and complements existing jurisdictional boundaries and management regimes and involves stakeholder communities.

Objectives:

- 2a. Develop and implement regional and global approaches, interagency agreements, and processes with partners to address key cross-jurisdictional activities such as education, research and monitoring, enforcement and surveillance, and access.
- 2b. Create a permit, notification, and tracking system for access and use that is compatible and coordinated with partner agencies.
- 2c. Coordinate all activities to minimize impacts to ecosystems, avoid redundant or duplicative efforts, and to achieve efficient use of agency resources.
- 2d. Engage representative stakeholder communities and the public in seeking advice for effective management.

Goal 3: Manage, minimize, or prevent negative human impacts by allowing access only for those activities that do not threaten the natural character or biological integrity of any ecosystem of the region.

Objectives:

- 3a. Allow access only for activities consistent with long-term ecosystem protection.
- 3b. The management system shall continue to allow Native Hawaiian cultural, religious, and subsistence uses.
- 3c. Develop a marine zoning system that prescribes further limits on use to enhance



ecosystem protection and ease of management and enforcement.

- 3d. Develop a permitting and tracking system to identify, evaluate, and monitor activities, access, and uses in order to ensure consistency with long-term ecosystem protection.
- 3e. Develop other measures as may be necessary to ensure long-term ecosystem protection.
- 3f. Work with the appropriate domestic and international agencies to adopt a notification requirement for transiting non-military vessels and the designation of special maritime zones on nautical charts.

Goal 4: Enhance public awareness, understanding, and appreciation of the marine environment and cultural and maritime heritage resources.

Objectives:

- 4a. Develop public outreach and education programs with partners to raise public awareness of NWHI marine ecosystems and the need to protect them and to effectively communicate access and use restrictions.
- 4b. In order to minimize the use of and impact to the region, plan and establish programs that emphasize the concept of bringing the place to the people, rather than people to the place.
- 4c. Increase the awareness of marine conservation in the NWHI by emphasizing the global nature of threats to the ecosystems and the importance of the region to the state, the nation, and the world.
- 4d. Enhance the effectiveness of education programs and public outreach by incorporating Native Hawaiian culturally based themes and traditional approaches to learning, multiple perspectives, histories, and stories of the region.

Goal 5: Support Native Hawaiian cultural, religious, and subsistence practices that are consistent with the long-term conservation and protection of the region.

Objectives:

- 5a. Build capacity within the Sanctuary program to develop a working relationship with Native Hawaiians to facilitate their participation in the management of the Sanctuary.
- 5b. Develop a plan for Native Hawaiian access and use in the NWHI collaboratively with Native Hawaiians and regional partners.
- 5c. Increase understanding of Native Hawaiian histories and cultural practices in the NWHI through research and oral traditions.
- 5d. Integrate Native Hawaiian traditional knowledge, values, and perspectives into management and education programs.

Goal 6: Support, promote, and coordinate research and long-term monitoring that improves management decision-making and is consistent with the conservation and protection of the region.

Objectives:

- 6a. Identify, assess, prioritize, and authorize ecological, historic, cultural, and socioeconomic research and monitoring necessary for effective management of the region.
- 6b. Coordinate with regional and national agencies to make vessels and other resources available for conservation and research activities.



- 6c. Compile existing research and avoid duplication by collaborating and coordinating with jurisdictional partner agencies and universities.
- 6d. Develop the ability to quickly assess and respond to unexpected, rapid ecological changes that have occurred as a result of storm events, dramatic climate and temperature shifts, and other occurrences.
- 6e. Establish criteria for cultural research activities through consultation with the Native Hawaiians.
- 6f. Work with partners and researchers to make NWHI research available and accessible to the public in a timely manner.

Goal 7: Maintain ecosystem integrity by limiting and controlling fishing activities using an ecosystem-based management approach. Maximize ecosystem protection while minimizing adverse socioeconomic impacts. Limit fishing activities to areas that minimize or prevent interactions with corals, seabirds, endangered Hawaiian monk seals, and other protected wildlife, or that do not threaten the natural character or biological integrity of any ecosystem of the region.

Objectives: As appropriate to maintain the natural character or biological integrity of any ecosystem of the region:

- 7a. Prohibit non-subsistence crustacean fishing.
- 7b. Prohibit commercial precious coral fishing.
- 7c. Prohibit harvest of all coral species, live rock, all aquaria species and live fish trade species, and algae, sponges, and other invertebrates.
- 7d. Allow recreational fishing for pelagic species except within sensitive habitats.
- 7e. Allow bottomfish fishing to continue except within sensitive habitats.
- 7f. Allow commercial pelagic fishing using handline, pole and line and trolling gear except within sensitive habitats.
- 7g. Prohibit subsistence use within the sanctuary except for Native Hawaiian subsistence use.
- 7h. Allow sustenance fishing for pelagic and bottomfish species using pole and line, trolling and handline methods with the Sanctuary except within sensitive habitats.
- 7i. Allow spearfishing without the use of SCUBA for pelagic species except within sensitive habitats.
- 7j. All fishing not specifically allowed shall be prohibited.
- 7k. When there is uncertainty in available information regarding the potential impacts of any fishing activity, err on the side of resource protection.



ATTACHMENT B

PROPOSED NORTHWESTERN HAWAIIAN ISLANDS NATIONAL MARINE SANCTUARY

Model Regulatory Language and Definitions

MODEL REGULATIONS FOR FISHING WITHIN A PROPOSED NORTHWESTERN HAWAIIAN ISLANDS NATIONAL MARINE SANCTUARY DEVELOPED FOR CONSIDERATION UNDER SECTION 304(a)(5) OF THE NATIONAL MARINE SANCTUARIES ACT

These model regulations are based on Fishing Alternative 3 of the draft document “Advice and Recommendations on Development of Draft Fishing Regulations Under the National Marine Sanctuaries Act Section 304(a)(5)”.

Subpart S – Northwestern Hawaiian Islands National Marine Sanctuary

[Note: These model regulations are specific, with noted exceptions, to fishing activities within the Sanctuary. Proposed regulations for the Sanctuary will include non-fishing restrictions and other provisions not relevant for these model regulations.]

I. – Purpose

II. – Definitions

III. – Prohibited activities – Sanctuary wide

IV. – Permits

V. – Fishing Activities, Ecosystem Management Plans, and Interim Protection and Conservation Measures

I– Purpose. [Note: This section is the general introductory language to the proposed NWHI regulations and is included in order to provide context for the model fishing regulations in sections II. – V.]

(a) The regulations in this subpart implement the comprehensive management plan for the Northwestern Hawaiian Islands National Marine Sanctuary (Sanctuary). The Sanctuary is designated to protect, preserve, restore, enhance and manage the conservation, ecological, recreational, research, educational, historical, cultural, and aesthetic resources and qualities of



the area. The regulations in this part are intended to protect, restore and enhance the resources of the Sanctuary, maintain the health of the ecosystems and natural assemblages of living resources for future generations, provide places for species dependent on such living resources to survive and propagate, and achieve the goals and objectives of the Sanctuary and the purposes and policies of the National Marine Sanctuaries Act.

- (b) Section 304(e) of the National Marine Sanctuaries Act requires the Secretary to review management plans and regulations every five years, and make necessary revisions. The Sanctuary management plan and these regulations will be reviewed at least every five years to evaluate the substantive progress toward implementing the plan and sanctuary goals and objectives, especially the effectiveness of site-specific management techniques and strategies, and this review will include a prioritization of management objectives. The management plan and these regulations will be revised as necessary to fulfill the purposes and policies of the designation and the National Marine Sanctuaries Act.

II – Definitions.

Act means the National Marine Sanctuaries Act.

Administrator means the Department of Commerce Under Secretary for Oceans and Atmosphere/Administrator, National Oceanic and Atmospheric Administration, or his or her designee.

Bandit gear means vertical hook and line gear with rods that are attached to the vessel when in use. Lines are retrieved by manual, electric, or hydraulic reels.

Bottomfishing means fishing for bottomfish species using hook-and-line method of fishing where weighted and baited lines are lowered and raised with electric, hydraulic, or hand-powered reels (bandit gear).

Bottomfish Species means *Aphareus rutilans* (lehi), *Aprion virescens* (uku), *Epinephelus quernus* (hapu'u), *Etelis carbunculus* (ehu/ulaula), *Etelis coruscans* (onaga/ulaula koae), *Pristipomoides filamentous* (opakapaka), *Pristipomoides sieboldii* (kalekale), and *Pristipomoides zonatus* (gindai).

Caranx means a genus of finfish species *C. ignobilis*, *C. melampygus*, *C. lugubris*, *C. sexfasciatus*.

Commercial Fishing means fishing in which the fish harvested, either in whole or in part, are intended to enter commerce or enter commerce through sale, barter or trade.

Director means the Director of NOAA's National Marine Sanctuary Program, or his or her designee.

Ecological Reserve means an area of the Sanctuary consisting of contiguous, diverse habitats, within which uses are subject to conditions, restrictions and prohibitions, including, but not



limited to, access restrictions, intended to minimize human influences, to provide natural spawning, nursery, and permanent residence areas for the replenishment and genetic protection of marine life, and to protect and preserve natural assemblages of habitats and species within areas representing a broad diversity of resources and habitats found within the Sanctuary. Specific coordinates for Ecological Reserves within the Sanctuary are found at Appendix A to this subpart.

[For purposes of these model regulations, coordinates for the Ecological Reserves are based on Fishing Alternative 3 of the Draft Document “*Advice and Recommendations on Development of Draft Fishing Regulations Under the National Marine Sanctuaries Act Section 304(a)(5)*”.]

Ecosystem-based management approach means Sanctuary management that carefully considers impacts to all species and trophic interactions. It includes maintenance of biological communities and the protection and, where appropriate, restoration and enhancement of natural habitats, populations and ecological processes. The approach emphasizes ecosystem values and recognizes the importance of species interactions and conservation of habitats, and permits resource utilization in a manner that is fully consistent with the National Marine Sanctuaries Act’s primary objective of resource protection.

Fish means finfish, mollusks, crustaceans and all other forms of marine and plant life other than marine mammals or birds.

Magnuson-Stevens Act means the Magnuson-Stevens Fishery Conservation and Management Act.

Native Hawaiian means any individual who is a descendent of the aboriginal people who, prior to 1778, occupied and exercised sovereignty in the area that now constitutes the State of Hawaii.

Native Hawaiian Subsistence Use means the use of marine resources by Native Hawaiians for the purposes of perpetuating traditional knowledge, taking responsibility and caring for the environment, and strengthening cultural and spiritual connections to the NWHI. Under this definition, resources are used only for direct personal consumption while in the Sanctuary. It does not include the sale of any marine resources. This definition also includes the customary practice by Native Hawaiian Niihau and Kauai families traveling to the NWHI and bringing back ocean resources for community sharing.

Pelagic Species means finfish *Coryphaena* spp., *Acanthocybium solandri*; *Makaira mazara*, *M. indica*; *Tetrapturus audax*, *T. angustirostris*; *Xiphias gladius*, *Istiophorus platypterus*; *Thunnus alalunga*, *T. obesus*, *T. albacares*, *T. thynnus*; *Katsuwonus pelamis*; *Euthynnus affinis*; *Lampris* spp.; *Gempylidae*; Family *Bramidae*; *Auxis* spp.; *Scomber* spp.; *Allothunus* spp.

Recreational Fishing means fishing for sport or pleasure, in which catch is not bartered, traded or sold.

Sanctuary means the Northwestern Hawaiian Islands National Marine Sanctuary.



Sanctuary Preservation Area (SPA) means discrete, biologically important areas of the Sanctuary within which uses are subject to conditions, restrictions and prohibitions, including, but not limited to, access restrictions, to avoid concentrations of uses that could result in declines in species populations or habitat, to reduce conflicts between uses, to protect areas that are critical for sustaining important marine species or habitats, or to provide opportunities for scientific research. Specific coordinates for Sanctuary Preservation Areas within the Sanctuary are found in appendix B to this subpart. [For purposes of these draft model regulations, coordinates are based on Fishing Alternative 3 of the Draft Document “*Advice and Recommendations on Development of Draft Fishing Regulations Under the National Marine Sanctuaries Act Section 304(a)(5)*”.]

Secretary means Secretary of Commerce or his or her designee.

Seriola means a genus of finfish species *S. dumerili*, *S. rivoliana*.

Scuba means self-contained underwater breathing apparatus and includes, but is not limited to, open circuit and re-breather technology.

Spearfishing means fishing underwater with a sharp, pointed, or barbed instrument on a shaft that is operated manually or shot from a gun or sling. It does not include explosive devices such as powerheads.

Sustenance Fishing means fishing in which all catch is consumed in the Sanctuary, and that is incidental to an activity permitted under these regulations.

Trolling means using one or more lines with hooks or lures attached drawn through the water behind a moving vessel.

VMS (Vessel Monitoring System) means the hardware and software used by vessels to track and transmit their positions.

III – Prohibited activities – Sanctuary wide.

Except as specified in sections IV - V below, the following activities are prohibited and thus are unlawful for any person to conduct or to cause to be conducted:

(1) Except for passage without interruption through the Sanctuary, or as necessary for valid law enforcement purposes, entering the Sanctuary without a valid access, research, education, Native Hawaiian, or manager’s permit issued pursuant to section IV, or a valid bottomfish permit issued under the Magnuson-Stevens Act, as provided in section V.

(2) Except as necessary for valid law enforcement purposes, entering or leaving the Sanctuary without notifying the Sanctuary Manager by telephone, radio, facsimile or electronic mail:

(A) no less than 72 hours but no more than one week before entering the Sanctuary; and



(B) no more than 12 hours after leaving the Sanctuary.

[Specific Contact Information would be included].

(3) Possessing, moving, harvesting, removing, taking, disturbing, breaking, cutting, spearing or otherwise injuring any coral, fish, marine invertebrate, bird, marine reptile, marine mammal, algae, or other living or dead organism, or part thereof, including shells, or bottom formation, or attempting any of these activities, except as provided in sections IV – V.

(4) Fishing by any means, except as provided in sections IV and V.

(5) Failing to have on board or to use a VMS unit.

[Note: Pursuant to section 305 of the NMSA, all regulations are applied in accordance with generally recognized principles of international law, and in accordance with treaties, conventions, and other agreements to which the United States is a party.]

IV. – Permits.

(a) Except for passage without interruption through the Sanctuary or as necessary for valid law enforcement purposes, a person may enter the Sanctuary, or conduct an activity otherwise prohibited by section III of this subpart, only if authorized by a valid access, research, education, Native Hawaiian, or managers permit issued pursuant to this section, or a valid bottomfish permit issued under the Magnuson-Stevens Act.

(b) Any person entering the Sanctuary pursuant to paragraph (a) of this section shall provide the Sanctuary Manager notice pursuant to section III(2) of this subpart.

(c) *Permit procedures and criteria.* [Example based on other sanctuary regulations]

(1) A person may conduct an activity prohibited by section III if conducted in accordance with scope, purpose, manner, terms and conditions of an access, research, education, Native Hawaiian subsistence, or manager's permit issued under this section, or a bottomfish permit issued under the Magnuson-Stevens Act.

(2) Applications for such permits should be addressed to the Director and sent to [Sanctuary Manager at Sanctuary address].

(3) The Director, at his or her discretion may issue a permit to conduct an activity prohibited by section III, subject to such terms and conditions as he or she deems appropriate (including, but not limited to, requiring that any data or information obtained under the permit be made available to the public, a NOAA official be allowed to observe any activity conducted under the permit, or the permit holder submit one or more reports on the status, progress or results of any



activity authorized by the permit), if the Director finds that the activity will have only negligible short-term adverse effects on Sanctuary resources and qualities and:

(A) for access permits –for entering the Sanctuary for the purpose of conducting activities not otherwise prohibited by section III of this subpart;

(B) for research permits -- will further research related to Sanctuary resources and qualities;

(C) for education permits -- will further the educational value of the Sanctuary;

(D) for Native Hawaiian subsistence permits -- for the purposes of perpetuating traditional knowledge, taking responsibility and caring for the environment, and strengthening cultural and spiritual connections to the NWHI; or

(E) for manager’s permits -- will further management activities of the Sanctuary consistent with the Sanctuary Management Plan.

(4) *Factors:* In deciding whether to issue a permit, the Director may consider such factors as: the professional qualifications and financial ability of the applicant as related to the proposed activity; the duration of the activity and the duration of its effects; the appropriateness of the methods and procedures proposed by the applicant for the conduct of the activity; the extent to which the conduct of the activity may diminish or enhance Sanctuary resources and qualities; the cumulative effects of the activity; and the end value of the activity. In addition, the Director may consider such other factors as he or she deems appropriate.

(5) *Public Display:* A person issued any Sanctuary permit shall display the permit or a copy thereof on board all vessels or aircraft used in the conduct of the activity.

V. – Fishing Activities, Ecosystem Fishery Management Plans, and Interim Protection and Conservation Measures.

(a) *Fishing Activities:*

(1) *Commercial bottomfishing:* Except within Ecological Reserves or Sanctuary Preservation Areas, a person holding a valid bottomfish permit issued under the Magnuson-Stevens Act may conduct commercial fishing for bottomfish species and associated fishing with handline or trolling gear for pelagic species in the following areas of the Sanctuary:

(A) east of 165 degrees west longitude;

(B) between 167.5 degrees and 173.5 degrees west longitude.

(2) *Commercial Pelagic (handline or trolling gear only):* Except within Ecological Reserves or Sanctuary Preservation Areas, a person may conduct commercial fishing with handline or trolling gear for pelagic species pursuant to and in accordance with a valid Sanctuary access



permit, as provided under section IV(a) of this subpart, in the area of the Sanctuary east of 165 degrees west longitude

(3) *Recreational Fishing*: Except within Sanctuary Preservation Areas, a person may conduct recreational fishing for pelagic species and fish belonging to the genera Caranx and Seriola with trolling, pole and line or handline gear, equipped with artificial lures and single, barbless hooks, pursuant to and in accordance with a valid Sanctuary access permit, as provided under section IV(a) of this subpart, in the following areas of the Sanctuary:

(A) east of 165 degrees west longitude, *provided that all fish belonging to the genera Caranx and Seriola are released*;

(B) west of 175 degrees west longitude, *provided that all catch is released*.

(4) *Sustenance Fishing*: Except within Sanctuary Preservation Areas, a person may conduct sustenance fishing for pelagics and bottomfish only, using trolling, pole and line and handline gear, incidental to activities conducted pursuant to and in accordance with a valid permit as provided under section IV(a) of this subpart.

(5) *Native Hawaiian Subsistence*: Native Hawaiian subsistence fishing may occur pursuant to and in accordance with a valid Sanctuary Native Hawaiian subsistence permit, as provided under section IV(a) of this subpart.

(6) *Spearfishing*: Except within Sanctuary Preservation Areas, a person may spearfish (without use of Scuba or any other means of assisted breathing) for pelagic species east of 165 degrees west longitude pursuant to and in accordance with a valid Sanctuary access permit as provided under section IV(a) of this subpart.

(7) *Research*: A person may conduct fishing for research purposes pursuant to and in accordance with a valid Sanctuary research permit as provided under section IV(a) of this subpart.

(8) *Educational*: A person may conduct fishing for educational purposes pursuant to and in accordance with a valid Sanctuary education permit as provided under section IV(a) of this subpart.

(b) All activities under paragraph (a) of this section are subject to the notice requirements of section IV(b).

(c) *Ecosystem Fishery Management Plans*

(1) For those fishing activities allowed under paragraph (a) of this section, fishing in the Sanctuary will be based on the ecosystem-based management approach.

(2)(A) For those fishing activities allowed under paragraph (a) of this section, the Western Pacific Fishery Management Council may recommend, and the Secretary may adopt and



implement pursuant to the Magnuson-Stevens Act, a Sanctuary ecosystem fishery management plan and implementing regulations. The Sanctuary ecosystem fishery management plan shall address and make necessary changes to fishery management measures established in paragraph (d) of this section in order to implement the ecosystem-based management approach within the Sanctuary, including:

- (i) maintenance of the natural character of the ecosystem and ecosystem processes and functions, i.e., ecological integrity with indicators that include, but are not limited to, maintenance of full age structure of population for all species including, but not limited to, fished species and discards;
- (ii) minimal alteration of fished habitats, with indicators that include, but are not limited to, observations to establish baseline and monitoring to compare fished and unfished areas;
- (iii) minimization of interactions with listed species, with indicators that include, but are not limited to, not exceeding incidental takes or other measures stated in biological opinions prepared pursuant to the Endangered Species Act; and
- (iv) no increase in the aggregate levels of fishing take based on the aggregate take amounts established pursuant to paragraph (d) of this section.

(B) In developing a recommended Sanctuary ecosystem fishery management plan, the Western Pacific Fishery Management Council shall consider any recommendations from the Sanctuary Fishery Ecosystem Task Force established pursuant to paragraph (4) of this section, provided that the Director finds such recommendations are consistent and compatible with the Act and the goals and objectives of the Sanctuary.

(C) Amendments to the Sanctuary ecosystem fishery management plan shall be developed, approved, and implemented subject to the same requirements and procedures applicable to its initial development, approval and implementation pursuant to this section.

(3)(A) Any Sanctuary ecosystem fishery management plan, plan amendments or implementing regulations for the Sanctuary must fulfill the purposes and policies of the Act and the goals and objectives of the Sanctuary. Such plan, amendments or regulations must also be consistent with the national standards of section 301(a) of the Magnuson-Stevens Act (16 U.S.C. 1851) to the extent that the standards are consistent and compatible with the goals and objectives of the Sanctuary.

(B) In approving an ecosystem fishery management plan for the NWHI Sanctuary, the Secretary shall consider the impacts of fishing activities, gear and methods on the ecosystem(s) in which the activity would be conducted, including, but not limited to, corals, seabirds, endangered Hawaiian monk seals, and other protected wildlife, or other Sanctuary resources.

(4)(A) The Secretary shall establish a Sanctuary Fishery Ecosystem Task Force (Task Force) to develop ecosystem-based fishery recommended strategies under this section, including recommendations on research and management priorities, ecosystem and fisheries indicators, and annual 5-year fishing action thresholds for management decision-making. The task force shall be co-chaired by the NWHI Sanctuary Manager and the Regional Administrator of the NOAA



Fisheries Pacific Islands Regional Office, and will include but will not be limited to representatives from:

- the Western Pacific Fishery Management Council;
- the NWHI Sanctuary Advisory Council;
- the State of Hawaii;
- the U.S. Fish and Wildlife Service;
- the U.S. Coast Guard; and
- other organizations with relevant expertise.

(B) The Task Force shall submit its recommendations to the Secretary within one year of the effective date of these regulations. The Director shall review the strategies for consistency and compatibility with the Act and goals and objectives for the Sanctuary.

(d) *Interim Protection and Conservation Measures.* Pending determination by the Secretary that the Sanctuary ecosystem fishery management plan developed pursuant to paragraph (c) of this section fulfills the purposes and polices of the Act and the goals and objectives for the Sanctuary, and pending adoption and implementation of the Sanctuary ecosystem fishery management plan by the Secretary, the following measures shall apply to the fishing allowed in the Sanctuary under paragraph (a) of this section:

(1) Bottomfishing: (A) Commercial bottomfishing and associated fishing for pelagics by handline or trolling may be conducted only by those persons with a currently valid Magnuson-Stevens Act permit that was in effect on December 4, 2000; and

(B) Commercial bottomfishing and associated fishing for pelagics by handline or trolling shall be limited to an amount equal to the Magnuson-Stevens Act permittee's average catch in pounds for bottomfish [definition includes certain pelagics] and the species catch ratio over the best three of the five calendar years from December 4, 1995 to December 4, 2000 in which the permittee was active in the fishery, as determined by the Director.

(C) Two Native Hawaiian Bottomfishing Magnuson-Stevens Act permits shall be allowed to operate in the Sanctuary east of 165 degrees west longitude for bottomfish.

(D) There shall be no increase in the number of bottomfish permits above the number of such permits that were in effect on December 4, 2000.

(2) Commercial fishing for pelagics by handline or trolling – the annual aggregate level of harvest shall be the individual's take the year from December 4, 1999 to December 4, 2000, as determined by the Director.



APPENDIX A: ECOLOGICAL RESERVES BOUNDARY COORDINATES

The following Ecological Reserves are located within the Sanctuary:

[For purposes of these draft model regulations, coordinates are based on Fishing Alternative 3 of the Draft Document “*Advice and Recommendations on Development of Draft Fishing Regulations Under the National Marine Sanctuaries Act Section 304(a)(5)*”.

Ecological Reserve 1 is defined by the area between 173.5° W longitude and 179.7° W longitude within the sanctuary.

Ecological Reserve 2 is defined by the area between 165° W longitude and 167.5° W longitude within the sanctuary.

APPENDIX B: SANCTUARY PRESERVATION AREAS BOUNDARY COORDINATES

[For purposes of these draft model regulations, coordinates are based on Fishing Alternative 3 of the Draft Document “*Advice and Recommendations on Development of Draft Fishing Regulations Under the National Marine Sanctuaries Act Section 304(a)(5)*”.]

[The Sanctuary Preservation Area boundaries are approximated using distance and fathom-based measures. Straight-line boundaries based on longitude and latitude coordinates to encompass each SPA, would be provided in the regulations.]

The Sanctuary Preservation Area boundaries are as follows:

1. Three nm around the approximate geographic center of Nihoa Island.
2. Three nm around the approximate geographic center of Necker Island
3. 12 nm around the approximate geographic center of French Frigate Shoals and surrounding all banks from the unnamed bank northwest of St. Rogatien Bank to French Frigate Shoals, and the unnamed bank northeast of French Frigate Shoals.
4. Three nm around the approximate geographic center of Gardiner Pinnacles.
5. 75 fm around Maro Reef.
6. 75 fm around Laysan Island.
7. 75 fm around Lisianski Island.
8. 100 fm around Pearl and Hermes Atoll.
9. Three nm around the approximate geographic center of Midway Atoll.
10. 100 fm around Kure Atoll.
11. 75 fm around Lisianski Island, Laysan Island, and Maro Reef.



ATTACHMENT C

PROPOSED NORTHWESTERN HAWAIIAN ISLANDS NATIONAL MARINE SANCTUARY

Fishing Alternatives Analysis



September 2004

**Prepared by Tetra Tech EM Inc.,
in consultation with the National Marine Sanctuary Program**



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Maps

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Acronyms and Abbreviations

CPUE	catch per unit effort
CRED	Coral Reef Ecosystem Division
DLNR/DAR	Department of Land and Natural Resources Division of Aquatic Resources
EEZ	Economic Exclusive Zone
EO	Executive Orders 13178 and 13196
ER	Ecological Reserve
FFS	French Frigate Shoals
fm	fathom
FMP	fishery management plan
G&O	Goals and Objectives
GIS	geographic information system
MSY	maximum sustainable yield
NGO	non-governmental organization
NMSA	National Marine Sanctuaries Act
NMSAA	National Marine Sanctuaries Amendments Act
NMSP	National Marine Sanctuary Program
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NTMPA	No-Take Marine Protected Area
NWHI	Northwestern Hawaiian Islands
NWR	National Wildlife Refuge
Reserve	Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve
RAC	NWHI Coral Reef Ecosystem Reserve Advisory Council
RPA	reserve preservation area
SCUBA	self-contained underwater breathing apparatus
SPA	Sanctuary Preservation Area
SPR	Spawning Potential Ratio
sq km	square kilometers
SRG	Sustainable Resources Group International
USFWS	U. S. Fish and Wildlife Service
WPRFMC	Western Pacific Regional Fishery Management Council



1.0 Introduction

The National Marine Sanctuary Program (NMSP) of the National Oceanic and Atmospheric Administration (NOAA) is in the process of designating the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve (Reserve) as a national marine sanctuary as directed by the National Marine Sanctuaries Amendments Act (NMSAA) of 2000 and Executive Orders 13178 and 13196 (EO), and in accordance with the National Marine Sanctuaries Act (NMSA). The Reserve was established in 2000 by EO 13178 with the principal purpose of long-term conservation and protection of the coral reef ecosystem and related marine resources and species of the Northwestern Hawaiian Islands (NWHI) in their natural character. The sanctuary designation process is described in Section 304 of the NMSA and requires the preparation of an environmental impact statement. In accordance with Section 304(a)(5) of the NMSA, the NMSP is providing the Western Pacific Regional Fishery Management Council (WPRFMC) the opportunity to prepare draft fishing regulations consistent with the purposes and policies of the NMSA and goals and objectives of the proposed sanctuary.

Coral reefs are some of the most productive and biologically rich ecosystems on Earth. The NWHI are among the few, large-scale, intact, predator-dominated coral reef ecosystems left in the world. Significant Native Hawaiian cultural and maritime historical resources are found throughout the region. These vast and remote coral reef ecosystems support a distinctive assemblage of marine mammals, fish, sea turtles, birds, and invertebrates, including species that are endemic, rare, threatened, or endangered. Federally protected species include the endangered Hawaiian monk seal and the threatened green sea turtle. Roughly one-quarter of the 7,000 species found in the NWHI are believed to be endemic to the Hawaiian Island chain, found nowhere else on Earth.

Unfortunately, coral reef ecosystems around the world are in a state of decline as a direct or indirect result of human activities (U.S. Coral Reef Task Force 2000). In recognition of this decline, and the importance of considering the effects of human activities in an ecosystem context, the United States Government has taken several steps to encourage the preservation of America's ocean treasures. These steps are articulated in several EOs, the work of the U.S. Coral Reef Task Force (established in 2000), and

National Marine Sanctuaries Act, Section 304(a)(5)

Fishing regulations

The Secretary shall provide the appropriate Regional Fishery Management Council with the opportunity to prepare draft regulations for fishing within the Exclusive Economic Zone as the Council may deem necessary to implement the proposed designation. Draft regulations prepared by the Council, or a Council determination that regulations are not necessary pursuant to this paragraph, shall be accepted and issued as proposed regulations by the Secretary unless the Secretary finds that the Council's action fails to fulfill the purposes and policies of this chapter and goals and objectives of the proposed designation. In preparing the draft regulations, a Regional Fishery Management Council shall use as guidance the national standards of Section 301(a) of the Magnuson-Stevens Act (16 U.S.C. 1851) to the extent that the standards are consistent and compatible with the goals of the proposed designation. The Secretary shall prepare the fishing regulations, if the Council declines to make a determination with respect to the need for regulations, makes a determination which is rejected by the Secretary or fails to prepare the draft regulations in a timely manner. Any amendments to the fishing regulations shall be drafted, approved, and issued in the same manner as the original regulations. The Secretary shall also cooperate with other appropriate fishery management authorities with rights or responsibilities within a proposed sanctuary at the earliest practicable stage in drafting any sanctuary fishing regulation.



other recent reports that call for strong and lasting protection for the coral reef ecosystems of the U.S. and the NWHI in particular.

Fishing is one of many human activities that may have direct and indirect effects on the health and integrity of coral reef ecosystems. Some of the direct impacts of fishing on coral reef ecosystems include depletion of fish stocks and habitat degradation. Examples of indirect effects include shifts in community structure and predator-prey relationships (Dinardo and Marshall 2001; Friedlander and DeMartini 2002). Historically, fisheries management approaches have been conducted through a single species approach. While this fishery management approach can provide valuable information, it does not consider the broader impacts of the activity on the ecosystem. The NMSP and NOAA as a whole are working toward an ecosystem approach to resource management (Ecosystem Principles and Advisory Panel 1998). This form of management is adaptive, is geographically specified, takes account of ecosystem knowledge and uncertainties, considers multiple external influences, and strives to balance diverse social objectives. Fishing in the NWHI must be carefully considered and evaluated in the

General Ecosystem-Based Management Principles and Policies

(adapted from the Ecosystem Principles Advisory Panel 1998)

Principles

- The ability to predict ecosystem behavior is limited.
- Ecosystems have real thresholds and limits which, when exceeded, can affect major system restructuring.
- Once thresholds and limits have been exceeded, changes can be irreversible.
- Diversity is important to ecosystem functioning.
- Multiple scales interact within and among ecosystems.
- Components of ecosystems are linked.
- Ecosystem boundaries are open.
- Ecosystems change with time.

Policies

- Change the burden of proof.
- Err on the side of caution in the face of uncertainty.
- Purchase “insurance” against unforeseen, adverse ecosystem impacts.
- Learn from management experiences.
- Make local incentives compatible with global goals.
- Promote participation, fairness, and equity in policy and management.

context of an ecosystem approach to management in order to achieve a healthy, functional, and resilient ecosystem. Through the designation of the NWHI as a national marine sanctuary, the NMSP, together with state and federal partners and other stakeholders, hope to catalyze the collaborative development of an ecosystem approach to address management issues such as fishing. WPRFMC’s considerable expertise in developing fishing regulations under Magnuson-Stevens Fishery Conservation and Management Act will add value and insight to fishing regulations that will be promulgated under the NMSA.

The NMSA Section 304(a)(5) review is an important step in the continued development of an ecosystem approach to management in the NWHI. As pursuant to this process, the NMSP is providing advice and recommendations to WPRFMC in the development of draft fishing regulations consistent with the NMSA and the Goals and Objectives (G&O) Statement (Attachment A) of the proposed sanctuary. This document describes the process used by NMSP to develop and refine the fishing alternatives and to identify the alternative considered most consistent with the G&O Statement of the proposed sanctuary from which model fishing regulations were developed as input for the Section 304(a)(5) review.



The sections of this document are as follows:

- Section 2.0 describes the process used to develop advice and recommendations for the NMSA 304(a)(5) review
- Section 3.0 describes fishing activities considered in the analysis.
- Section 4.0 summarizes the socioeconomic and ecological resource assessment conducted to provide information about the nature and distribution of resources in the NWHI.
- Section 5.0 describes the range of fishing alternatives provided by partner agencies and organizations.
- Section 6.0 describes the evaluation of fishing activities within the range of alternatives based on screening criteria.
- Section 7.0 describes the refined range of alternatives considered in this analysis, including the associated zoning options.
- Section 8.0 describes the evaluation of the full range of alternatives using screening criteria derived from the NMSA and the management goals of the proposed sanctuary. The alternatives are evaluated (including zoning options) using information from the resource assessment and the objectives of management goal 7.
- Section 9.0 describes the fishing alternative considered most consistent with the relevant provisions of the NMSA and the G&O Statement for the proposed sanctuary which serves as the basis for developing model regulations provided as Attachment B.



2.0 Process Description

This section provides an overview of the process used to develop a range of fishing alternatives and identify the alternative considered most consistent with the National Marine Sanctuaries Act (NMSA) and Goals and Objective (G&O) Statement of the proposed sanctuary. The process steps are described below and shown on Figure 1. A summary of the G&O Statement is provided at the end of this section.

Step 1: Stakeholder Consultation, Data Compilation, and Analysis

The National Marine Sanctuary Program (NMSP) began the process by soliciting input from Western Pacific Regional Fishery Management Council (WPRFMC), the Reserve Advisory Council (RAC), and stakeholder groups on fishing alternatives. The NMSP worked with the RAC to develop the goals and objectives for the proposed sanctuary. Available and relevant ecological, socioeconomic, cultural, and other information and data were collected and analyzed in a geographic information system through interagency collaboration. A resource assessment, literature review, and expert interviews were conducted to further develop the database and facilitate the development of the complete process.

Step 2a: Develop Range of Fishing Alternatives

A preliminary range of fishing alternatives was developed beginning with those provided by WPRFMC and the RAC, and included the *status quo*, sanctuary based on the Reserve, and full closure. Each fishing alternative was composed of a combination of commercial and/or non-commercial fishing activities and fishing activity restrictions. The range was further developed based on input from the data compilation and analysis under Step 1. The range of fishing alternatives is described in Section 5 and presented in Table 5.

Step 2b: Develop G&O Statement for Proposed Sanctuary

The G&O Statement was developed based on the NMSA, the advice of the RAC and RAC subcommittees, interagency partners, and the public through a series of meetings beginning in July 2003. The G&O Statement provides the vision, mission, management principles, goals, and objectives of the proposed sanctuary. The language was based largely on the purposes and policies of the NMSA and the Executive Orders 13178 and 13196 (EO); it was supplemented by reference to multiple documents including scoping comments, the draft interagency memorandum of understanding, and the Hawaii State Constitution. In addition, the development of the G&O Statement incorporated information and data analysis resulting from the resource assessment conducted under Step 1. The G&O Statement is included as Attachment A.

Step 3: Evaluate Fishing Activities

Fishing activities identified in Step 2a were evaluated using screening criteria developed from provisions of the NMSA and management goal 7 of the G&O Statement. The evaluation of fishing activities is described in Section 6 and presented in Table 7.



Step 4: Refine Range of Fishing Alternatives

Results from the evaluation of the fishing activities under Step 3, along with information from the resource assessment, were used to refine the fishing alternatives to include two new alternatives. The resulting refined range provided a broad spectrum of fishing alternatives by configuring fishing activities in different ways through geographic zoning and regulation. The refined range of fishing alternatives is discussed in Section 7 and presented in Table 9.

Step 5: Evaluate Fishing Alternatives

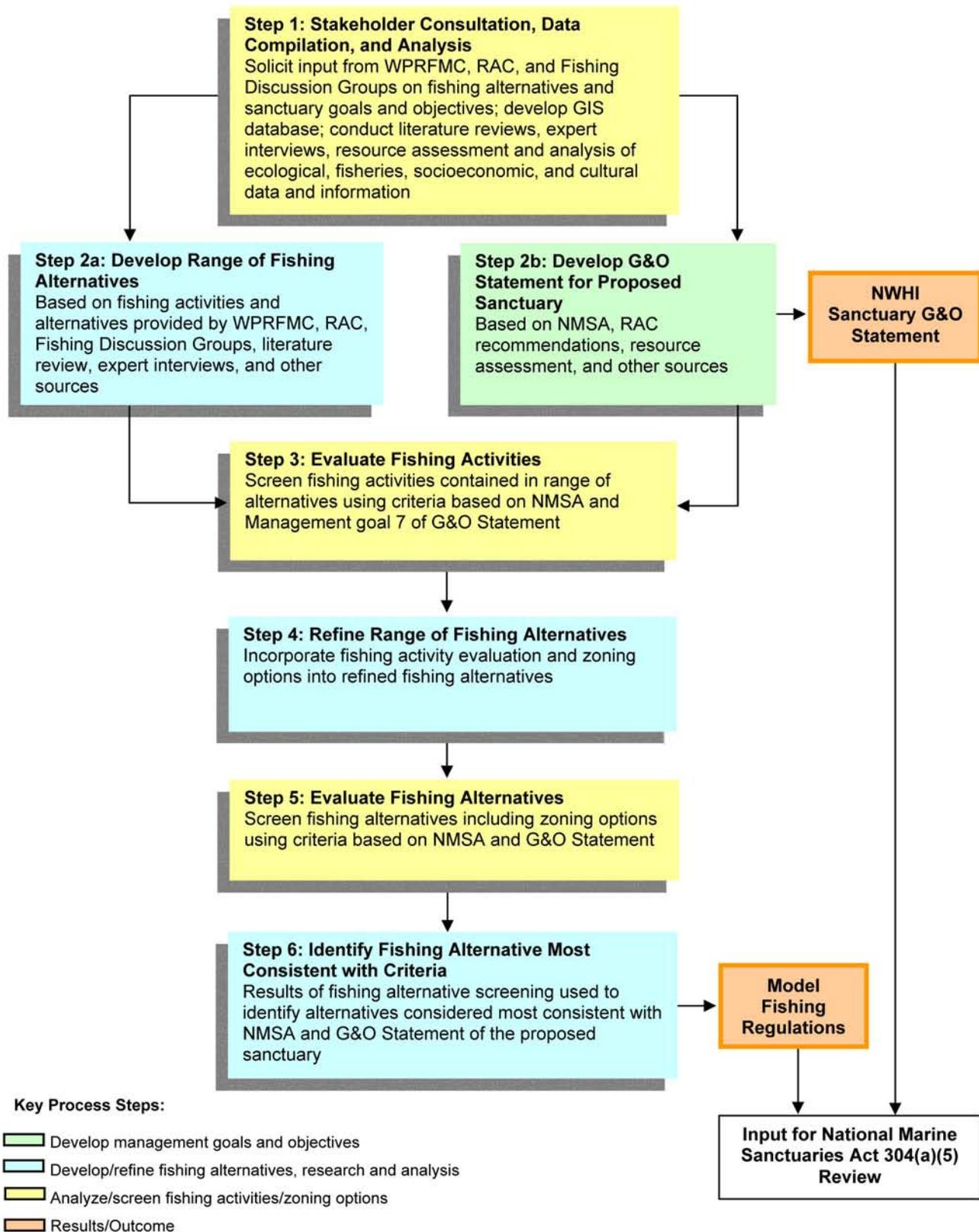
The fishing alternatives including zoning options were screened using criteria based on the NMSA and the G&O Statement. The results of screening fishing alternatives are discussed in Section 8 and presented in Table 11. In addition, the fishing alternatives were evaluated based on the objectives for management goal 7; results are presented in Table 14.

Step 6: Identify Fishing Alternative Most Consistent with Criteria

Results of the screening evaluations in Step 5 were used to identify the fishing alternatives considered by the NMSP to be the most consistent with the NMSA and G&O Statement. Alternative 3 was identified as providing the maximum ecological protection while minimizing the socioeconomic impacts. This alternative is described in Section 9 and was used as a basis for developing model fishing regulations included as Attachment B to serve as input to the NMSA 304(a)(5) review along with the G&O Statement.



Figure 1. Process To Develop Advice and Recommendations for NMSA 304(a)(5) Review





**Summary of Goals and Objectives Statement for the Proposed
NWHI Sanctuary**

Vision: *That the vast coral reefs, marine resources and ecosystems of the Northwestern Hawaiian Islands -- unique in the world -- remain healthy and diverse forever.*

Mission: *Carry out coordinated and integrated management to ensure strong and long-term protection of the marine ecosystems, continuation of Native Hawaiian cultural practices, and preservation of historical resources of the Northwestern Hawaiian Islands.*

Management Principles: *The Sanctuary shall be managed in a manner that:*

- 1. Is consistent with the Vision and Mission;*
- 2. Recognizes that the resources of the NWHI are held as a public trust;*
- 3. Incorporates and integrates best practices, available science, traditional knowledge, and innovative management techniques in order to have a comprehensive approach to both the ecological and social environment;*
- 4. Honors the significance of the region for Native Hawaiians;*
- 5. Enhances public awareness and appreciation of the unique character and marine environments of the NWHI;*
- 6. Errs on the side of resource protection when there is uncertainty in available information on the impacts of an activity;*
- 7. Authorizes only uses consistent with the primary purpose of resource protection and applicable law;*
- 8. Coordinates with federal, state, and local governments, Native Hawaiians, and appropriate organizations;*
- 9. Carries out appropriate and effective enforcement and surveillance and associated public outreach.*

Goal 1: Protect, preserve, maintain, and where appropriate restore the natural biological communities, including habitats, populations, native species, and ecological processes of the Sanctuary, as a public trust for current and future generations.

Goal 2: Provide for comprehensive and coordinated conservation and management that recognizes and complements existing jurisdictional boundaries and management regimes and involves stakeholder communities.

Goal 3: Manage, minimize, or prevent negative human impacts by allowing access only for those activities that do not threaten the natural character or biological integrity of any ecosystem of the region.

Goal 4: Enhance public awareness, understanding, and appreciation of the marine environment and cultural and maritime heritage resources.

Goal 5: Support Native Hawaiian cultural, religious, and subsistence practices that are consistent with the long-term conservation and protection of the region.

Goal 6: Support, promote, and coordinate research and long-term monitoring that improves management decision-making and is consistent with the conservation and protection of the region.

Goal 7: Maintain ecosystem integrity by limiting and controlling fishing activities using an ecosystem-based management approach. Maximize ecosystem protection while minimizing adverse socioeconomic impacts. Limit fishing activities to areas that minimize or prevent interactions with corals, seabirds, endangered Hawaiian monk seals, and other protected wildlife, or that do not threaten the natural character or biological integrity of any ecosystem of the region.



3.0 Description of Fishing Activities

The following fishing activities were evaluated because they are either ongoing or contemplated for the area of the proposed sanctuary. These fishing activities are described below and include various forms of commercial fishing, recreational fishing, sustenance fishing, and Native Hawaiian cultural and subsistence uses.

Commercial Pelagic Longlining

Current Status: No commercial longlining occurs within the study area of the proposed Northwestern Hawaiian Islands (NWHI) sanctuary. This activity is restricted to areas outside a protected species zone established in 1991 by Western Pacific Regional Fishery Management Council (WPRFMC) as an amendment to the fishery management plan for pelagic species.

The domestic longline fishing fleet has evolved from a few wooden sampan boats deploying 1 to 2 miles of rope line in the 1920s (called “flag line”) to a 156-vessel fleet in 1991. Hawaii-based longline vessels operate in the U.S. Economic Exclusive Zone (EEZ) and on the high seas, targeting tuna and swordfish by deploying as much as 40 miles of spool-fed nylon monofilament main line, with snap-on monofilament branch lines (WPRFMC 2003a). From 1965 to 1977, Japanese longliners annually conducted as many as 2,170 vessel days in the NWHI, harvesting as much as 2,204 metric tons of tuna and 1,260 metric tons of billfish, prior to being prohibited from fishing in the U.S. EEZ under the Magnuson-Stevens Act (WPRFMC 2003b). In the late 1980s, concerns regarding interactions with the endangered Hawaiian monk seal, *Monachus schauinslandi*, led to designation of the Protected Species Zone (56 FR 52214). Since 1991, all pelagic longliners have been prohibited from fishing in this 100-nautical-mile corridor surrounding the NWHI.

Commercial Precious Coral Fishing

Current Status: No domestic commercial precious coral fishery has ever operated in the study area of the proposed NWHI sanctuary, although a fishery management plan was issued in 1981. Only one permit has ever been issued to harvest coral under an experimental fishing permit, but the venture was unsuccessful.

The precious coral fishery is currently divided into two categories: shallow-water (35 to 110 meters) black corals harvested by self-contained underwater breathing apparatus (SCUBA) divers, and deep-water (380 to 475 meters) pink, red, gold and bamboo corals harvested with submersibles or remotely operated vehicles. No black coral fishery, foreign or domestic, has ever operated in the NWHI. In 1965, Japanese coral fishermen discovered a large pink coral bed (*Corallium spp.*) near the northwestern end of the Hawaiian archipelago. Intermittently over the next two decades, dozens of foreign vessels employed tangle-net dredges to extract precious corals in the waters around the NWHI. During the 1980s, Japanese and Taiwanese coral vessels frequently fished illegally in the U.S. EEZ around the NWHI. Poaching stopped in these areas in the late 1980s because the remaining precious corals could not sustain an economically viable fishery (WPRFMC 2003a). In 1988, the domestic fishing vessel *Kilauea* received a federal experimental fishing permit to collect precious corals at Hancock Seamount in excess of extraction quotas established by the Western Pacific Regional Fishery Council in 1980. This



vessel conducted three trips with virtually no success (WPRFMC 2003a). Recent research dives on the banks near French Frigate Shoals led to the discovery and designation of the first new bed since the 1981 passage of the fishery management plan for precious corals (Parrish *et al* 2002).

Commercial Coral Reef Species Fishing

Current Status: Although harvest of coral reef species such as black-lipped pearl oysters, turtles, and reef fish occurred in the early and mid-1900s, coral reef species are not commercially harvested in the study area of the proposed NWHI sanctuary.

Evidence of nearshore commercial exploitation stretches as far back as the 1800s, when Western sailing ships exploited the area for seals, whales, reef fish, turtles, sharks, birds, pearl oysters, and sea cucumbers (WPRFMC 2003b). Japanese vessels harvested bird skins and feathers until 1909, when the area was designated the Hawaiian Island Bird Reservation by President Theodore Roosevelt. Between 1910 and the 1940s, six known vessels and three to four sampans fished for turtles, lobsters, pearl oysters, and a wide variety of fish species. Two of these vessels were lost at sea. In the 1920s, a fishing station was established at Pearl and Hermes Atoll. Between 1946 and 1959, nine large commercial vessels fished the NWHI, split equally between shoal and deep-sea vessels and inshore vessels. Two fishing stations at Tern Island in French Frigate Shoals (FFS) supported the inshore vessels, using a DC-3 cargo aircraft to fly *akule* and other species to Honolulu. These were unmanaged fisheries with no regulations limiting or accurately documenting their activities. The black-lipped pearl oyster fishery decimated the population, leading to a 1929 act prohibiting their harvest. After 75 years of protection, this species is beginning to recover, with 200 to 300 counted during a recent survey of the lagoon at Pearl and Hermes Atoll, the site of the original fishery (Maragos and Gulko 2002). The large *akule* schools kept the FFS fishing station active for a few years, but disappeared and were not spotted by fishermen for 10 years after the original harvest (Agard 2000). The harvest of live rock and live coral is currently prohibited throughout the Hawaiian Islands by both state and federal regulations (WPRFMC 2001, Hawaii Administrative Rules 13-95).

Commercial Crustacean Fishing

Current Status: Although a commercial crustacean fishery existed in the study area of the proposed sanctuary between 1976 and 1999, the fishery was closed in 2000 by federal court order and by National Ocean and Atmospheric Administration (NOAA) Fisheries through the establishment of a zero-harvest limit that has been in place to the present.

Exploitable lobster populations in the NWHI were discovered in the mid-1970s by NOAA ship *Townsend Cromwell*. By 1976, commercial vessels began fishing at Necker Island. Commercial logbook data became mandatory with the enactment of the Crustacean Fishery Management Plans in 1982 (WPRFMC 1982). Catch per unit effort (CPUE) (lobsters per trap) declined dramatically between 1983 and 1990, causing NOAA Fisheries to issue an emergency closure of the 1991 fishing season. Reasons for closure included (1) continual increase in fishing effort, (2) decrease in CPUE to an all-time low of 0.66 lobster per trap-haul, (3) poor recruitment, and (4) an indication that the spawning stock biomass was at 22 percent of pre-exploitation levels, dangerously close to the 20 percent definition of overfishing (56 FR 21961). Research indicates that this decline was caused by both commercial harvest and a decadal oscillation in productivity that reached an all-time low in the mid-1980s (Polovina and Haight 1999, Kawamoto and Pooley



2000). A 20-year time series of fishery-independent data has not shown improved recruitment to this population (Dinardo and Marshall 2001). The NWHI lobster fishery was closed in 2000 by both federal court order, and by NOAA Fisheries to protect lobster stocks because of (1) shortcomings in understanding the dynamics of the NWHI lobster populations, (2) the increasing uncertainty in population model parameter estimates, and (3) the lack of appreciable rebuilding of the lobster population despite significant reductions in fishing effort throughout the NWHI (65 FR 39314). The closure has continued through 2004 (69 FR 12303). In compliance with an order of the U.S. district court for the District of Hawaii, the crustacean fisheries must remain closed until an environmental impact statement and biological opinion have been prepared. NOAA Fisheries has continued its fishery research during this closure, including tagging studies and population assessments, and has developed a spatially structured population model to replace the archipelago-wide harvest guideline (Botsford *et al* 2002).

Commercial Bottomfish/Pelagic Trolling

Current Status: A small commercial bottomfish/pelagic fleet currently exists in the study area of the proposed NWHI sanctuary. The fishery management plan divides the fishery into two zones, the Mau and Ho`omalau. The Mau zone includes areas E of 165° longitude and the Ho`omalau zone includes areas W of 165° longitude. Five permittees currently operate in the Mau zone and four in the Ho`omalau zone, with the fleet comprising of a total of nine vessels. The fish caught in the NWHI represents only 1 percent of the total pounds of fish landed each year in the State of Hawaii, and a total of 2 percent of the value of all commercial fish landed in Hawaiian waters.

Evidence of deep-slope bottomfishing in the NWHI dates back to the 1700s, when Native Hawaiians fished at Necker and Nihoa islands (WPRFMC 2003b). This type of fishing likely also occurred pre-contact. Bottomfishing by Western vessels has occurred since at least the 1930s. At least five commercial vessels targeted bottomfish species in the years following WWII. Efforts increased between the late 1960s and the mid-1980s due to an expanded local market (WPRFMC 2003a). The federally permitted NWHI commercial bottomfish fishery has been regulated under the current management regime since 1986. Limited entry (maximum 7 permits) for the larger, more distant Ho`omalau zone was established in 1989 and for the Mau zone (maximum 10 permits) in 1999 (WPRFMC 1999). Fishery statistics (spawning potential ratio, percent immature, average size, and CPUE) indicate a healthy, well managed, and sustainable fishery with relatively stable participation. The four primary targeted species, *opaka* (26 percent), *onaga* (20 percent), *hapu`u* (17 percent), and *uku* (15 percent) comprise 78 percent of the total landings (WPRFMC 2004a). The allowable gear and fishing methods are highly selective, minimizing habitat impacts and unwanted bycatch. As of 2003, four vessels operate in the Ho`omalau zone and five operate in the Mau zone. These vessels have historically provided between 40 percent and 50 percent of the fresh Hawaiian bottomfish to the local market, averaging 345,000 pounds per year.

Commercial Pelagic Trolling

Current Status: A very small number of commercial pelagic fishermen have recently operated or currently operate in the study area of the proposed NWHI sanctuary. These fishermen are not federally permitted, as the fishery management plan for pelagic species does not regulate this small fleet. These fishermen operate under a State of Hawaii commercial marine license that



enables them to sell their catch legally. Historically, this mosquito fleet has operated only in the southern portion of the study area, largely around a weather buoy near Nihoa Island.

Commercial pelagic trolling is divided into three distinct types of fishermen: *aku* (pole and line) boats, handline (*ika shibi* and *palu ahi*) boats, and pelagic trolling boats. Of these, pelagic trolling is the most popular statewide, with 90 percent of the participants and 50 percent of the landings (WPRFMC 2003a). Over the years, a few vessels have occasionally ventured into the southern portion of the NWHI. The Hawaii Department of Land and Natural Resources, Division of Aquatic Resources (DLNR/DAR) has records for nine commercial pelagic trolling vessels fishing in the NWHI between 1991 and 2000, around Nihoa, Necker, Gardner Pinnacles and French Frigate Shoals, with most of the catch focused around the National Weather Service's Buoy 1 near Nihoa. These vessels reported landing slightly less than 140,000 pounds over this period, which corresponds to less than 0.5 percent of total statewide landings (Ehler 2004). The current fishing gear and methods have little to no impact on the habitat and have very low levels of bycatch. Anecdotal information suggests that only a few of these fishermen, if any, still commercially fish for pelagic species in the southern portion of the sanctuary study area.

Recreational (Catch and Release) Fishing

Current Status: A very small charter catch and release industry, which operated out of Midway, opened in the study area of the proposed NWHI sanctuary in 1996, with some vessels venturing into the Reserve, including waters surrounding Kure Atoll. When the ecotourism operation at Midway Atoll ceased in 2002, this charter industry was largely impacted, and few charter trips take place within the NWHI currently. No data is available to determine whether non-charter catch and release fishing occurs in the NWHI by recreational fishermen. If it does, it is assumed that this effort occurs only in the southern portion of the NWHI.

A small charter catch and release industry operated out of the Midway Atoll National Wildlife Refuge (NWR) between 1996 and 2001, with some of the trips venturing into the Reserve. The season occurred roughly between April and November, with an estimated 375 angler-trips per year (WPRFMC 2001). Targeted species included tuna, billfish, and large jacks, with a smaller inshore fishery targeting bonefish and other reef fish (House 2004). Although they were mandatory, vessels did not regularly complete trip data logs for fishing activities, which inhibits accurately determining total fishing days and hours, fishing location, or numbers of target species kept, tagged, or released (Sustainable Resources Group, Inc. [SRG] 2004). Operations largely ceased in 2002 when Midway stopped providing facilities for tourists. Anecdotal information indicates that charter-based catch and release fishing may have occurred at locations outside of Midway, including Kure Atoll (by Midway-based operations). In addition, no information is available to confirm whether a noncharter-based catch and release fishery exists in the NWHI.



Recreational (Catch and Keep) Fishing

Current Status: Although only anecdotal information exists to confirm this, very little recreational fishing exists within the study area of the proposed NWHI sanctuary. Any such fishing that does exist takes place in the southern portion of the study area near Weather Buoy 1 and Nihoa Island.

Due to the NWHI's isolation from human population, recreational catch and keep fishing (as separate from the charter fishery industry) is virtually non-existent in most parts of the NWHI. Any such fishing takes place at Weather Buoy 1, Nihoa Island, and the southern portion of the Mau zone. Reports of pelagic spearfishing and recreational trolling at Weather Buoy 1 by fishermen from the main Hawaiian Islands are two of the few examples available. This type of recreational fishing activity differs from sustenance fishing and recreational catch and release fishing (largely by charter boats) as catch is kept and generally not consumed on site but kept for later consumption. Catch and effort data is unavailable for this fishing activity.

Sustenance Fishing

Current Status: Sustenance fishing, as defined below, is known to take place aboard research and military vessels and by island-based researchers and resource managers in the study area of the proposed NWHI sanctuary. This type of fishing is also believed to occur from transiting vessels, including sailboats, although no data exists to confirm this assumption.

Sustenance fishing is defined as fishing for on-site consumption conducted as incidental to another permitted, non-fishing activity in the proposed sanctuary. Sustenance fishing includes fishing for pelagic reef and/or bottomfish species using trolling, handline, and pole and line fishing techniques. Such fishing has historically been conducted by field biologists, refuge/sanctuary managers, and military personnel while aboard research and military vessels, as well as from other vessels passing through the NWHI. Fishing effort and landings are currently undocumented and unknown.

Native Hawaiian Cultural and Subsistence Uses

Current Status: Evidence shows that for generations, Native Hawaiian cultural and subsistence harvest has traditionally and customarily occurred in the study area of the proposed NWHI sanctuary. Although it is unknown how often such harvest occurred, it is known through oral histories and other records that in more recent times, such cultural and subsistence use has continued to take place by a small number of indigenous people. Such access has occurred most recently by the voyaging canoe Hokule`a in May and June of 2004.

Native Hawaiians hold the NWHI as a sacred connection to their past. There are 88 archaeological sites dating back to 1000 A.D. on Nihoa Island and at least 52 on Necker Island (NOAA 2003). Descriptions of voyages to the NWHI have been preserved through the oral history and legends of the Hawaiian people and provide further evidence that cultural and subsistence use by Native Hawaiians have occurred historically (WPRFMC 2003b). Due to lack of access to the region in recent times, the number of trips by Native Hawaiians has been limited; however, strong interest remains in continuing this type of access and harvest, but based on traditional values and only as part of broader cultural access purposes. In this context, Native



Hawaiian subsistence is defined as the use of ocean resources by Native Hawaiians for the purposes of perpetuating traditional knowledge, taking responsibility and caring for the environment, and strengthening cultural and spiritual connections to the NWHI. Under this definition, developed by the Reserve Advisory Council (RAC) Native Hawaiian Cultural Subcommittee (RAC 2004), resources shall be used only for direct personal consumption while in the NWHI, and the sale of any marine resources is prohibited. This may also include the customary practice by Native Hawaiian Niihau and Kauai families to travel to the NWHI and bring back ocean resources for community sharing. Native Hawaiians are individuals who are descendents of the aboriginal people who, prior to 1778, occupied and exercised sovereignty in the area that now constitutes the State of Hawaii.



4.0 Resource Assessment

The resources of the Northwestern Hawaiian Islands (NWHI) are distinguished, in the U.S., if not globally, by an apex predator-dominated trophic structure (Friedlander and DeMartini 2002), possibly the highest levels of taxonomic endemism of any large-scale coral reef ecosystem in the world (Maragos and Gulko 2002), and in contrast to the main Hawaiian Islands, an extremely low prevalence of invasive marine species (Friedlander *et al.* in prep). The presence of the critically endangered Hawaiian monk seal and the importance of the NWHI as the primary nesting area for threatened green turtles in the Hawaiian archipelago, contribute significantly to the unique status of the region. Despite a history of human activity and resource use, including military use, commercial fishing, and other forms of resource extraction and disturbance, the NWHI coral reef ecosystem has been characterized as a relatively pristine area, limited in its level of degradation compared to other coral reef ecosystems around the world (Sustainable Resources Group International [SRG] 2004).

The National Marine Sanctuary Program (NMSP) conducted an assessment of the status and distribution of ecological and fisheries/socioeconomic resources to serve as a basis for developing and evaluating fishing alternatives and zoning options for the region. This section describes information and data used and analyses conducted to compare ecological and socioeconomic considerations in the proposed sanctuary. A geographic information system (GIS) was developed to facilitate compilation and spatial analyses of information and data. A ranking system was developed to facilitate comparisons of ecological and socioeconomic parameters. The results of the resource assessment are provided in this and other sections of the document and serve as a basis for developing and refining fishing alternatives and zoning options for the proposed NWHI sanctuary.

Information and Data Review

Ecological and socioeconomic information and data were compiled and analyzed through multi-agency effort. Numerous scientific studies and resources assessments have been conducted by National Oceanic and Atmospheric Administration (NOAA), U.S. Fish and Wildlife Service (USFWS), State of Hawaii, Bishop Museum, and other organizations in the NWHI over the last 30 years, with research and monitoring activities intensifying over the last 5 years.

Information and data from multi-agency research expeditions beginning with the tripartite studies of the 1980s (Grigg and Pfund 1980; Grigg and Tanoue 1983) and continuing through the NWHI Reef Assessment and Monitoring Program conducted annually from 2000 to 2003 (Maragos and Gulko 2002; Maragos *et al.* 2004), were reviewed for input into this assessment. Coral abundance, distribution, condition, biodiversity, and population structure in the NWHI were surveyed at more than 536 sites between 2000 and 2003 using rapid ecological assessment techniques (Maragos *et al.* 2004). Data sets were drawn from various NOAA reports and projects including the *Sensitivity of Coastal Environments and Wildlife to Spilled Oil* (NOAA 2001) and the *Atlas of Shallow-Water Benthic Habitats of the NWHI* (NOAA 2003), among



others. A detailed report on the current status of resources in the NWHI is being prepared (Friedlander *et al.* in prep).

During the past year, the NMSP conducted a series of meetings and interviews with scientists representing NOAA's National Ocean Service (NOS), NOAA Fisheries, Hawaii Department of Land and Natural Resources/Division of Aquatic Resources (DLNR/DAR), the USFWS, University of Hawaii, and various non-governmental organizations (NGO) to collect data sets, administrative and technical reports, cruise reports, white papers, and relevant published literature. Information and data on corals, reef fish, birds, and threatened and endangered species, among others, was synthesized and discussed among scientists representing partner agencies, the University of Hawaii, and other institutions to assess the current condition of these resources and potential threats, and to identify priority ecological protection needs for the region. A significant addition to the ecological data associated with this resource assessment includes a recent project completed by NOAA Fisheries, with support by the NMSP, to identify the foraging biogeography of the endangered monk seal (Stewart 2004a).

Fisheries and socioeconomic information and data were compiled from existing data sets, dock side surveys, reports, fishery management plans, published papers, and fishing focus group discussions. In 2003, NOAA contracted the Sustainable Resources Group International, Inc. (SRG) to conduct background research on commercial and recreational fishing in the NWHI and to facilitate a series of fishing discussion groups. The work involved literature review, expert interviews, and feedback from fishing discussion groups. Fishing discussion groups, involving more than 50 participants from government agencies, commercial fishermen, researchers, native practitioners, and NGOs, were assembled to assess fishing activity including Native Hawaiian cultural and subsistence uses in the region. The final report (SRG 2004) provides a comprehensive review of each fishing activity in the NWHI.

In addition, a focused socioeconomic assessment was conducted on the only active, commercial fishery in the NWHI, the bottomfish/pelagic trolling fishery. Existing data and information on this fishing activity, including pounds landed, number of fish caught, and value of the catch by location throughout the region, were provided by the Hawaii DLNR/DAR. These datasets were augmented with detailed interviews with each active permittee currently operating in the region. The socioeconomic assessment (Ehler 2004) provides a detailed description of the current bottomfish/pelagic trolling fishing activity in the NWHI.

Geographic Information System Database Development

A GIS database was developed to facilitate spatial analyses of ecological, fisheries-related, and socioeconomic data. The GIS was used to generate a base map of the NWHI that included NOAA digital nautical charts and ecological and fisheries and socioeconomic data layers. These data layers are displayed on Map 1 at the end of this section.

Ecological Data Layers: Ecological data layers include a detailed characterization of coral reef resources to approximately 30-meter (m) depths (NOAA 2003). Data on coral reefs such as coral cover and species richness, and reef fish endemism and species richness, and apex predator biomass were provided from NOS (Friedlander *et al.* in prep.) and USFWS (Maragos *et al.*



2004). Information and locations of observed coral bleaching were provided by the Hawaii DLNR/DAR (Hawaii DLNR/DAR 2004) and NOAA Fisheries (NOAA Fisheries 2004a). Additional coral information (areas of high coral cover, unique features, and personal observations) were provided by USFWS (USFWS 2004a). Pearl oyster information and locations were provided by the Coral Reef Ecosystem Division (CRED) (Friedlander *et al.* in prep).

Potential lobster habitats were identified as areas within 35 fathoms (fm) depth contour, combining the concentration of spiny lobsters (15-25 fm) and slipper lobsters (25-35 fm) based on DiNardo and Marshall (2001). Areas within 35 fm were generated from existing digital bathymetry data from NOAA Fisheries, CRED.

Potential monk seal foraging ranges were developed by merging two sources of information: areas within 100 fm and foraging range data. Areas within 100 fm were generated from existing bathymetric data (CRED 2003). Foraging range data were provided by NOAA Fisheries, Pacific Islands Fisheries Science Center (Stewart 2004a).

Masked boobies, brown boobies, red-footed boobies, and great frigatebirds are the species most vulnerable to trolling (USFWS 2004b). Seabird range data were developed using the buffer tool in ArcMap. Nesting sites for these species were identified through queries to the Environmental Sensitivity Index (ESI) database (the *Sensitivity of Coastal Environments and Wildlife to Spilled Oil* [NOAA 2001]). Foraging ranges for most birds were generated by buffering nesting sites using radius distances for comparable estimates of species in the main Hawaiian Islands (USFWS 2004c). A distance of 3 nautical miles (nm) around the NWHI was used as the estimated foraging range for juvenile boobies (USFWS 2004d).

Socioeconomic Data Layers: Hawaii DLNR/DAR fisheries data layers were captured as 20 x 20 nm reporting grids with pounds of fish landed and associated economic value for bottomfish/pelagic trolling fishing. These data were augmented with specific track line data collected during the interview process to assess fishing effort on a fine scale at each bank, island, and atoll (Ehler 2004).

Coral Reef Ecosystem Assessment

Coral reef ecosystems support a diverse array of marine plants and animals, geomorphologic features and habitats as well as complex biological and physico-chemical processes. A set of representative parameters was selected from the GIS database to characterize the NWHI coral reef ecosystem and to facilitate the development of zoning options applicable to the proposed sanctuary (Table 1). These parameters were identified by partner agencies and scientists as important measures of the biological and ecological communities of the NWHI and represent a range of ecological values including: biogeographic representation, ecological significance, ecosystem integrity, biodiversity, species maintenance, habitat structure, special resource elements (U.S. Coral Reef Task Force 1999). For example, levels of reef fish endemism provide an indication of the unique characteristics of this remote island chain. Apex predators are thought to be keystone species in structuring coral reef ecosystems (Carr *et al.* 2002). The large



reduction in apex predators in coral reef ecosystems in the main Hawaiian Islands has been attributed to fishing pressure (Friedlander and DeMartini 2002). The 100 fm depth contour serves as a proxy for generalized bottomfish habitat, and previous monk seal studies have indicated that this could be used as a generalized indicator of monk seal range (Abernathy and Siniff 1998; Abernathy 1999). Executive Orders 13178 and 13196 (EO) which created the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve (Reserve) established the no-take Reserve Preservation Areas (RPA) based on this depth contour at French Frigate Shoals, Pearl and Hermes Atoll, and Kure Atoll.

These and other representative parameters were used to describe the status and distribution of ecological and socioeconomic values in the NWHI (Table 1).

Representative parameters used in the assessment are contained in the GIS database and are presented in various formats depending on the nature of the dataset. Resource parameters are presented in tabular form by location (Table 2; e.g. reef fish endemism, coral cover). Spatial representation of some of the parameters (e.g. monk seal foraging area) is presented in Map 1 at the end of this section. Resource statistics for area-based parameters are provided as Attachment D (e.g. area of coral reef habitat in the NWHI). These parameters together with information and data obtained from literature review and scientific experts were evaluated together to facilitate the development of zoning options for the proposed NWHI sanctuary. Key findings of the assessment are summarized below by location for coral reefs and threatened and endangered species of the NWHI.

Coral Reef Habitat: The shallow water coral habitat less than 30 m covers an area of 3,687 sq. m, or approximately 1 percent of the total area of the proposed sanctuary (Attachment D, *Status Quo*). The flora and fauna inhabiting this area include a large percentage of endemic species. In terms of abundance of reef fish, over 50 percent of the numbers of reef fish on Maro Reef, Lisianski Island, and Pearl and Hermes, Midway, and Kure Atolls, are endemic species (Table 2).

Coral species richness is higher in the NWHI, with 52 species, compared to the main Hawaiian Islands with 48 species (Friedlander *et al.* in prep). Coral species richness is highest at French Frigate Shoals, followed by Maro Reef and Pearl and Hermes Atoll (Table 2).

Coral reefs in the NWHI are among the few remaining large-scale, intact, predator-dominated reef ecosystems left in the world (Friedlander *et al.* in prep). Areas with the highest apex predator biomass include Pearl and Hermes Atoll, followed by Lisianski and Laysan Islands (Table 2). Overall, the NWHI apex predator biomass in the NWHI is about 55 percent of the total biomass (Friedlander 2004).



Table 1. Representative Parameters Used in Resource Assessment of the NWHI

Resource Value ¹	Description	Representative Parameters for the NWHI Coral Reef Ecosystem ²
Biogeographic Representation	<i>Represents the degree to which the area exemplifies the undisturbed habitat types, ecological processes, biological communities, physiographic features, or other natural attributes associated with the region.</i>	Area of shallow water coral habitat <30 m depth Area encompassing 100 fm bathymetric contour
Ecological Significance	<i>Supports ecologically limited or endemic species, ecologically important species, unique species associations or biological assemblages, or unique, rare, or fragile ecosystems. Applies to marine habitat areas upon which ecologically limited species (e.g., threatened, endangered, rare, depleted, endemic, or peripheral species) are dependent during all or part of their lives.</i>	Reef fish endemism Foraging area for endangered Hawaiian monk seal Foraging area for endangered or threatened sea birds
Ecosystem Integrity	<i>Characterizes high level of primary and/or secondary production and attendant higher trophic level communities.</i>	Apex-predator biomass Living coral cover Area of potential lobster habitat
Biodiversity	<i>Contains a representative variety of species or an important sample of the diversity of ecosystems, communities, species, populations, and gene pools found within the prescribed region or habitat.</i>	Reef fish species diversity Coral species diversity
Species Maintenance	<i>Critical life history functions, including feeding, courtship, breeding, birthing/nursery, resting/staging, or migration.</i>	Monk seal colony size Number of green turtle nesting sites
Habitat Structure	<i>Characterizes unique, rare, or unusual chemical, physical, geological, and/or oceanographic features, structures, or conditions.</i>	Geomorphology (atolls, islands, pinnacles, reefs, banks)
Special Resource Elements	<i>Refers to the protection of special, atypical elements within the marine waters of a coastal state, such as species at risk, unique biological assemblages, or special habitat, oceanographic, geologic, physical or chemical features.</i>	Most northern coral reefs in the world (e.g. Kure and Midway Atolls)
Renewable Resources of Importance for Sustainable Uses	<i>Characterizes fish and shellfish species, species groups (e.g. snapper-grouper complex), or other resources which are important to various modes of sustainable use and for which conservation and management are in the public interest.</i>	Pounds of bottomfish/pelagic fish kept Value of bottomfish/pelagic fishing activity

Notes: 1 – Adapted from the U.S. Coral Reef Task Force (1999) and Crosby *et al.*, 1997; 2 – Representative parameters based on available information and data for the NWHI coral reef ecosystem



Table 2. Comparison of Coral Reef Ecosystem Parameters By Location

Location	Reef Fish Endemism ¹ (% Abundance)	Reef Fish Species Richness ¹ (No. Species)	Apex Predator Biomass ² (Tons per hectane)	Coral Species Richness ³ (No. of Species)	Coral Cover ³ (% Living Cover)	Coral Reef Area ⁴ (Square kilometer) hardbottom with >10% live coral)	Monk Seal Breeding Colony Size ⁵ (No. individuals)	Green Turtle Nesting Sites ⁶ (No. of nesting sites)
Kure Atoll	56	155	0.14	27	13.8	1.8	90	0
Midway Atoll	54	163	0.33	16	9.6	1.4	64	0
Pearl and Hermes Atoll	62	174	1.89	33	12.8	20.3	203	<25
Lisianski Island	58	124	1.44	24	59.3	16.4	178	<25
Laysan Island	41	131	1.02	27	21.7	5.8	272	<25
Maro Reef	50	142	0.80	37	64.1	14.8	0	0
Gardner Pinnacles	36	124	0.96	27	7.3	<0.1	0	0
French Frigate Shoals	46	178	0.84	41	14.7	48.3	290	400
Necker Island	35	125	0.52	18	4.4	<0.1	45.7	0
Nihoa Island	20	127	0.43	17	11.5	<0.1	54.3	0

Notes: 1 - DeMartini and Friedlander 2004; 2 - Friedlander and DeMartini 2002; 3 - Maragos *et al* 2004; 4 - NOAA 2003; 5 – Necker and Nihoa; NOAA Fisheries 2003; All other islands; Stewart 2004; 6 – NOAA/FWS 1998; Numbers in **bold** represent highest values for each parameter.



Monk Seals: The Hawaiian monk seal is one of the most critically endangered marine mammals in the U.S. with an estimated population size of 1,409 individuals based on 2003 stock assessment report (NOAA Fisheries 2003). The Hawaiian monk seal depends almost entirely on the islands of the NWHI for breeding and the surrounding reefs for sustenance (Friedlander *et al.* in prep). The total of mean non-pup beach counts at the main reproductive NWHI subpopulations in 2001 is approximately 60 percent lower than in 1958 (NOAA Fisheries 2003). French Frigate Shoals has the largest monk seal breeding colony (Table 2) followed by Laysan Island, Pearl and Hermes Atoll, and Lisianski Island.

The foraging biogeography of the Hawaiian monk seal has been described in a number of recent reports (Stewart 2004a, b, and c; Stewart and Yochem 2004a, b, and c). Between 1996 and 2002, the movements and diving patterns of 147 Hawaiian monk seals in the NWHI were monitored with satellite-linked depth recorders (41 adult males, 35 adult females, 29 juvenile males, 15 juvenile females, 12 weaned male pups, 15 weaned female pups). Major overall findings of these studies include:

- Monk seal foraging range covers an area of approximately 48,156 sq. km, or almost 14 percent of the total area of the proposed sanctuary (Map 1; Attachment D, *Status Quo*).
- Seals foraged extensively at or near their colony sites (95 percent within 20 miles of the colonies) except at French Frigate Shoals where foraging distances were demonstrated to be greater.
- The highest concentration of monk seal activity in the NWHI is focused on French Frigate Shoals and the surrounding banks.
- The lowest concentration of monk seal activity in the NWHI was observed at Nihoa and Necker Islands because no monk seals were tagged from breeding colonies on these islands.
- Seals used movement corridors to transit between colonies and extra-colony sites were closely associated with the NWHI submarine ridge. Seals likely forage along these corridors at near surface features like reefs, banks, and seamounts.
- Several banks located northwest of Kure Atoll represent the end of the monk seal foraging range (Stewart 2004a). In addition, recent submersible work conducted by NOAA's Office of Ocean Exploration (OE) identified these areas as important precious coral habitat (NOAA OE 2003).

Past and present impacts to the monk seal population in the NWHI include hunting in the 1880s, disturbance from military uses of the area, entanglement in marine debris (Hendersen 2001; 1990; 1984a; 1984b), direct fishery interaction including recreational fishing (Kure Atoll) and commercial fishing prior to the establishment of the 50 nm Protected Species Zone around the NWHI in 1991 (NOAA Fisheries 2003), predation by sharks (Nolan 1981), aggression by adult



male monk seals, and reduction of habitat and prey due to environmental change (Friedlander *et al.* in prep).

Green Turtles: Over 90 percent of all sub-adult and adult Hawaiian Green Sea turtles found throughout Hawaii come from the NWHI. The Hawaiian green turtle (*Chelonia mydas*) stock is clearly recovering after more than 25 years of protecting their nesting and foraging habitats in the Hawaiian archipelago (Balazs and Chaloupka in press). Green turtle nesting sites occur at Pearl and Hermes Atoll, Lisianski Island, Maro Reef, and French Frigate Shoals (Map 1). The principal rookery for the Hawaiian green turtle is located on sand islands at French Frigate Shoals which accounts for 400 nesting sites (Table 2) or 90 percent of all nesting within the Hawaiian archipelago.

Seabirds: Seabird colonies in the NWHI constitute one of the largest and most important assemblages of seabirds in the world (Friedlander *et al.* in prep). NWHI contain 98 percent of the world's black-footed albatross and 99 percent of the Laysan albatross. The estimated foraging range of juvenile boobies extends approximately 3 nm from their nesting site and covers an area of 1,083 square kilometers (sq km) (Map 1; Attachment D, *Status Quo*).

Socioeconomic Assessment

The NMSP conducted assessments of commercial and recreational fishing activities and Native Hawaiian cultural and subsistence uses that are presently active, historically conducted, or have been considered or are known to have existed even in some limited manner in the NWHI. The current status, biological and socioeconomic condition of each fishing activity was described based on a comprehensive set of information and data compiled from studies, reports and published papers as well as fishing discussion groups held as part of a study on fishing in the NWHI conducted in 2003 (SRG 2004). Information and data on all commercial and recreational fishing activities and Native Hawaiian cultural and subsistence uses are used in descriptions and analyses presented in different sections throughout this document.

Commercial bottomfish/pelagic trolling fishing is the principal active fishery operating in the NWHI. Only small amounts of commercial pelagic trolling, recreational fishing, sustenance fishing, and Native Hawaiian cultural and subsistence use are known to occur in the region; however, information and data on these activities are limited. Also, the commercial bottomfish/pelagic trolling activity operates around islands, atolls, and banks. As a result, the socioeconomic assessment focused on the bottomfish/pelagic trolling fishing activity. Existing data and dockside interviews with each active permittee were used in the assessment. A detailed description of this analysis can be found in: *Socio-Economic Assessment of Commercial Bottomfishing in the Northwestern Hawaiian Islands* report (Ehler 2004).

This socioeconomic assessment involved several activities. The first activity involved completing a baseline review of the NWHI Bottomfish Trip Daily Log data collected by Hawaii DLNR/DAR from 1996 to 2002. Fishery data collected over a period of 7 years was analyzed to provide an accurate picture of trends through time. This is consistent with the NMSP long-term management responsibilities in the region. This review was augmented in March 2004 through



extensive interviews conducted with the nine active bottomfish permit holders in the NWHI, the manager of the Honolulu fish auction, the six major seafood distributors, and a retail seafood market owner. These interviews were conducted together with Hawaii DLNR/DAR personnel. The purpose of these interviews was to supplement the information provided by the Hawaii DLNR/DAR Trip Daily Log data, which contains fishing landings and revenue data. Survey questions were designed to fill in the analysis gaps between the Hawaii DLNR/DAR data collected at the dock and the data supporting a full value estimate. The data collection process, survey, and subsequent report, were made possible through cooperation, interagency meetings, and a data sharing Memorandum of Understanding between NMSP, NOAA Fisheries, and Hawaii DLNR/DAR.

Key parameters used to describe bottomfishing in the NWHI are pounds and value of bottomfish kept from the Hawaii DLNR/DAR dataset. Total bottomfish catch between 1996 and 2002, reported as pounds of fish kept, was approximately 1.4 million pounds (Table 3). The highest bottomfish catch, reported as pounds of fish kept, occurred at Maro Reef and Necker Island, accounting for about 36 percent of the total bottomfish catch from 1996 to 2002 (Table 3). The distribution of fishing value is shown on Map 1. Key findings of the socioeconomic assessment include:

- There are currently nine active commercial bottomfishermen in the NWHI, five in the Mau zone and four operating in the Ho`omalulu zone.
- Currently none of these fishermen operate northwest of Lisianski Island. The nine bottomfishermen active in the NWHI represent 1 percent of the total Hawaiian commercial landings of all types of fish and 2 percent of all fish revenue in the state.
- Fishing activities were fairly evenly distributed spatially from Nihoa Island to Lisianski Island.
- Despite the even distribution of effort, Maro Reef, Gardiner Pinnacles, French Frigate Shoals, and Necker Island were the locations where most of the fish was being landed.
- The NWHI account for approximately 50 percent of the bottomfish landings in Hawaii.
- Total reported 2003 gross revenue for the nine NWHI fishermen was just under \$1.3 million with \$611 thousand for the Mau zone and \$674 thousand for the Ho`omalulu zone. Total costs for 2003 were estimated at \$974 thousand for all NWHI fishermen.
- The economic benefits to the fishermen in the NWHI is relatively small due to the high cost of operating in such a harsh environment (Ehler 2004).
- The importance of the industry is primarily to the restaurant industry from which the estimated full market value of the fishery can be calculated to be approximately \$5 million annually.



- Current regulations do not directly address levels of bycatch for bottomfishing in the NWHI.
- According to interviews with fishermen, French Frigate Shoals is a location that deserves the highest level of preservation and they do not depend on it for fishing.
- The fishermen would consider a buy out program.

**Table 3. Bottomfish Catch¹ by Location in the NWHI
from 1996 to 2002**

Area	Bottomfish (Pounds Kept)	% of Total Pounds kept
Islands/Atolls		
Kure Atoll	0	0%
Midway Atoll	0	0%
Pearl and Hermes Atoll	11,388	0.8%
Lisianski Island	84,859	6.2%
Laysan Island	625	0.1%
Maro Reef	244,044	17.9%
Gardner Pinnacles	160,709	11.8%
French Frigate Shoals (includes 1 st bank east of FFS)	168,667	12.4%
Necker Island	248,363	18.3%
Nihoa Island	33,434	2.5%
Submerged Banks/Seamounts		
Seamounts north of Kure Atoll	0	0%
Nero Seamount	0	0%
Ladd Seamount	0	0%
Salmon Bank	31,123	2.3%
Unnamed Bank North of Lisianski Island	0	0%
Pioneer Bank	67,861	4.9%
North Hampton Seamounts	449	0.03%
Raita Bank	9,954	0.7%
St. Rogatien Bank (includes 1 st bank west of St. Rogatien)	174,053	12.8%
Brooks Banks (includes Southeast Brooks Bank)	18,745	1.4%
Two banks between Necker and Nihoa Islands	104,813	7.7%
Total NWHI	1,359,088	100%

Notes: 1 - Catch is reported as a total aggregate over the 7-year period to represent long-term trends between locations; Aggregate catch, calculated from annual grid totals, exclude data from grids outside the study area and from those protected by confidentiality requirements.



Comparison of Ecological and Socioeconomic Parameters

Ecological and socioeconomic parameters were compared to identify potential conflicts between bottomfishing and protection of sensitive ecological areas. This comparison was made to facilitate the development of zoning options that will maximize ecological protection and minimize adverse socioeconomic impacts. A ranking system was developed to facilitate comparisons between ecological and socioeconomic parameters by location in the NWHI. Ecological and fisheries parameters described in Table 1 were ranked for each location in the NWHI based on data presented in Tables 2 and 3. Each parameter was given equal weight. The ranking system generally reflects spatial overlays provided in Map 1 and provides a numerical comparison that can be used to address conflicting resource uses. In addition, spatial overlays comparing key ecological and socioeconomic parameters are provided in Map 1.

Ecological and bottomfish ranks ranged from high (4) to low (1) or none reported (0) (Table 4). A reef fish rank was developed based on reef fish species richness, level of endemism, and the apex predator biomass. A coral rank was developed based on coral species richness, coral cover, and area of coral reef with greater than 10 percent coral cover. An endangered species rank was developed based on the presence and size of monk seal breeding colonies and number of nesting sites for green turtles. An average ecological rank was calculated from these three ranks. This average ecological rank is related only to shallow coral reef ecosystems because of the absence of ecological data from submerged banks and seamounts. The bottomfish rank was assigned based on the percentage of pounds kept to the total pounds kept in the NWHI.

The results of ecological ranking are shown graphically in Figure 2. Areas with the highest average ecological ranks are French Frigate Shoals, Pearl and Hermes Atoll, and Lisianski Island (Table 4, Figure 2). These areas have the highest values in reef fish, coral, and endangered species ranks, and maintain the largest breeding populations of the Hawaiian monk seal. The most extensive monk seal foraging area and colony size and green turtle nesting sites are around French Frigate Shoals (Map 1) making this atoll and the banks around it stand out from an ecological perspective. Laysan Island, Maro Reef, Kure and Midway Atolls have the next highest ecological ranks characterized, by moderate reef fish and coral ranks. Maro has high coral species richness and the highest coral cover (Table 2) but has no breeding colony of Hawaiian monk seals. Areas with the lowest average ecological rank are Necker and Nihoa Islands and Gardner Pinnacles. The low ecological rank at Gardner Pinnacles results from low reef fish and coral ranks in addition to the absence of a breeding population of Hawaiian monk seals. Despite the absence of breeding populations, all areas are used by monk seals for foraging (Map 1). Ecological ranks tend to decrease traveling northeast from Pearl and Hermes Atoll to Kure Atoll and southeast from Pearl and Hermes Atoll to Gardner Pinnacles.



Table 4. Comparison of Ecological and Bottomfish Ranks by Location

Location	Type	Average Ecological Rank ¹	Bottomfish Rank ²
Islands/Atolls			
Kure Atoll	Atoll	2.3	0
Midway Atoll	Atoll	2.0	0
Pearl and Hermes Atoll	Atoll	3.6	1
Lisianski Island	Island	3.3	2
Laysan Island	Island	2.6	0
Maro Reef	Reef	2.0	4
Gardner Pinnacles	Pinnacle	1.0	3
French Frigate Shoals	Atoll	3.7	3
Necker Island	Pinnacle	1.0	4
Nihoa Island	Island	1.3	1
Submerged Banks/Seamounts			
Seamounts North of Kure Atoll	Seamount	n/a	0
Nero Seamount	Seamount	n/a	0
Ladd Seamount	Seamount	n/a	0
Salmon Bank	Bank	n/a	1
Unnamed bank north of Lisianski Island	Bank	n/a	0
Pioneer Bank	Bank	n/a	2
North Hampton Seamounts	Seamount	n/a	0
Raita Bank	Bank	n/a	1
1 st bank west of St. Rogatien	Bank	n/a	w/ St. Rogatien
St. Rogatien Bank	Bank	n/a	3
Brooks Banks (2)	Bank	n/a	1
Southeast Brooks Bank	Bank	n/a	w/ Brooks Banks
1 st bank east of FFS	Bank	n/a	w/ FFS
Two banks between Necker and Nihoa Islands	Bank	n/a	2
Banks W. of Nihoa	Bank	n/a	w/ Nihoa

Notes: 1 - Average ecological rank is based on coral reef ecosystem parameters (Table 2) where 4 is the highest ecological value, 1 is the lowest ecological value and n/a denotes absence of ecological data; 2 - Bottomfish Rank is based on percent lbs landed in the NWHI (Table 3) where 4 is the highest percent lbs bottomfish landed, 1 is the lowest and 0, none reported. **Bold** numbers represent highest ranks.



Figure 2. Ecological Ranking of Islands and Atolls of the Northwestern Hawaiian Islands

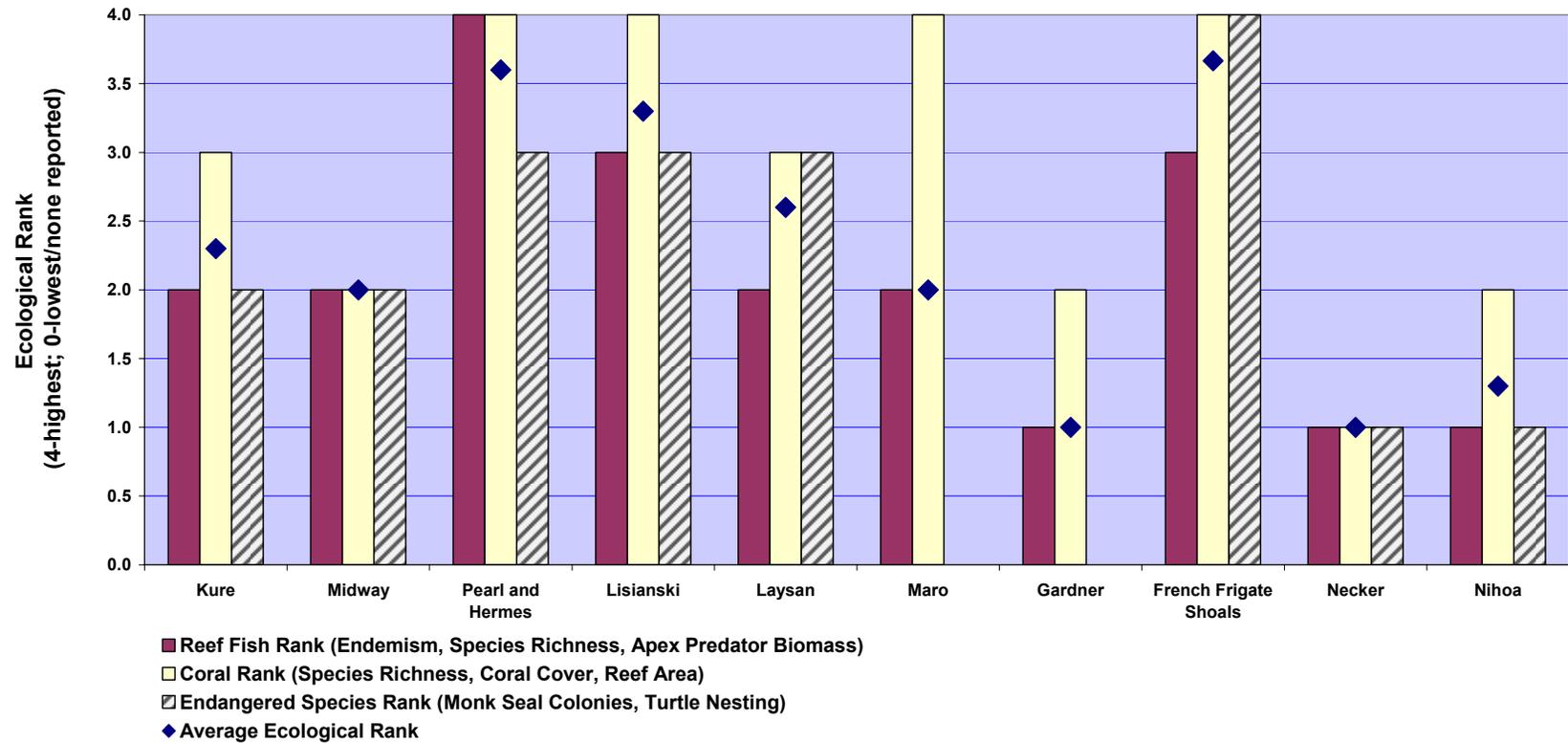




Figure 3 shows the results of bottomfish ranking for all areas in the NWHI. Islands and atolls with the highest bottomfish ranks are Necker Island, Maro Reef, French Frigate Shoals, and Gardner Pinnacles. The highest bottomfish rank for submerged banks and seamounts is St. Rogatien Bank, followed by Pioneer Bank and the two banks between Necker and Nihoa Islands (Table 4; Figure 3). Bottomfish ranks for Kure and Midway Atolls, an unnamed bank north of Lisianski Island, and Ladd, Nero, and other seamounts northwest of Kure Atoll are zero because no catch was reported in these areas.

The results from the ranking system provide insight into the relationship between ecological and socioeconomic resource values and provide a basis for developing and refining zoning options to maximize ecological protection and minimize socioeconomic impacts to the bottomfish/pelagic trolling fishing activity in the NWHI. A comparison between ecological and bottomfish ranks for islands and banks of the NWHI is provided in Table 4 and shown graphically in Figure 4. Key findings of this comparison include:

- Gardner Pinnacles and Necker Island are characterized by the highest bottomfish ranks and lowest ecological ranks.
- Pearl and Hermes Atoll and Laysan and Lisianski Islands have the highest ecological ranks coupled with the lowest bottomfish ranks.
- Nihoa has both a low ecological rank and low bottomfish rank.
- Kure and Midway Atolls are characterized by relatively high ecological ranks and no bottomfish ranks as no catch was reported from these areas. Kure Atoll is the world's most northern atoll and is referred to as the Darwin Point, where coral growth and subsidence and erosional processes balance one another (Grigg 1982).

The two areas identified as potentially having a resource management conflict are French Frigate Shoals and Maro Reef. French Frigate Shoals is characterized with the highest ecological rank and a high bottomfish rank. Maro Reef has a moderate ecological rank and high bottomfish rank. Information collected during the socioeconomic survey of bottomfishermen indicated that fishermen recognized the high resource value associated with French Frigate Shoals and believed they did not rely on the area to maintain economic viability. They further suggested that French Frigate Shoals be afforded additional resource protection. In addition, current fishing practices around Maro Reef, based on bathymetric considerations, precluded fishermen from conducting fishing operations near most of the coral reef resources at this location.

Although not enough ecological information was available to generate ranks for banks and seamounts in the NWHI, fishing data were available to generate bottomfish ranks based on reported landings. The banks typically had lower bottomfish ranks than the islands and atolls, and the value tended to be distributed more evenly traveling southeast from Pioneer Bank to the bank west of Nihoa. However, it is clear from the data in Table 3 that very little fishing activity takes place northwest of Pioneer Bank. This is reinforced by the socioeconomic surveys, which indicated that no bottomfishing of any kind was active in this area.



Figure 3. Bottomfish Rank for all Locations in the Northwestern Hawaiian Islands

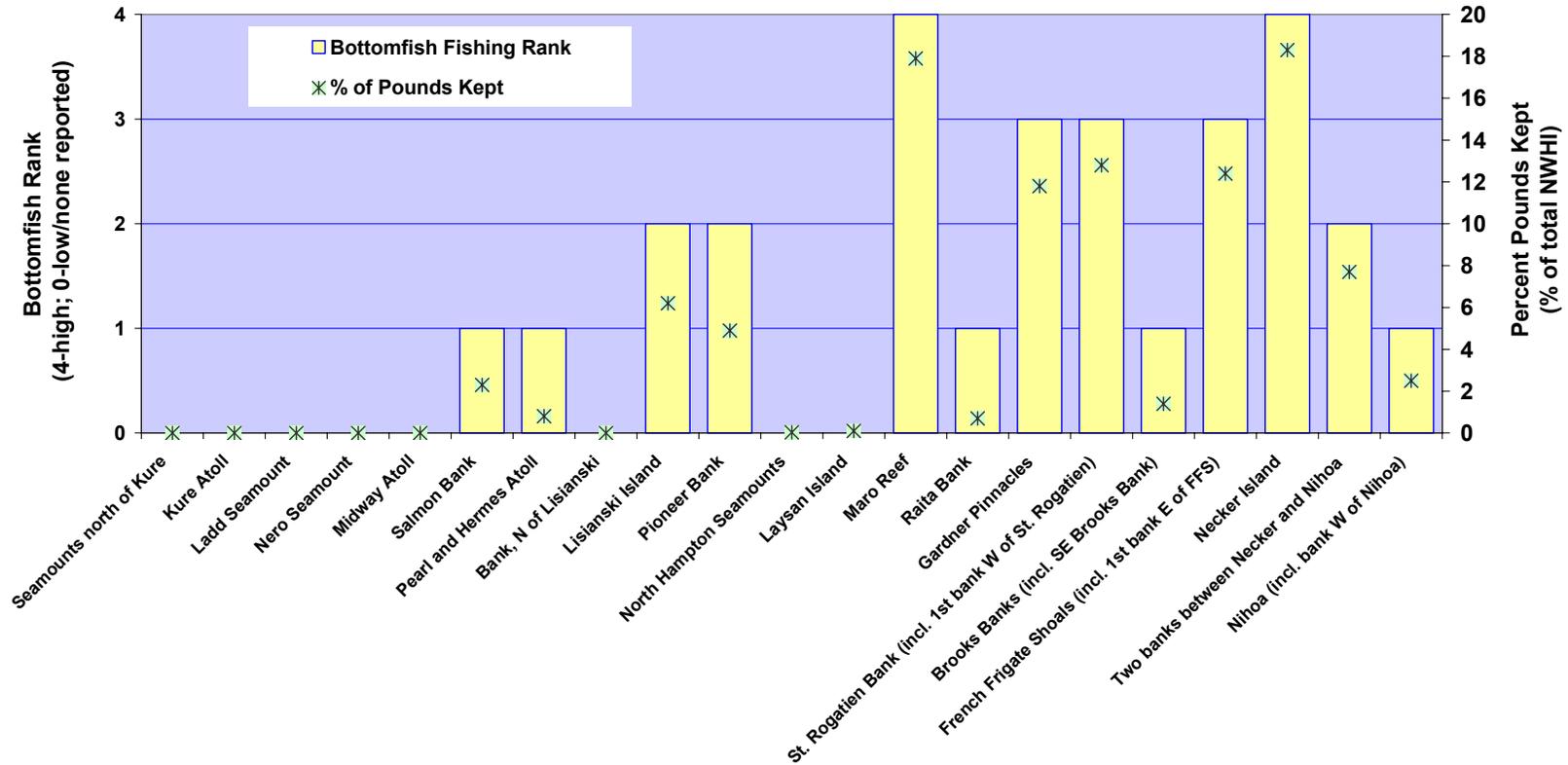
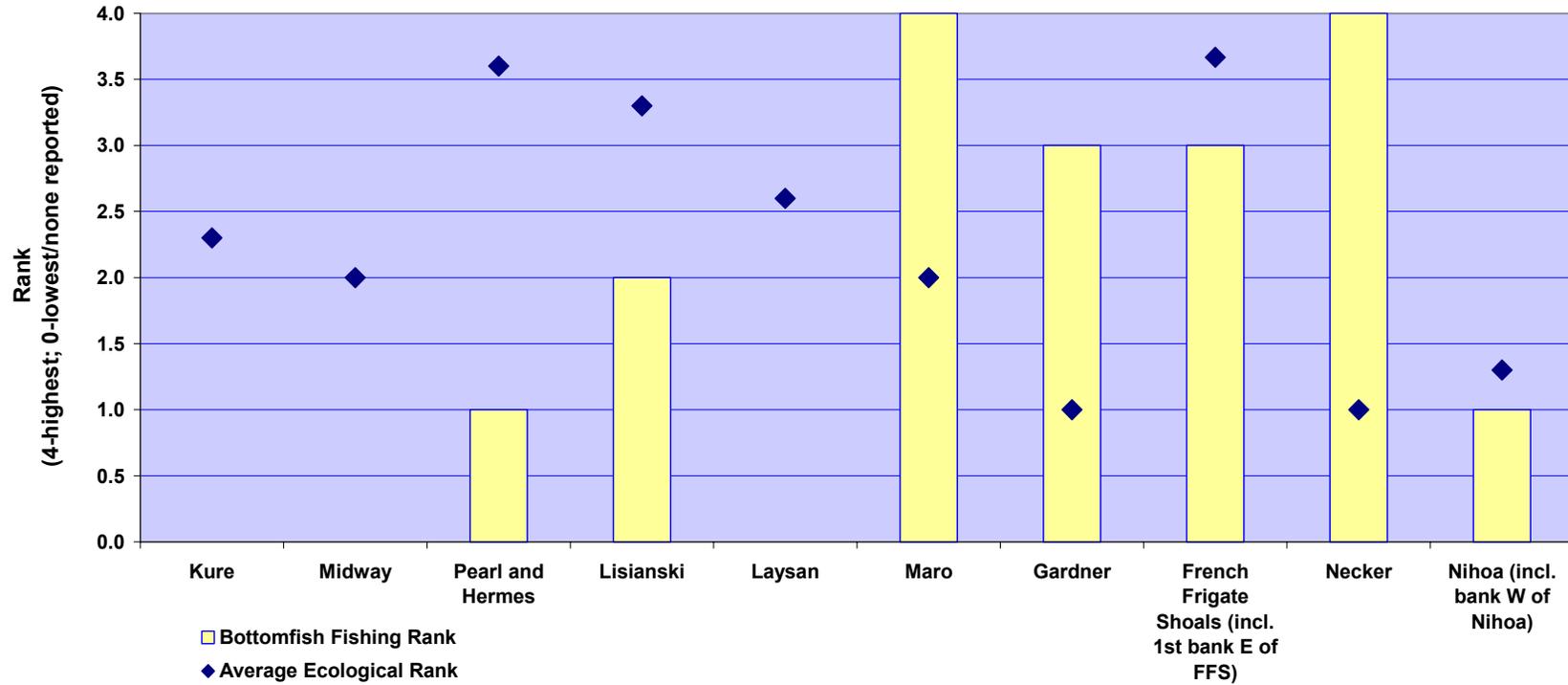
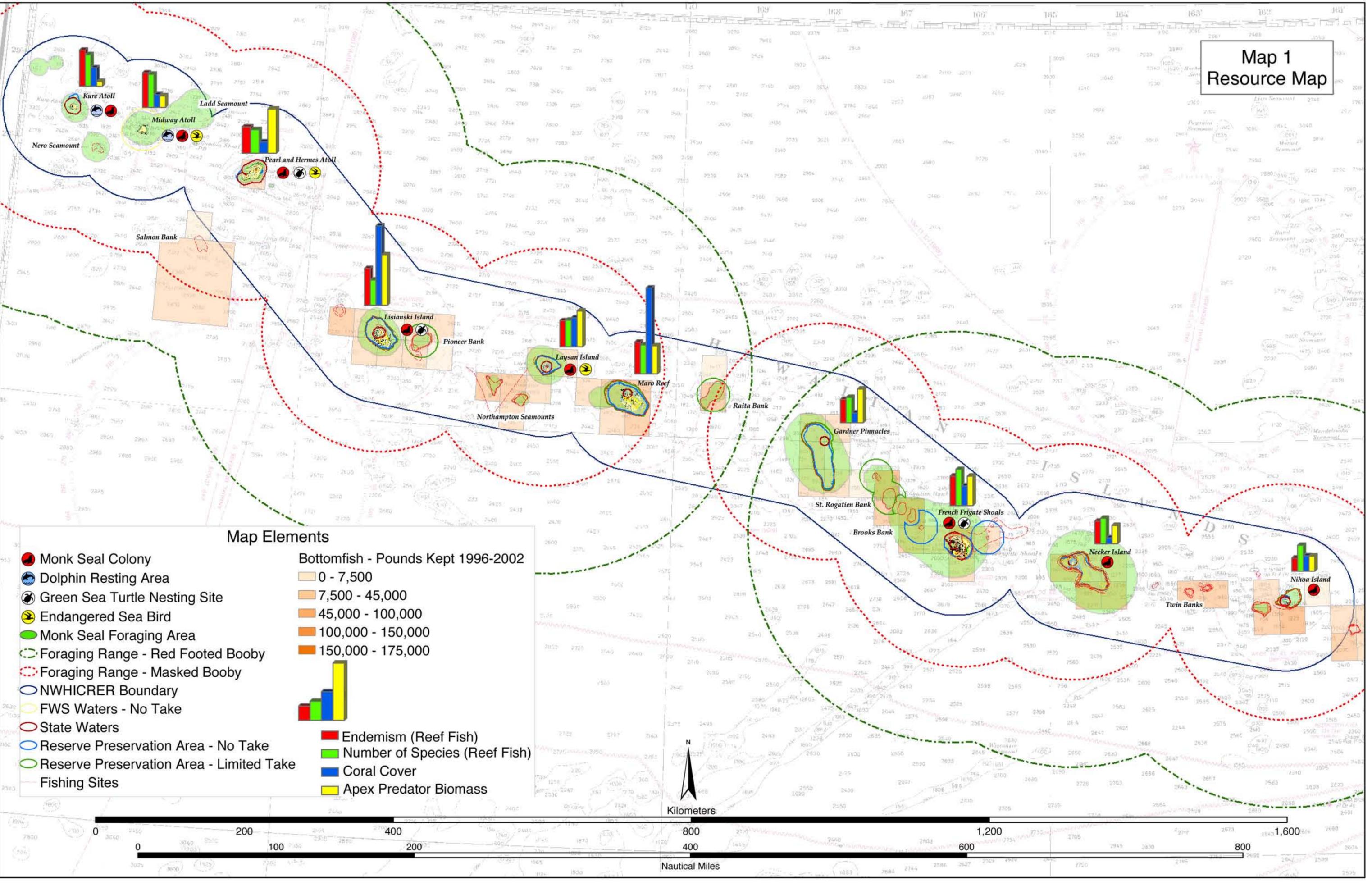




Figure 4. Comparison of Ecological and Bottomfish Ranks by Location



Map 1 Resource Map

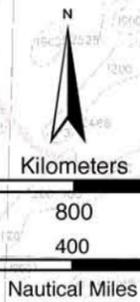


Map Elements

- Monk Seal Colony
- Dolphin Resting Area
- Green Sea Turtle Nesting Site
- Endangered Sea Bird
- Monk Seal Foraging Area
- Foraging Range - Red Footed Booby
- Foraging Range - Masked Booby
- NWHICRER Boundary
- FWS Waters - No Take
- State Waters
- Reserve Preservation Area - No Take
- Reserve Preservation Area - Limited Take
- Fishing Sites

Bottomfish - Pounds Kept 1996-2002

- 0 - 7,500
- 7,500 - 45,000
- 45,000 - 100,000
- 100,000 - 150,000
- 150,000 - 175,000





5.0 Range of Fishing Alternatives

The National Marine Sanctuary Program (NMSP) met with Western Pacific Regional Fishery Management Council (WPRFMC) and other partners several times in the summer and fall of 2003. These meetings were held to determine the best format for the NMSP to provide advice and recommendations to WPRFMC on how to draft regulations pursuant to Section 304(a)(5) of the National Marine Sanctuaries Act (NMSA). During these meetings, WPRFMC requested that the NMSP provide an analysis of a range of fishing alternatives, and identify the alternative considered the most consistent with the Goals and Objectives (G&O) Statement of the proposed sanctuary. To support this process, WPRFMC transmitted an alternative for analysis on July 22, 2003.

The NMSP placed WPRFMC's proposed alternative among a preliminary range of five others, which included the status quo, a variation on the status quo, an alternative provided by the Reserve Advisory Council (RAC), and an alternative that contemplates closing the entire sanctuary to extractive use. These alternatives are briefly summarized below and are more fully described in Section 7, which presents a refined range of alternatives. Each of these alternatives has geographic zoning components which are also discussed later.

Status Quo/No Action Alternative: The status quo alternative is based on the executive orders (EO) and assumes a sanctuary will not be designated in the Northwestern Hawaiian Islands (NWHI). This alternative places caps on all fishing activities that were active at the time the EO was issued (2000), and prohibits the development of new or inactive fisheries. This alternative makes provisions for several types of commercial and recreational fishing including bottomfishing/pelagic trolling, commercial trolling, sustenance fishing, and Native Hawaiian cultural and subsistence use.

Sanctuary Based on Reserve Alternative: This alternative mirrors the provisions of the Executive Orders 13178 and 13196 (EO) but assumes those provisions will become regulations promulgated under the NMSA. In addition, this alternative provides straight-line boundaries, as opposed to fathom boundaries, to define Reserve/Sanctuary Preservation Areas to aid in user compliance and enforcement.

WPRFMC Alternative: This alternative developed by WPRFMC is based on a summary and compilation of its fishery management plans (FMP). This alternative is silent on recreational fishing, sustenance fishing, and Native Hawaiian cultural and subsistence use. However, it makes provisions for many forms of commercial fishing including the harvest of coral reef species, precious corals, crustaceans, bottomfish, and pelagic fish. Two of these fisheries, and the portions of their FMPs that pertain to the NWHI, have previously been disapproved by National Oceanic and Atmospheric Administration (NOAA). In addition, in a Federal Register notice on March 16, 2004, NOAA Fisheries issued a zero-harvest guideline and cited the EO as a reason to continue the closure of the crustacean fishery (69 FR 12303).

RAC Alternative: This alternative, developed by the RAC, is similar to the one that envisions a sanctuary based on the EO. However, it contains provisions calling for the closure of



bottomfishing/pelagic trolling to be closed after 1 year. In addition, this alternative significantly restricts the locations where any fishing activities can take place beyond the restricted areas provided by the EO for the current Reserve. This alternative prohibits crustacean and precious coral harvest and the harvest of all coral reef species (e.g. aquaria and live fish trade species, coral, live rock, invertebrates, etc.). It allows for some commercial pelagic and recreational pelagic fishing, but restricts such fishing to the outer 30 nm perimeter of the proposed sanctuary boundary.

Full Closure Alternative: The final alternative in the range is one that closes immediately the entire area to all extractive use. This alternative was developed based on input from the public during sanctuary designation scoping meetings.

Table 5 below depicts this preliminary range of fishing alternatives.

**Table 5. Comparison of Fishing Activity Prohibitions¹
for the Range of Fishing Alternatives**

Fishing Activity	Status Quo Alternative	Status Quo w/Regulations Alternative	Western Pacific Regional Fishery Management Council Alternative	Reserve Advisory Council Alternative	Full Closure Alternative
Commercial Pelagic (longline)	Shaded	Shaded	Shaded	Shaded	Shaded
Commercial Precious Coral	Shaded	Shaded	White	Shaded	Shaded
Commercial Coral Reef Species	Shaded	Shaded	White	Shaded	Shaded
Commercial Crustacean	Shaded	Shaded	White	Shaded	Shaded
Commercial Bottomfish/Pelagic	White	White	White	Shaded	Shaded
Commercial Pelagic (trolling)	White	White	White	White	Shaded
Recreational (Catch and Release)	White	White	White	White	Shaded
Recreational (Catch and Keep)	White	White	White	Shaded	Shaded
Sustenance Fishing	White	White	White	White	Shaded
Native Hawaiian Cultural/ Subsistence	White	White	White	White	Shaded

Notes: 1 - Prohibited fishing activities shown as shaded areas



6.0 Evaluation of Fishing Activities

The component fishing activities of each alternative were evaluated based on screening criteria developed from relevant provisions of the National Marine Sanctuaries Act (NMSA) and management goal 7 from the Goals and Objectives Statement (Table 6). Management goal 7 focuses on the ecological and socioeconomic impacts of fishing activities.

Table 6. Screening Criteria Used to Evaluate Fishing Activities Based on Relevant Provisions of the NMSA and Sanctuary Management Goal 7

National Marine Sanctuaries Act Purposes and Policies	Sanctuary Management Goal Related to Fishing	Screening Criteria for Fishing Activities
<p>(1) Identify and designate as national marine sanctuaries areas of the marine environment that are of special national significance and manage these areas as the National Marine Sanctuary System.</p> <p>(3) Maintain the natural biological communities in the national marine sanctuaries, and protect, and, where appropriate, restore and enhance natural habitats, populations, and ecological processes.</p> <p>(6) Facilitate to the extent compatible with the primary objective of resource protection, all public and private uses of the resources of these marine areas not prohibited pursuant to other authorities.</p> <p>(8) Create models of, and incentives for, ways to conserve and manage these areas, including the application of innovative management techniques.</p>	<p>Goal 7: Maintain ecosystem integrity by limiting and controlling fishing activities using an ecosystem-based management approach. Maximize ecosystem protection while minimizing adverse socioeconomic impacts. Limit fishing activities to areas that minimize or prevent interactions with corals, seabirds, endangered Hawaiian monk seals, and other protected wildlife, or that do not threaten the natural character or biological integrity of any ecosystem of the region.</p>	<ol style="list-style-type: none"> 1. Does the proposed activity currently provide socioeconomic benefits? 2. Is proposed activity based on the knowledge of life history and ecological characteristics of target species? 3. Does proposed activity protect prey species of and minimize interactions with endangered species? 4. Does the proposed activity maintain existing range of social, cultural, and/or historical benefits? 5. Does the proposed activity target species resilient to natural and anthropogenic perturbations (e.g. climate change, invasive species, marine debris)?

Fishing activities considered in the screening process include those that are either currently active, historically conducted, or have been considered or known to have recently existed in the Northwestern Hawaiian Islands (NWHI) even in some limited manner. The evaluation was conducted with information and data on the history and current status of the fishing activity, as well as a biological and ecological characterization of target and non-target species. This section briefly describes each fishing activity and the results of the screening process. The results of the screening process are summarized in Table 7.



Table 7. Evaluation of Fishing Activities Using Screening Criteria

Criteria Used to Screen Fishing Activities ¹	Fishing Activity Score ²								
	Commercial Pelagic (longlining)	Commercial Precious Coral	Commercial Coral Reef Species	Commercial Crustacean	Commercial Bottomfish/Pelagic	Commercial Pelagic (trolling)	Recreational (Catch and Release)	Sustenance	Native Hawaiian Cultural/Subsistence
Does the proposed activity currently provide socioeconomic benefits??	Prohibited under MSA since 1991 (-1)	Fishery is inactive, and never occurred within sanctuary (-1)	FMP not approved for NWHI, no permits and no activity (-1)	Fishery closed since 2000, no fishing has occurred since 1999 (-1)	Fishery has been active for decades and permitted since 1986 (+1)	Activity is unpermitted but occurs at low levels in the NWHI (0)	Activity was permitted and occurred regularly from 1996-2001 (+1)	Activity is known to occur at limited sites in NWHI (+1)	Activity has occurred traditionally and historically (+1)
Is proposed activity based on knowledge of life history and ecological characteristics of target species?	Species traits not considered in management regime (-1)	Stock size unknown, growth rates by proxy (-1)	Little to no information available for most species (-1)	Fishery closed due to court order & life trait uncertainty; documented shift in community structure, vulnerable meta-population (-1)	Species traits not considered in management regime (-1)	Species traits not considered in management regime (-1)	Tag/release program aids life history knowledge (+1)	Species traits not considered (-1)	Utilizes traditional ecological knowledge based system. (+1)
Does proposed activity protect prey species of and minimize interactions with endangered species?	Activity prohibited to protect endangered species (-1)	No data supporting association with endangered species (0)	Activity likely to occur in shallow habitat (-1)	Major concern is importance of lobster in monk seal diet (-1)	Biological opinion (2001) found no impact by this activity (+1)	Occurs in deep water away from endangered species (+1)	Concerns raised for shore-based activities (-1)	Participants aware of environment, can avoid endangered species (+1)	Activities could disturb monk seals, and could include use of materials from protected species (-1)
Does the proposed activity maintain existing range of social, cultural, and/or historical benefits?	No activity= no benefits (-1)	No activity= no benefits (-1)	No activity= no benefits (-1)	Value of fishery declined steadily until closure (-1)	Low economic significance (2%) but socially important (+1)	Augments local fresh fish demand (+1)	Enjoyment for small group of participants, profitable business (+1)	Enjoyment for small group of people who regularly visit the NWHI (+1)	Very important to the native Hawaiian community (+1)
Does the proposed activity target species resilient to natural and anthropogenic perturbations (e.g. climate change, invasive species, marine debris)?	Pelagic species are typically more resilient (+1)	Slow growth rates, susceptible to invasive species (-1)	Slow growth, bleachings, susceptible to invasive species, storms, groundings, marine debris (-1)	Lobster decline caused by both commercial harvest decadal oscillation (-1)	Deep-water species are typically more resilient (+1)	Pelagic species are typically more resilient (+1)	Pelagic species–yes; reef species- no; concern expressed for jacks (-1)	Pelagic species–yes, reef species-no, concern for jacks (-1)	Uncertain what the target species will be (0)
Total Score³	-3	-4	-5	-5	+3	+2	+1	+1	+2

Notes: 1 – Screening criteria from Table 3 ; 2 – Scoring Range: -1=negative response; 0=neutral response; +1=positive response; 3 – Total Score: negative total score means fishing activity incompatible with primary purpose of proposed sanctuary; positive total score means fishing activity may be compatible with primary purpose of proposed sanctuary



Fishing Activities That Do Not Meet Screening Criteria

This section describes the fishing activities that do not meet the screening criteria, as reflected in a negative total score for all criteria. These fishing activities are considered inconsistent with the relevant provisions of the NMSA and goals for the proposed sanctuary. These activities are commercial pelagic longlining, precious coral harvest, coral reef species harvest, and crustacean fishing. Supporting rationale for the screening results is described below and summarized in Table 7.

Commercial Pelagic Longlining: Commercial pelagic longlining within the study area of the proposed sanctuary, received a negative total score of -3 for all screening criteria and is considered inconsistent with the relevant provisions of the NMSA and goals for the proposed sanctuary. This activity has been prohibited in the NWHI since 1991 under the Pelagic Fishery Management Plan (FMP) of the Western Pacific Regional Fishery Management Council (WPRFMC). As a result, it is not considered an existing fishery. The fishery is characterized by high bycatch rates and a history of interactions with endangered Hawaiian monk seals, turtles, and seabirds (National Oceanic and Atmospheric Administration [NOAA] Fisheries, 2002a). The 100 nm-wide protected species zone around the NWHI was established based on documented interactions with endangered and protected species. All fishing alternatives have identified commercial pelagic longlining as a prohibited activity within the boundaries of the proposed sanctuary.

Socioeconomic Impact: Maintaining this closure will not likely have a socioeconomic impact because the fishery does not currently operate in the area.

Commercial Precious Coral Fishing: Commercial precious coral fishing within the study area of the proposed sanctuary received a negative total score of -4 for all screening criteria and is considered inconsistent with the relevant provisions of the NMSA and goals for the proposed sanctuary. No commercial harvest of precious coral resources has occurred in the NWHI, except in 1988, when the domestic vessel *Kilauea* (with federal permit) used a dredge to harvest precious coral beds at Hancock Seamount; the operation was discontinued because of insufficient harvests of high quality corals (WPRFMC 2003a). NOAA Fisheries is not implementing proposed precious coral management measures for the NWHI because they were determined to be inconsistent with certain provisions of Executive Orders 13178 and 13196 (EO), which together establish the NWHI Coral Reef Ecosystem Reserve (67 FR 11941). Little is known about the size of the standing stock, habitat requirements, growth rates, and many life history traits of targeted species. As a result, basic fisheries management parameters, such as maximum sustainable yield (MSY), cannot be accurately estimated, and therefore would be a poor management indicator for the NWHI. The importance of deep-water precious coral beds as refuge for eels and bottomfish, and consequently as monk seal foraging habitats is unresolved and may be significant to the management and health of the critically endangered Hawaiian monk seal population (Parrish *et al* 2002). These factors strongly weigh against allowing this fishery in the proposed sanctuary. All fishing alternatives except the alternative provided by



WPRFMC have identified commercial harvest of precious coral as a prohibited activity within the boundaries of the proposed sanctuary.

Socioeconomic Impact: An attempt was made to establish a domestic precious coral fishery in 1998 but it was unsuccessful due to economic inviability. Prohibiting this activity would likely have no socioeconomic impact because no domestic precious coral fishery has ever existed in the NWHI.

Commercial Coral Reef Species Fishing: Commercial coral reef species fishing within the study area of the proposed sanctuary received a negative total score of -5 for all screening criteria and is considered inconsistent with relevant provisions of the NMSA and goals for the proposed sanctuary. The harvest of live rock and live coral is currently prohibited by both state and federal regulations (Hawaii Administration Rules [HAR], 1995; WPRFMC, 2001a). The primary purpose of the NMSA is to identify and designate marine ecosystems of special national significance as marine sanctuaries. Protection of the shallow-water coral reef environment is the core of this sanctuary’s designation. Past coral reef fisheries in the NWHI experienced sudden collapses and required decades for even partial recoveries (Maragos and Gulko, 2002). The shallow-water environment is also the primary habitat and foraging grounds for endangered Hawaiian monk seals, fledgling seabirds, and nesting threatened green sea turtles. The impact inshore fisheries may have on these populations is unknown. All fishing alternatives except the alternative provided by WPRFMC have identified commercial harvest of coral reef species as a prohibited activity within the boundaries of the proposed sanctuary.

Socioeconomic Impact: A coral reef species fishery has not been in place in the NWHI since the 1950s. The harvest of several coral reef-related species is already prohibited under various state and federal regulations, thus limiting the scope of reef-related fishing activities. Prohibiting this fishery would likely have little socioeconomic impact because it is not currently being practiced, and many of the species that would be considered harvestable are already prohibited.

Commercial Crustacean Fishing: Commercial crustacean fishing (e.g. lobsters, crabs, and shrimp) within the study area of the proposed sanctuary received a negative total score of -5 for all screening criteria and is considered inconsistent with the relevant provisions of the NMSA and goals for the proposed sanctuary. The only commercial fishery operated under this FMP has been a lobster fishery.

The commercial crustacean fishery experienced a classic “boom and bust” scenario. Table 8 depicts a six-fold decrease in landings, an eleven-fold decrease in value, a five-fold decrease in effort and a doubling of regulatory discards. The following graph illustrates that a precipitous drop in catchability foreshadowed the bust by 5 years. This decline occurred across all lobster grounds, including the primary banks of Necker Island, Maro Reef, and Gardner Pinnacles (Figure 5).

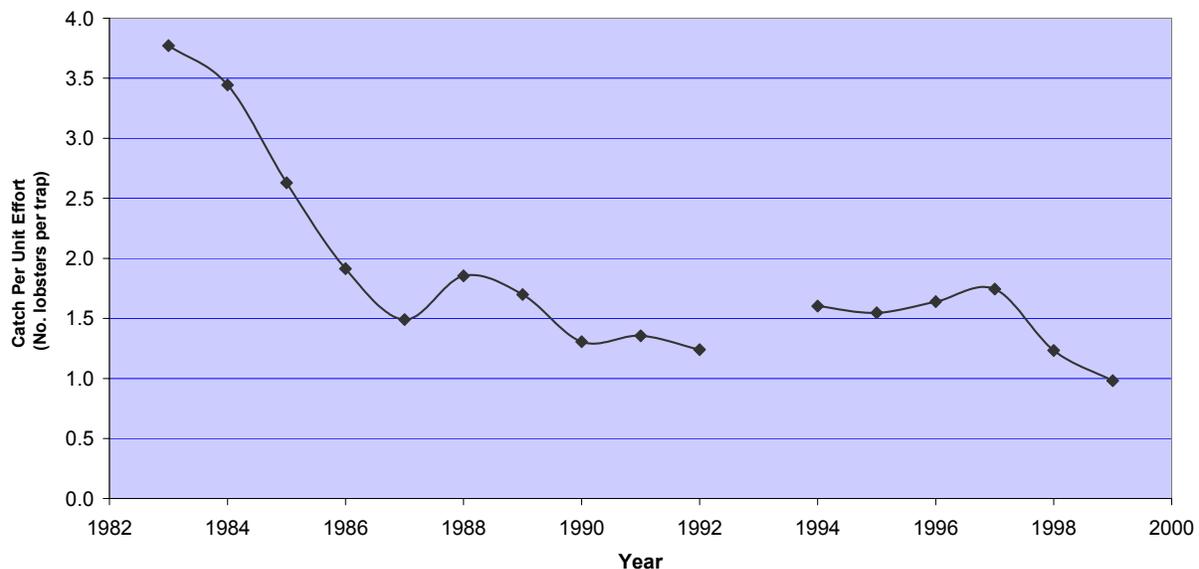


Table 8. Change in Commercial Crustacean Fishery in the NWHI¹

Parameter	Boom Years (1984 – 1990)	Bust Years (1991-1999)
Lobsters Landed (Average per year)	1,275,000	211,000
Value of Fishery (inflation-adjusted)	\$11,000,000 (1985)	\$1,000,000 (1999)
Participation (Average boats per year)	14	6
Effort in trap-hauls per year (Average per year)	1,037,000	213,000
Discard rate (percent of juveniles and berried females in catch) ²	28% (1982)	62% (1995)

Notes: 1 - Based on data from Dinardo and Marshall 2001; 2 - Changed to a “retain-all” fishery in 1996

Figure 5. Commercial Crustacean Catch Per Unit Effort (all species) in the NWHI
(Dinardo and Marshall 2001)



The commercial fishery began in 1976, and within eight years developed advances in trap design and processing techniques that led to huge increases in total landings. New trap designs, introduced in 1984, tripled trap hauls in a single year (Kawamoto and Pooley 2000). Moving from a live lobster fishery to a frozen tail fishery allowed fishermen to remain at sea longer and return with much more product. Federal fishery management began in 1983, with the adoption of the Fishery Management Plan for Crustaceans of the Western Pacific. Between 1984 and 1988, landings exceeded the MSY of 300,000 lobsters (WPRFMC 1982) by an average of 445%. In 1989, the MSY was increased to 1,000,000 lobsters (SRG 2004), adjusted to include slipper lobsters in the catch. A “laissez-faire management strategy” of allowing the free-market to address overcapacity problems, with a minimum of biological regulation, was employed through 1988 (Clarke, Yoshimoto and Pooley 1992). This strategy was unsuccessful, propelling development of a limited-entry program in 1991 and catch quotas in 1992 (Kawamoto and Pooley 2000).



These management tools were being applied at the same time that NOAA Fisheries began a series of emergency actions for the lobster fishery. An emergency action was taken on May 13, 1991 to close the fishery from May 8 through August 12 in response to indications of NWHI lobster stocks approaching an overfished condition (56 FR 21961). The closure was extended until November 12, 1991 through another emergency action on July 30 (56 FR 36912). The fishery was reopened in 1992 under new harvest guidelines. The fishery was closed for the entire 1993 season and a second emergency closure was issued eight weeks into the 1994 season (59 FR 44341). The fishery was open to a single vessel in 1995 under an experimental fishing permit to assess stock conditions.

The sudden decline of the lobster stocks was a cause for concern for fishermen, managers and scientists (56 FR 21961). An environmental regime shift that decreased the productivity of the entire island chain (Polovina and Mitchum 1992) and biotic factors including competition over suitable habitat (Parrish and Polovina 1994), were likely exacerbated by intensive fishing efforts being conducted in the region at the time (Polovina *et al.* 1995). Most recently, research has focused on the meta-population¹ dynamics of these species (Dinardo and Marshall, 2001).

The lobsters' metapopulation structure is considered highly vulnerable to rapid depletion under the combined strain of environmental variability and fishing pressure. Both of these factors have played a role in the population dynamics of NWHI lobsters. Because spiny and slipper lobsters have a very long pelagic life stage (11 to 12 months and 3 to 4 months, respectively), but do not migrate after settling to the ocean floor, individual bank habitats serve as recruitment sources, sinks, or both (Dinardo and Marshall, 2001). This was demonstrated at Laysan Island, where a population depletion occurred in spite of a 20-year ban on fishing within 20 miles of shore. In the late 1990s, apparent recruitment failures reduced stock size at a number of banks that had not been fished for ten years (Dinardo and Marshall 2001). Scientists now believe that poor recruitment and overharvest of spiny lobsters at Maro Reef, 110 kilometers (km) away, contributed to stock depletions at Laysan as well as a shift in species dominance at Maro Reef, with slipper lobsters occupying much of their former shallow-water habitat. These data suggest ecosystem-level impacts have resulted from the sharp decline of the spiny lobster population. Furthermore, populations with low or sporadic recruitment are very susceptible to depletion and overfishing (Dinardo and Marshall 2001).

The NWHI lobster fishery was closed again in 2000 to protect lobster stocks because of shortcomings in understanding the dynamics of the NWHI lobster populations, increasing uncertainty in population model parameter estimates, and the lack of appreciable rebuilding of the lobster population despite significant reductions in fishing effort throughout the NWHI (65 FR 39314). The closure has continued through 2004 as a precautionary measure to prevent overfishing (69 FR 12303). Meta-population modeling efforts are under way, but due to data limitations are focusing only on spiny lobsters. Recent stock assessments indicate that no recovery has occurred for spiny lobsters during the four-year fishery closure, although slipper lobsters may be increasing at Maro reef. However, it will likely take several years to develop reasonable estimates of exploitable biomass for both species (Botsford *et al.* 2002).

¹ A population of geographically separated populations linked through limited recruitment.



This closure is also in compliance with an order of the U.S. district court for the District of Hawaii to keep the crustacean fisheries closed until an EIS and Biological Opinion have been prepared regarding the potential interactions with monk seals. These concerns include uncertainty surrounding the depletion of stocks that serve as a potential food source for the endangered monk seal. This depletion may occur due to direct competition for lobsters within the fishery and through bycatch of octopi, other crustaceans, eels, and reef fish.

Direct and indirect interactions between the lobster fishery and monk seals are ongoing concerns for resource managers. Starvation of juvenile monk seals is a major cause of population decline in recent years. The lobster fishery has been implicated in removing important food sources for these seals, including both lobsters and bycatch species such as octopi, eels, and reef fish. Of greatest concern is the French Frigate Shoals population where evidence of limited prey availability includes small and emaciated pups as well as smaller nursing females than at other colonies. Although the relative importance of different prey items in the diet of Hawaiian monk seals is not yet certain, preliminary results from both scat and fatty acid analyses reveal that lobsters may constitute a significant percentage of the diet of monk seals (Goodman-Lowe *et al* 2000).

Direct interactions have been identified as a concern. In 1983, trap entrance dimensions were limited to a maximum diameter of 6.5 inches to prevent entrapment of monk seals foraging around fishing operations (WPRFMC, 1982). However, during the height of the fishery in 1986, a monk seal was entangled and drowned in a trap bridle (Nitta and Henderson, 1993).

Lobster fishing can also damage the benthic habitat during normal operations. Vessels deploy as many as 1,000 lead-weighted traps in a single evening, sometimes directly on coral reef. Traps can shift along the ocean floor by strong currents or dragged during hauling operations. Evidence of damage to the reef has come from fishery observers reports and includes entire coral heads entangled in the mainline and pieces of broken coral wedged in traps.

Because lobsters live in relatively shallow waters (10-100 meters), lobster vessels must operate both close to shore and in the coral reef environment. This necessity brings with it additional ecosystem threats, including shipwrecks and groundings, oil spills, bycatch, benthic habitat damage, ghost fishing from discarded or lost gear, and entanglements with protected marine species.

In 1998, the *Paradise Queen II* ran aground at Kure Atoll, spilling 11,000 gallons of diesel fuel and 500 gallons of hydraulic fluids and oil. The vessel also lost 3,000 pounds of frozen lobster tails, 4,000 pounds of bait, 11 miles of lobster pot mainline, and 1,040 lead-weighted plastic lobster traps. Broken coral and uprooted coralline algae structures were apparently caused by these traps rolling around in the surf. Only 600 of the traps on board were recovered and remain stacked on Kure Atoll. Two years later, researchers found broken coral, 600 lobster traps, and the bodies of two monk seals among piles of nets surrounding the decaying wheelhouse (USFWS, HIHWNMS, DLNR; press release 10/03/00).

Bycatch of all types in the lobster fishery has been an ongoing issue of concern. The annual NOAA Fisheries lobster assessment cruise has kept a running total of the number of different



bycatch species found in their traps over the past two decades. In attempts to retain all species entering the traps, research traps do not have escape vents. To date, a total of 18,476 total pieces, 11 species groups, and 217 species have been identified over a 17-year period. Bycatch species known to be eaten by monk seals include eels, kona crab and octopus (MMC 2004).

Past history of a boom and bust cycle, unknowns regarding vulnerability of the species to natural and anthropogenic perturbations, the ecological impact of slipper lobsters displacing spiny lobsters in traditional spiny lobster habitat due to overharvest in the fishery, potential ecosystem threats to the habitat and reef species, and unresolved questions on the importance of lobsters in the monk seal diet, make this fishery, as it is currently managed, incompatible with the goals of the proposed sanctuary. All fishing alternatives except the alternative provided by WPRFMC have identified commercial harvest of crustaceans as a prohibited activity within the boundaries of the proposed sanctuary.

Socioeconomic Impact: The economic impact to this fishery occurred when the fishery was closed in 2000 both by NOAA Fisheries and through a federal court order. Maintaining a closure of this fishery will not create significant additional economic impact because it is not currently in operation and catch declined by 90% while the fishery was open - fluctuating dramatically as it dropped. This variability, and ultimately the decline in catch, led to an overall economic decline in the fishery from its height in the 1980s until it closed in 2000. Recent research indicates a small level of population rebuilding may be taking place, but likely not enough to support a substantial fishery.

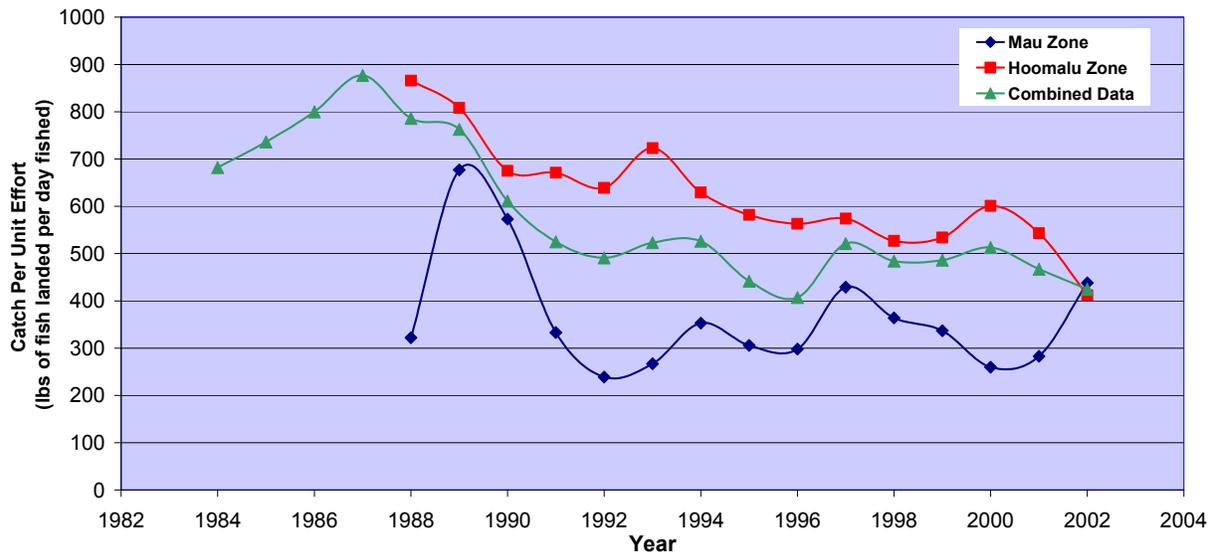
Fishing Activities That Meet Screening Criteria

This section describes the fishing activities that meet screening criteria as reflected in a positive total score for all criteria. These fishing activities are considered consistent with the relevant provisions of the NMSA and goals for the proposed sanctuary. These activities are commercial bottomfish/pelagic trolling, commercial pelagic trolling, recreational catch and release fishing, recreational catch and keep fishing/sustenance, and Native Hawaiian cultural and subsistence uses. Supporting rationale for the screening results is summarized in Table 7.

Commercial Bottomfish/Pelagic Trolling: Commercial bottomfish/pelagic trolling within the study area of the proposed sanctuary received a positive total score of +3 for all screening criteria and appears to be consistent with the relevant provisions of the NMSA and goals of the proposed sanctuary. NOAA Fisheries issued a Biological Opinion concluding that the NWHI bottomfish fishery was not likely to jeopardize the continued existence of any endangered or threatened species or destroy or adversely modify critical habitat (NOAA Fisheries 2002b). Data show that in over a decade of fairly stable fishing operations (Figure 6), the target species populations have remained high based on traditional management measures, including MSY (WPRFMC 2004a). While small in total number of boats and pounds landed, the fishery is important to restaurants promoting fresh, sustainably caught fish from the islands, as well as to local people who celebrate important events by serving these fish.



Figure 6. Catch Per Unit Effort of Bottomfish in the NWHI (WPRFMC 2004a)



In developing the final draft of the recovery plan, the Hawaii Monk Seal Recovery Team recommended the prohibition of all fisheries that (1) result in direct interactions with seals, (2) take monk seal prey species, or (3) impact monk seal feeding habitats or habitats essential to the ecology of prey species. Based on these principles, the Recovery Team recommended, “The bottomfish fishery could be allowed to continue in sanctuary waters, provided that the fishery continues to be monitored for monk seal interactions” (Hawaii Monk Seal Recovery Team 2004). Nevertheless, current fishery management practices, interactions with monk seals, overfishing of a susceptible species, and impacts to the coral reef environment have been voiced as ongoing concerns.

Catch per unit effort (CPUE) in the NWHI is documented in pounds per trip (WPRFMC 2004a). This does not take into account individual bank CPUE, targeted species CPUE, or even the length of the trip. Recent research on a variety of groundfish populations suggests that a broad spatial distribution of larger, older female fish is at least as important as stock-wide spawning biomass spawning potential ratio (SPR) in maintaining long-term sustainable population levels (Berkeley *et al.* 2004). This issue is not considered in the current fishery management plan.

The Marine Mammal Commission (2004) recommended the fishery be closed within one year of sanctuary designation. The commission supports its position based on the premise that the fishery as currently managed has not met a burden of proof that it will not affect the ecological integrity of the environment. It cites a similar management regime to the collapsed crustacean fishery, a lack of species-specific and bank-specific life history and stock data, and a decrease in abundance and size of the highly valued bottomfish, *onaga*.

Numerous studies have addressed the vulnerability of deep-water snappers to intensive commercial fishing operations. In an extreme example, 82 percent of an estimated 200,000 pounds of *Pristipomoides filamentosus*, known as *opakapaka* in Hawaii, was caught at a single bank in the Indian Ocean over a 13-day period by 12 small vessels (Grandcourt 2003). Hawaii



fisheries managers have noted concern in recent years for *onaga* stocks, as it consistently has the lowest SPR for all of the targeted bottomfish species (WPRFMC 2004a). Others have noted concern over fishing for *uku* and *hapu`u* because they are reef-related species, as opposed to *onaga*, *opakapaka* and *ehu*, which are deep-slope species.

While this fishery appears to meet the screening criteria, recent developments in fisheries management support an ecosystem-based approach that extends beyond a focus on target species to address impacts on non-target species, trophic interactions, and other ecosystem parameters. In order for this fishery to operate within the proposed sanctuary, the management system needs to emphasize these values in a manner that is fully consistent with the primary objective of resource protection. All fishing alternatives, except the RAC alternative and the full closure alternative, would allow this fishing activity with appropriate regulatory measures, including zoning.

Commercial Pelagic Trolling: Commercial pelagic trolling within the study area of the proposed sanctuary received a positive total score of +2 for all screening criteria and appears to be consistent with the relevant provisions of the NMSA and goals of the proposed sanctuary. Most of the species targeted have a large home range, extending well beyond the proposed sanctuary boundaries (WPRFMC 2002a). Fishing methods do not impact the benthic environment. Participation is currently limited to one or two boats in any given year. Participants of this fishery must obtain a state-issued commercial marine license, through which data is collected on numbers and pounds of each species caught, location fished, and selling price. The status of stocks for most targeted species is encouraging, with *aku*, *mahi mahi*, *uku* and *ono* abundance at safe levels. Some concerns have been raised for yellowfin tuna, and this trend should be monitored closely (WPRFMC 2004b). All fishing alternatives, except the full closure alternative, would allow this fishing activity with appropriate regulatory measures, including zoning.

Recreational (Catch and Release): Recreational (catch and release) fishing within the study area of the proposed sanctuary received a positive total score of +1 for all screening criteria and appears to be consistent with the relevant provisions of the NMSA and goals of the proposed sanctuary. This charter-based fishery operated primarily in the U.S. Fish and Wildlife Service-managed waters of the Midway Atoll National Wildlife Refuge (NWR) between 1996 and 2001.

A number of issues will need to be addressed in order to allow recreational fishing in the study area of the proposed sanctuary. Preliminary studies of this fishery pointed to possible localized ecosystem impacts, including a reduction of apex predators in the nearshore waters of Midway (DeMartini *et al* 2002). Unfortunately, documentation of fishing effort and other data collection has been inconsistent at Midway, limiting the ability to assess this fishery's impacts, making monitoring and collection of catch and effort data for this type of fishery a priority. A number of studies have also raised concerns over interactions with protected species, namely seabirds, turtles, and monk seals. While these concerns are primarily based on observations during related activities in the main Hawaiian Islands, Bonnet and Gilmartin (1998) did report monk seal interactions during recreational fishing activities on Midway's Sand Island in a research study assessing interactions between shoreline fisheries and wildlife. All fishing alternatives, except



the full closure alternative, would allow this fishing activity with appropriate regulatory measures including zoning.

Recreational (Catch and Keep): Recreational catch and keep fishing within the study area of the proposed sanctuary received a positive total score of +1 for all screening criteria and appears to be consistent with the relevant provisions of the NMSA and goals of the proposed sanctuary. There is little mention in the purposes and policies of the NMSA regarding such recreational fishing. Given its limited scale in terms of geography and number of fishermen to date, this activity's impact to the ecosystem is likely minimal. All fishing alternatives, except the Reserve Advisory Council's (RAC) alternative and the full closure alternative, would allow this fishing activity with appropriate regulatory measures, including zoning and reporting requirements.

Sustenance: Sustenance fishing within the study area of the proposed sanctuary received a positive total score of +1 for all screening criteria and appears to be consistent with the relevant provisions of the NMSA and goals of the proposed sanctuary. There is little mention in the purposes and policies of the NMSA regarding sustenance fishing. This activity, considered to occur during other permitted activities, is likely minimal and dispersed over a large area. This tends to diminish the impact of this type of fishing on the ecosystem. More importantly, prohibiting these activities may not be easy to enforce. Educating people who visit and work in the sanctuary on proper protocol and best practices to minimize impacts will likely better achieve the goals of the sanctuary. All fishing alternatives, except the full closure alternative, would allow this fishing activity with appropriate regulatory measures including zoning and reporting requirements. Sustenance fishing would be limited to fishing for pelagic and bottomfish species only, using trolling, pole and line, and hand line methods.

Native Hawaiian Cultural and Subsistence Use: Native Hawaiian cultural and subsistence use within the study area of the proposed sanctuary received a positive total score of + 2 and appears to be consistent with the relevant provisions of the NMSA and goals of the proposed sanctuary. The NMSA describes two policy objectives pertaining to native people's use of sanctuary resources. Policy 4 aims to enhance understanding and wise and sustainable use of the cultural and archeological resources. Policy 7 aims to coordinate management plans with native organizations that desire to preserve and protect these resources. The NWHI is of great significance to Native Hawaiians. The cultural working group of the RAC has defined proper and allowable use of these resources to facilitate understanding, appreciation, and a spiritual connection in the Hawaiian community. These are reflected in a number of goals developed for the proposed sanctuary. All fishing alternatives, except the full closure alternative, would allow this fishing activity with appropriate regulatory measures including zoning and reporting requirements. These requirements would likely include a monitoring of activities through permit requirements.



7.0 Refined Range of Fishing Alternatives

Results from the evaluation of fishing activities, along with information and data from the resource assessment were used to refine the range of alternatives to include two new alternatives. The resulting refined range of fishing alternatives includes geographic zoning options. The resource assessment discussed in Section 4.0 provided important information regarding the distribution of significant ecological indices and their relationship to fishing activity. Each one of the alternatives considers allowing, restricting, or prohibiting various forms of fishing in the proposed sanctuary. Evaluating the zoning associated with each alternative provides valuable insight into its compatibility with the proposed sanctuary.

The National Marine Sanctuary Program (NMSP) views marine zoning as one of several effective regulatory management tools to be considered when protecting and managing marine resources. The NMSP defines a marine zone as follows: *a specific area contained within the boundary of a national marine sanctuary that is subject to different regulations than the rest of the sanctuary*. Marine zoning is considered an essential element of the proposed Northwestern Hawaiian Islands (NWHI) sanctuary to protect unique and sensitive coral reef ecosystems, to facilitate the recovery of the critically endangered Hawaiian monk seal and other endangered species, and to manage impacts of fishing, cultural use, tourism, and other potential uses of resources in the proposed sanctuary.

The NMSP reviewed the alternatives in the context of the resource assessment and the results of the fishing activities screening process from Table 7. After reviewing these results, two additional alternatives and associated zoning schemes were developed (Table 9). This was done to provide a range that maximizes ecosystem protection and minimizes socioeconomic impacts in a way that is consistent with the National Marine Sanctuaries Act (NMSA) and goals of the proposed sanctuary. Specifically, these alternatives continue to allow some degree of commercial fishing, while providing strong and lasting protection to the NWHI ecosystems. In addition, these two additional alternatives were developed in consideration of effective enforcement and management needs associated with a region as large as the NWHI by including large unambiguous zoning schemes that reflect the guidance of National Oceanic and Atmospheric Administration (NOAA) enforcement and U.S. Coast Guard personnel.

This section describes each of the fishing alternatives included in Table 9 below. These descriptions discuss the current status of the fisheries associated with each alternative, as well as their historical context. In addition, the spatial and temporal zoning aspects of the alternatives are described in detail. Maps depicting all of the zoning options can be found at the end of Section 7.0.



Table 9. Refined Range of Fishing Alternatives

Fishing Activity ¹	No Action Fishing Alternative	Fishing Alternative 1	Fishing Alternative 2	Fishing Alternative 3	Fishing Alternative 4	Fishing Alternative 5	Fishing Alternative 6
Commercial Pelagic (longling)							
Commercial Precious Coral							
Commercial Coral Reef Species							
Commercial Crustacean							
Commercial Bottomfish/Pelagic							
Commercial Pelagic (trolling)							
Recreational (Catch and Release)							
Recreational (Catch and Keep)							
Recreational/Sustenance							
Native Hawaiian Cultural/Subsistence							
Zoning Options	No Action Zoning Option: Reserve Preservation Areas (RPA) per EO without regulations; 100 nm-wide protected species zone	Zoning Option 1: Sanctuary Preservation Areas (SPA-1) follow RPA boundaries with regulations; 100 nm-wide protected species zone	Zoning Option 2: No-Take Marine Protected Areas; 100 nm-wide protected species zone; precious coral refugia	Zoning Option 3: Two Ecological Reserves and Sanctuary Preservation Areas	Zoning Option 4: Two Ecological Reserves and Sanctuary Preservation Areas; and remaining Ho'omalu zone phase-out	Zoning Option 5: 40 nm limited entry zone; SPAs based on RPAs; 100 nm-wide protected species zone	Zoning Option 6: Entire sanctuary closed to extractive harvest

Notes: 1 - Prohibited fishing activities are shown as dark shaded areas
 EO – Executive Orders 13178 and 13196
 fm – fathom
 nm – nautical miles

Status Quo Fishing Alternative: The status quo fishing alternative (the current NWHI Coral Reef Ecosystem Reserve) is based on the provisions of Executive Orders 13178 and 13196 (EO), rules and regulations promulgated by NOAA Fisheries, court injunctions, and current practices, and assumes no sanctuary would be designated. The EO provisions preclude fishing activities such as the harvest of precious corals or coral reef species by stating: “*There shall be no increase in the number of permits of any particular type of fishing beyond the number of permits of that type in effect the year preceding the date of this order (December 4, 2000)*”. In addition, the EO prohibits “*any type of touching or taking of living or dead coral.*” The crustacean fishery was closed in 2000 to protect lobster stocks because of shortcomings in understanding the dynamics of the NWHI lobster populations, the increasing uncertainty in population model parameter estimates, a court injunction put in place based on concerns over interactions with endangered



monk seals, and the lack of appreciable rebuilding of the lobster population despite significant reductions in fishing effort throughout the NWHI. Ecological impacts of this decline include species shift, where slipper lobsters have occupied spiny lobster habitat, and possible reduction in prey of monk seals. Fishing caps, as specified in the EO, apply to all fishing activities throughout the Reserve (§ 7(a) 1 and § 8 of EO 13178 as modified by 13196).

Status Quo Zoning Option: This zoning option would maintain RPAs established by the EO. The specific purpose of the RPAs was to “*further protect Reserve resources.*” No-take and limited-take RPAs were established around islands, atolls, and banks in the NWHI ranging from 25 to 100 fathoms. RPAs exclude state waters. Prohibited activities and other restrictions in the RPAs are detailed in the EO and include depth-related restrictions and caps on commercial and recreational fishing. Limitations on fishing to levels in existence in the years just prior to the EO are also provided for in the provisions of the order (§ 7 (a)(1) and § 8 of EO 13178 as amended by EO 13196). RPA boundaries would be maintained as is under the Reserve. These boundaries are difficult to enforce from a practical standpoint because they are based on bottom contours in a region with a lot of bathymetric variability. This alternative does not include state waters.

This alternative is depicted on Map 2 (title Status Quo).

Fishing Alternative 1: Fishing alternative 1 (Sanctuary based on EO provisions) assumes that the Reserve would be designated as a national marine sanctuary. Sanctuary Preservation Areas (SPA) would be established following existing RPA boundaries (straight-lined for better user compliance and enforcement). 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. Fishing regulations would be promulgated under the NMSA. The resulting regulations would prohibit precious coral and crustacean harvest, but provide for bottomfish/pelagic trolling, commercial pelagic trolling, various forms of recreational fishing, and Native Hawaiian cultural and subsistence uses.

Zoning Option 1: In this zoning option, RPA boundaries are straight-lined (e.g calculated using a series of latitude and longitude coordinates) to create SPAs. Under this option, the straight-line boundaries are developed as close to the current RPA boundaries as possible, and therefore include dozens of coordinates per SPA. This option does not consider the inclusion of state waters. All commercial, recreational, and sustenance fishing would be prohibited within the no-take SPAs. Commercial bottomfishing and commercial and recreational pelagic trolling would be allowed in limited take SPAs, while other extractive activities would be prohibited.

This alternative is depicted on Map 3 (titled Alternative 1).

Fishing Alternative 2: Fishing alternative 2 (WPRFMC recommendation) is the alternative developed by the Western Pacific Regional Fishery Management Council (WPRFMC) and provided to the NMSP on July 22, 2003. This alternative assumes that the Reserve would be designated as a national marine sanctuary, with fishing regulations promulgated under the NMSA. However, fishing activities would be managed in accordance with existing fishery management plans (FMP) for those fishing activities currently practiced, including the bottomfish FMP. Fishing alternative 2 also suggests that future harvest of precious corals and



crustaceans would be managed using the FMP developed previously for these activities. In addition, this alternative calls for the reinstatement of the Coral Reef Ecosystem FMP, which was previously partially approved by NOAA. Disapproved sections were all those pertaining to the NWHI.

Zoning Option 2: This zoning option includes No-Take Marine Protected Areas closed to fishing or harvesting of species managed under all WPRFMC FMPs. These areas include any federal waters around the NWHI shallower than 10 fathoms, except for French Frigate Shoals, Laysan Island, and the northern half of Midway Atoll National Wildlife Refuge bisected by the 28° 14' N parallel, which includes federal waters shallower than 50 fathoms. Zoning option 2 also provides for precious coral “mega-refugia.” This zone would encompass the waters beginning northwest of Nihoa Island (encompassing twin banks), and continue just northwest of French Frigate Shoals. This zone would prohibit all precious coral fishing for pink, red, and gold corals.

This alternative is depicted on Map 4 (titled Alternative 2).

Fishing Alternative 3: Fishing alternative 3 (sanctuary with fishing regulations based on a combination of EO provisions, Goals and Objectives Statement for the proposed sanctuary, FMPs, and ecosystem-based approach to management) was developed considering ecosystem protection goals and objectives as the foundation of sanctuary designation. 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.

Alternative 3 incorporates elements of several alternatives in an effort to maximize resource protection while providing for socioeconomic considerations. Fishing alternative 3 was developed with the fishery management goal of protecting areas with the highest ecosystem value while allowing compatible fishing activities in areas where they are likely to have less impact on the ecosystem. This alternative prohibits precious coral and crustacean harvest, and pelagic longlining, but provides for commercial bottomfish/pelagic trolling, commercial pelagic trolling, various forms of recreational fishing, and 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 shall 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 will manage fishing activities based on the caps provided by the EO. This formula was designed to maintain the annual level of bottomfishing conducted in the NWHI during the 5 years prior to 2000 when the EO was issued.



Zoning Option 3: In addition to caps, zoning option 3 provides for two Ecological Reserves (ER)² and Sanctuary Preservation Areas (SPA)³. The ERs cover large areas of the proposed sanctuary and are used in conjunction with SPAs to protect ecosystem relationships between coral reef and pelagic systems. For ease of enforcement and management, the ERs utilize longitude degrees to define the boundaries. 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, 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 SPA would be developed by expanding the current RPAs at Lisianski Island, Laysan Island, and Maro Reef out to 75 fathoms. In addition, SPAs would be created out to 3 miles at Gardner Pinnacles, Necker Island, and Nihoa Island. All of the SPAs would include state waters.

This alternative is depicted on Map 5 (titled Alternative 3).

Fishing Alternative 4: Fishing alternative 4 is an iteration of alternative 3 and includes the same boundary addition to the northwest of Kure Atoll. This alternative prohibits the same fishing activities as alternative 3, which include precious coral and crustacean harvest; it also provides for bottomfish/pelagic trolling, commercial pelagic trolling, various forms of recreational fishing, and Native Hawaiian cultural subsistence uses.

Zoning Option 4: Nearly identical to zoning option 3, zoning option 4 provides for ERs west of 173.5° W longitude and around French Frigate Shoals between 165° and 167.5° W longitude. SPAs would be identical to those in zoning option 3 and include State waters. The primary distinction between these two alternatives is the degree of restrictions placed on bottomfishing/pelagic trolling in the Ho`omalulu zone. The region located between the two ERs (see cross-hatched section of alternative 4 map) would phase out bottomfish/pelagic trolling by maintaining nontransferable fishing permits that could not be renewed.

² Ecological Reserve means an area of the Sanctuary consisting of contiguous, diverse habitats, within which uses are subject to conditions, restrictions, and prohibitions, including access restrictions, intended to minimize human influences, to provide natural spawning, nursery, and permanent residence areas for the replenishment and genetic protection of marine life, and to protect and preserve natural assemblages of habitats and species within the Sanctuary.

³ Sanctuary Preservation Area means an area of the Sanctuary that encompasses a discrete, biologically important area, within which uses are subject to conditions, restrictions, and prohibitions, including access restrictions, to avoid concentrations of uses that could result in declines in species populations or habitat, to reduce conflicts between uses, to protect areas that are critical for sustaining important marine species or habitats, or to provide opportunities for scientific research.



Under this zoning option, voluntary buyouts would be offered to Ho`omaluku zone federal commercial bottomfish permittees to mitigate the loss of fishing habitat within the two ERs, with the intent that over time, through buy outs or through attrition, the entire Ho`omaluku zone (west of 165° W longitude) would eventually be closed to bottomfishing. Commercial pelagic fishing would be limited to East of 165° W longitude, except for pelagic catch associated with the remaining Ho`omaluku zone federal commercial bottomfish permittees. Maps depicting the zoning options are provided following the descriptions of all fishing alternatives.

This alternative is depicted on Map 6 (titled Alternative 4).

Fishing Alternative 5: Fishing alternative 5 (Reserve Advisory Council Recommendation) was developed and adopted by the RAC. This alternative is similar to alternative 1 in that it maintains the location and configuration of the straight-lined RPAs. However, this alternative would have provisions to ensure an accelerated prohibition of bottomfish/pelagic trolling within 1 year of sanctuary designation. In addition, it calls for a time-area zoning scheme to limit commercial and recreational pelagic fishing to areas outside of a 40 nm-wide corridor centered around the islands and atolls of the region. The intent of this corridor is to limit fishing activities to areas where interactions with protected wildlife have been demonstrated to be low. In addition, reporting requirements would be developed so these fisheries can be monitored to collect data for ongoing evaluation of impacts.

Zoning Option 5: This zoning option provides a 40 nm-wide limited entry zone surrounding the NWHI and no-take and limited-take SPAs based on those in zoning option 1. The limited entry zone would prohibit all commercial and recreational fishing, but would allow federally permitted bottomfishing to continue for 1 year (except in SPAs), to provide time for the fishery to close. Commercial and recreational pelagic fishing would be allowed outside the zone. Sustainance fishing would be allowed Sanctuary-wide, except in SPAs. Other activities, including research and educational uses and Native Hawaiian cultural and subsistence uses, would be allowed throughout the Sanctuary by permit.

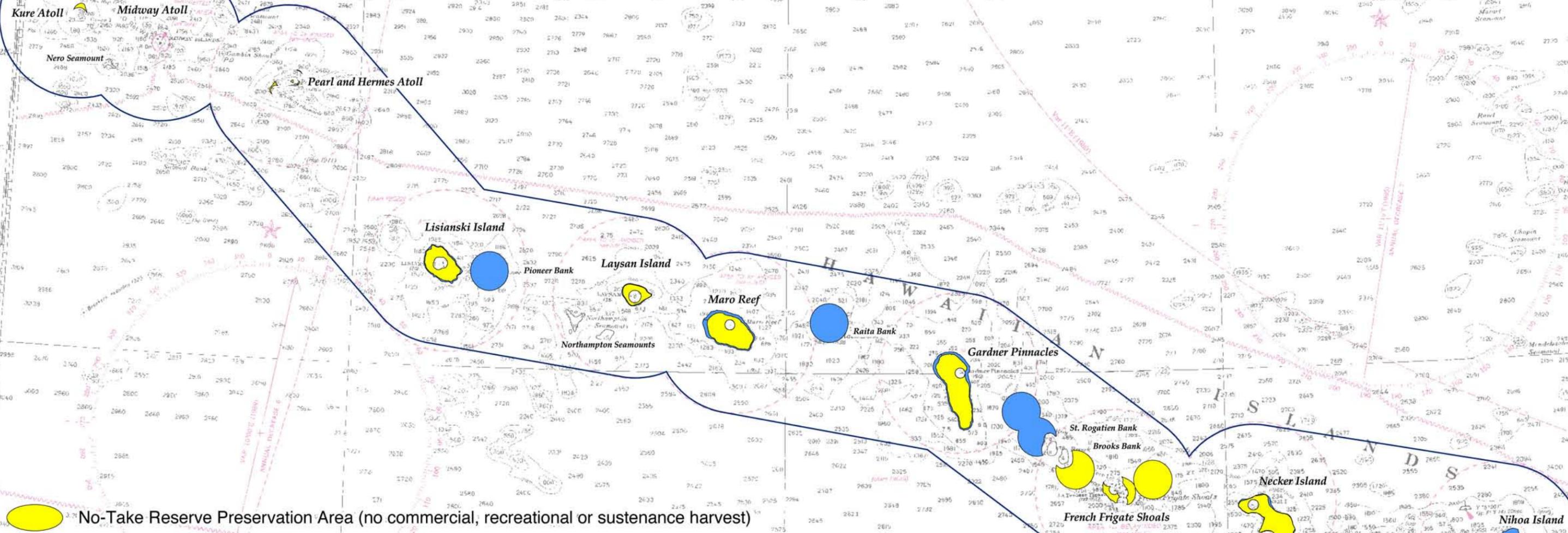
This alternative is depicted on Map 7 (titled Alternative 5).

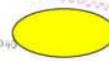
Fishing Alternative 6: Fishing alternative 6 (Sanctuary with all forms of fishing prohibited including subsistence and sustainance) represents the most restrictive fishing alternative, prohibiting all forms of commercial and recreational fishing, including subsistence fishing associated with Native Hawaiian cultural practices. 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.

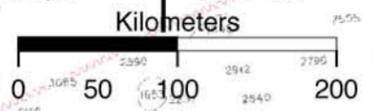
Zoning Option 6: This zoning option places the entire area of the proposed sanctuary into a limited entry zone. All extraction, except that conducted under a research or education permit, would be prohibited throughout the proposed sanctuary, including Native Hawaiian cultural and subsistence use and sustainance fishing.

This alternative is depicted on Map 8 (titled Alternative 6).

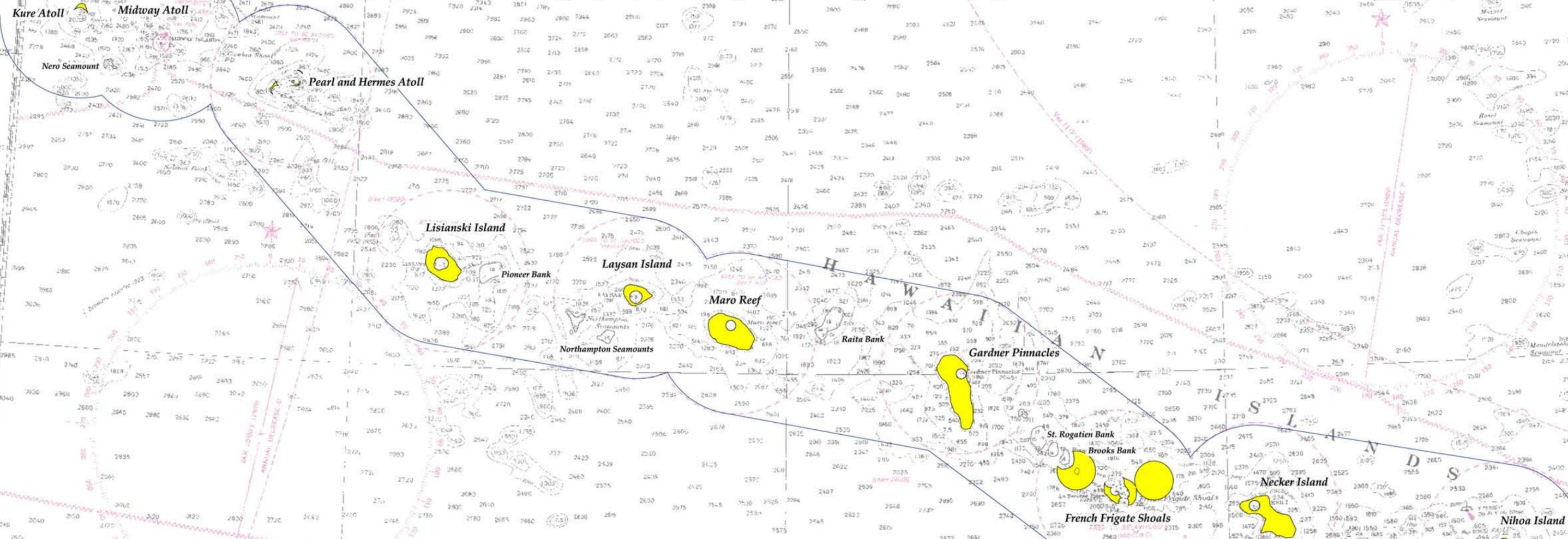
Map 2 Status Quo



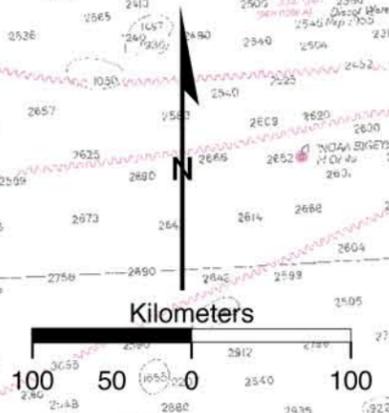
-  No-Take Reserve Preservation Area (no commercial, recreational or sustenance harvest)
-  Limited-Take Reserve Preservation Area (existing commercial bottomfishing and pelagic trolling allowed)
-  Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve Boundary



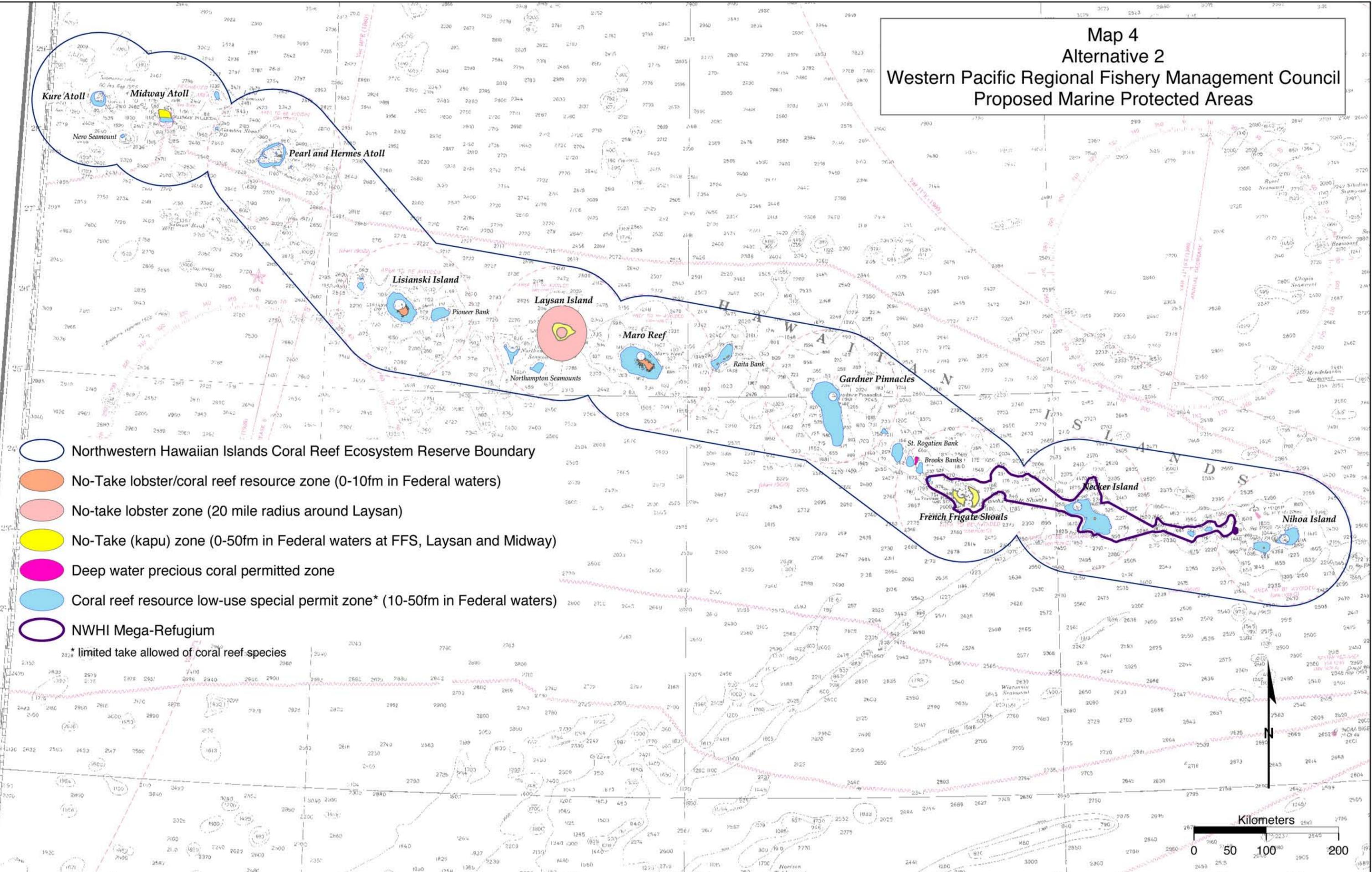
Map 3 Alternative 1

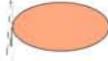


- Sanctuary Preservation Area* - no commercial, recreational or sustenance harvest
*SPAs consist of RPAs now defined by lat/long coordinates.
- Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve Boundary

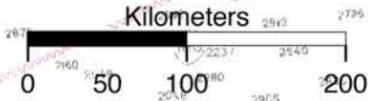


Map 4
Alternative 2
Western Pacific Regional Fishery Management Council
Proposed Marine Protected Areas

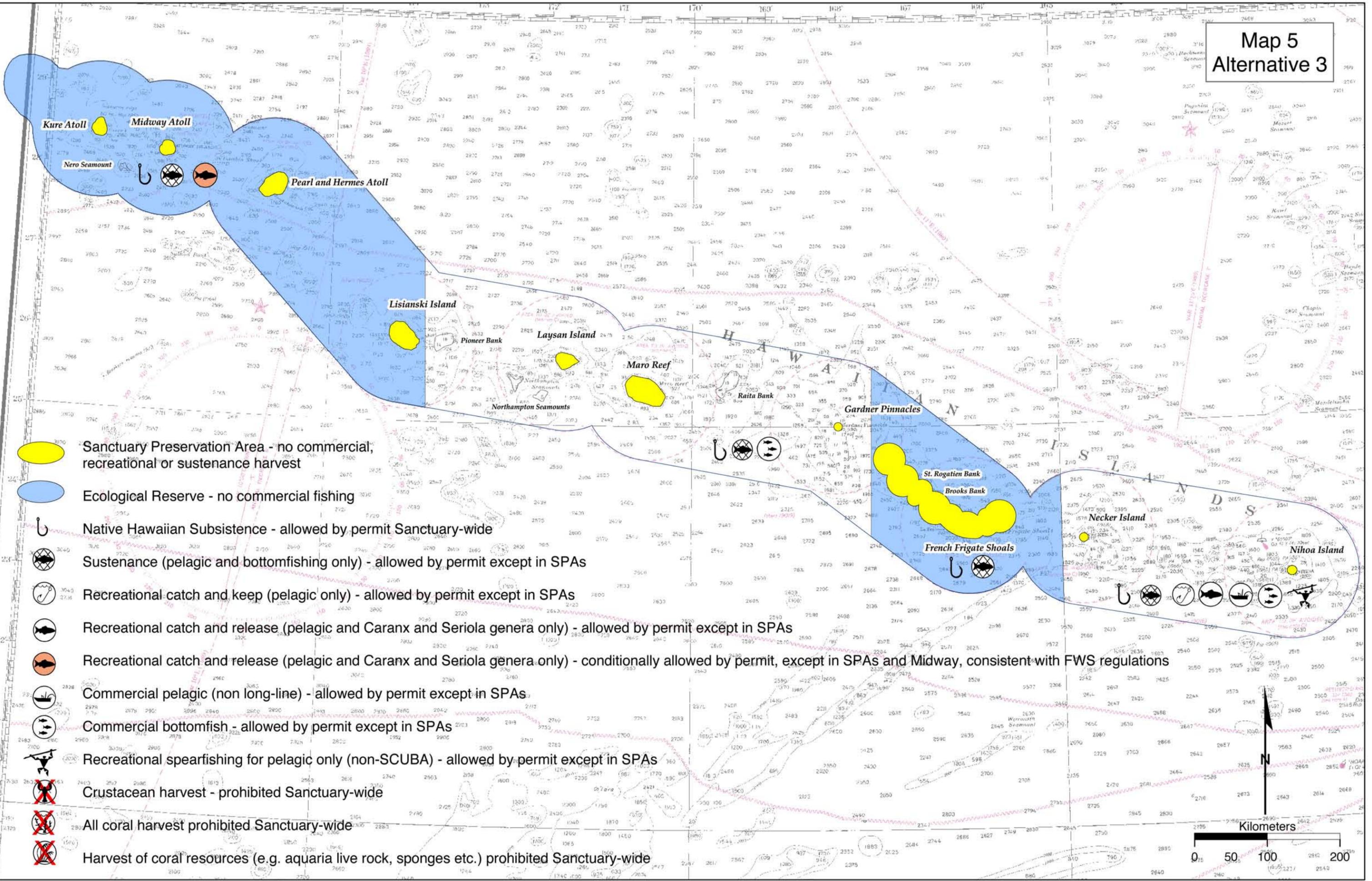


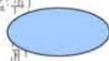
-  Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve Boundary
-  No-Take lobster/coral reef resource zone (0-10fm in Federal waters)
-  No-take lobster zone (20 mile radius around Laysan)
-  No-Take (kapu) zone (0-50fm in Federal waters at FFS, Laysan and Midway)
-  Deep water precious coral permitted zone
-  Coral reef resource low-use special permit zone* (10-50fm in Federal waters)
-  NWHI Mega-Refugium

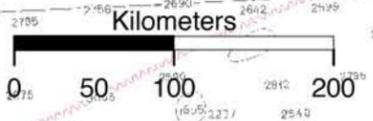
* limited take allowed of coral reef species



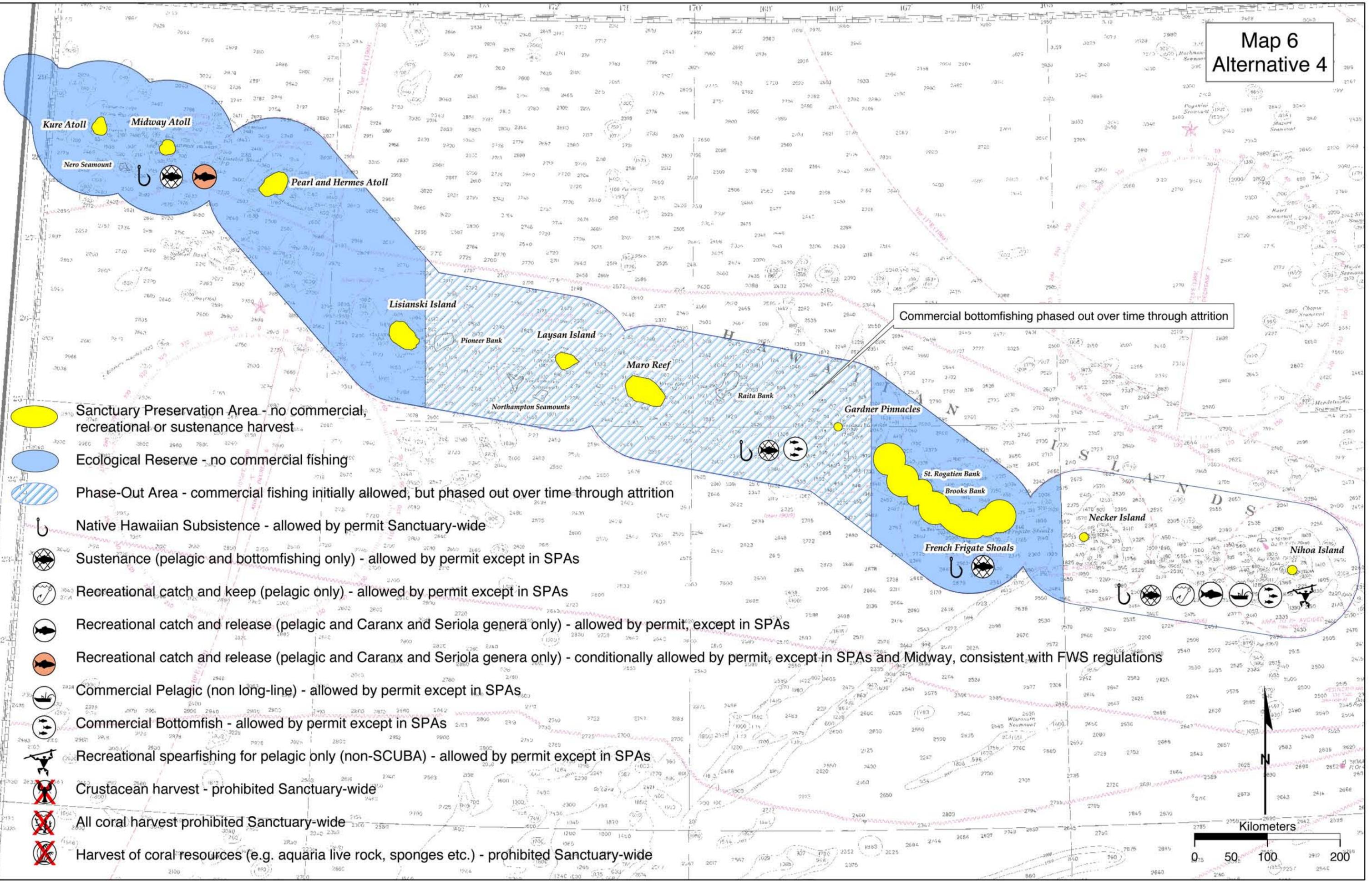
Map 5 Alternative 3



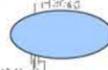
-  Sanctuary Preservation Area - no commercial, recreational or sustenance harvest
-  Ecological Reserve - no commercial fishing
-  Native Hawaiian Subsistence - allowed by permit Sanctuary-wide
-  Sustenance (pelagic and bottomfishing only) - allowed by permit except in SPAs
-  Recreational catch and keep (pelagic only) - allowed by permit except in SPAs
-  Recreational catch and release (pelagic and Caranx and Seriola genera only) - allowed by permit except in SPAs
-  Recreational catch and release (pelagic and Caranx and Seriola genera only) - conditionally allowed by permit, except in SPAs and Midway, consistent with FWS regulations
-  Commercial pelagic (non long-line) - allowed by permit except in SPAs
-  Commercial bottomfish - allowed by permit except in SPAs
-  Recreational spearfishing for pelagic only (non-SCUBA) - allowed by permit except in SPAs
-  Crustacean harvest - prohibited Sanctuary-wide
-  All coral harvest prohibited Sanctuary-wide
-  Harvest of coral resources (e.g. aquaria live rock, sponges etc.) prohibited Sanctuary-wide

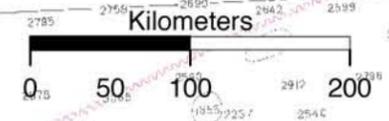


Map 6 Alternative 4



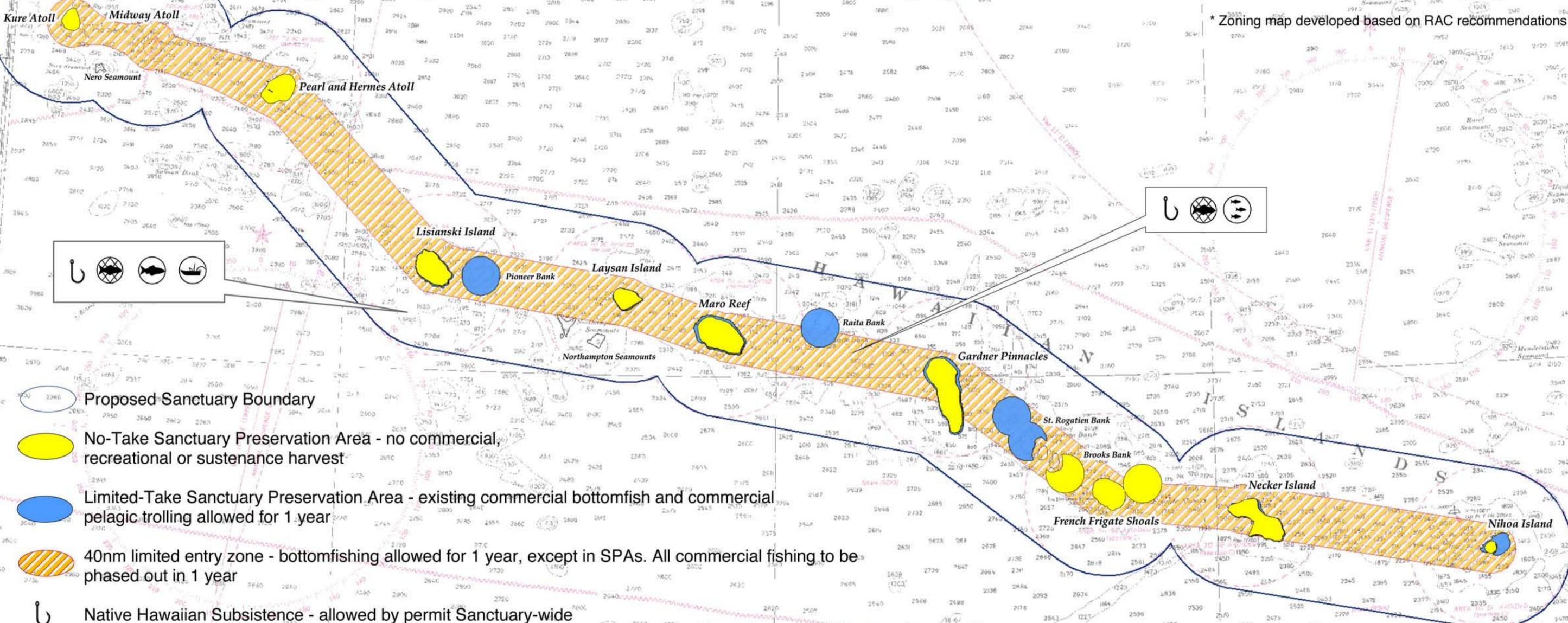
Commercial bottomfishing phased out over time through attrition

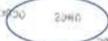
-  Sanctuary Preservation Area - no commercial, recreational or sustenance harvest
-  Ecological Reserve - no commercial fishing
-  Phase-Out Area - commercial fishing initially allowed, but phased out over time through attrition
-  Native Hawaiian Subsistence - allowed by permit Sanctuary-wide
-  Sustenance (pelagic and bottomfishing only) - allowed by permit except in SPAs
-  Recreational catch and keep (pelagic only) - allowed by permit except in SPAs
-  Recreational catch and release (pelagic and Caranx and Seriola genera only) - allowed by permit, except in SPAs
-  Recreational catch and release (pelagic and Caranx and Seriola genera only) - conditionally allowed by permit, except in SPAs and Midway, consistent with FWS regulations
-  Commercial Pelagic (non long-line) - allowed by permit except in SPAs
-  Commercial Bottomfish - allowed by permit except in SPAs
-  Recreational spearfishing for pelagic only (non-SCUBA) - allowed by permit except in SPAs
-  Crustacean harvest - prohibited Sanctuary-wide
-  All coral harvest prohibited Sanctuary-wide
-  Harvest of coral resources (e.g. aquaria live rock, sponges etc.) - prohibited Sanctuary-wide

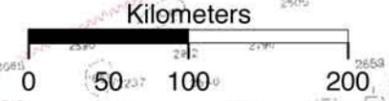
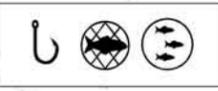


Map 7 Alternative 5 Reserve Advisory Council Recommendation*

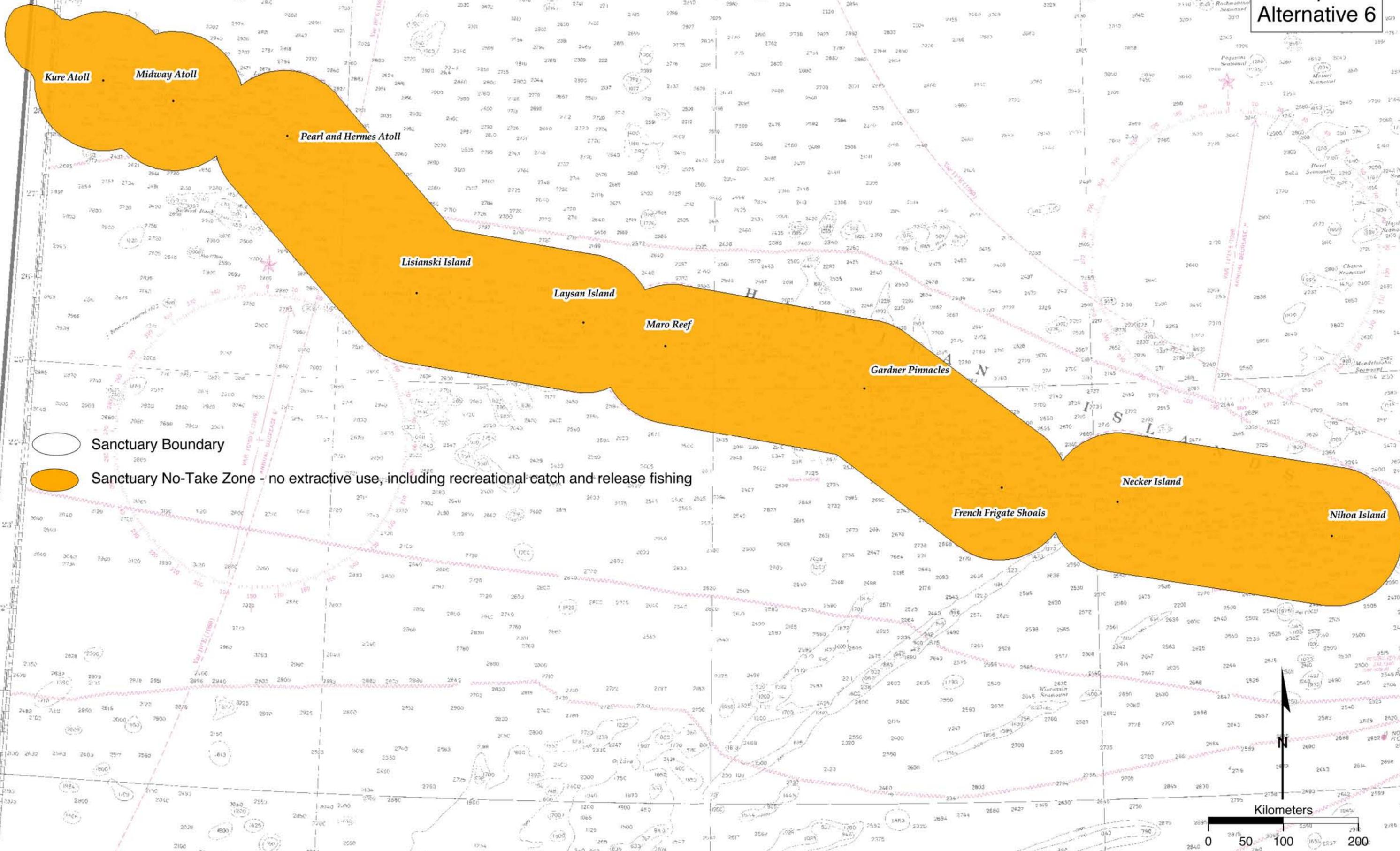
* Zoning map developed based on RAC recommendations



-  Proposed Sanctuary Boundary
-  No-Take Sanctuary Preservation Area - no commercial recreational or sustenance harvest
-  Limited-Take Sanctuary Preservation Area - existing commercial bottomfish and commercial pelagic trolling allowed for 1 year
-  40nm limited entry zone - bottomfishing allowed for 1 year, except in SPAs. All commercial fishing to be phased out in 1 year
-  Native Hawaiian Subsistence - allowed by permit Sanctuary-wide
-  Sustenance (pelagic and bottomfishing only) - allowed by permit except in SPAs
-  Recreational catch and release (pelagic and Caranx and Seriola genera only) - allowed by permit except in SPAs
-  Commercial Pelagic (non long-line) - allowed by permit except in SPAs
-  Commercial Bottomfish - allowed by permit for 1 year, except in No-Take SPAs
-  Crustacean harvest - prohibited Sanctuary-wide
-  All coral harvest prohibited Sanctuary-wide
-  Harvest of coral resources (e.g. aquaria live rock, sponges etc.) - prohibited Sanctuary-wide



Map 8 Alternative 6



Kure Atoll

Midway Atoll

Pearl and Hermes Atoll

Lisianski Island

Laysan Island

Maro Reef

Gardner Pinnacles

Necker Island

French Frigate Shoals

Nihoa Island

○ Sanctuary Boundary

● Sanctuary No-Take Zone - no extractive use, including recreational catch and release fishing

Kilometers





8.0 Evaluation of Fishing Alternatives and Zoning Options

Fishing alternatives with associated zoning options were evaluated in three ways. First, the alternatives were screened based on criteria developed from relevant provisions of the National Marine Sanctuaries Act (NMSA) and management goals from the Goals and Objectives (G&O) Statement of the proposed sanctuary. Fishing alternatives were then evaluated based on the degree to which the associated zoning options maximized ecological protection while minimizing socioeconomic impacts. Finally, the fishing alternatives were evaluated based on the objectives for management goal 7. These evaluations were used to identify the fishing alternatives considered by the National Marine Sanctuary Program (NMSP) to be the most consistent with the provisions of the NMSA and G&O Statement of the proposed sanctuary.

Evaluation of Fishing Alternatives Based on Relevant Provisions of the NMSA and Proposed Sanctuary Management Goals

The refined range of fishing alternatives from Table 9 was evaluated using screening criteria developed from the NMSA and the proposed sanctuary's management goals found in Table 10. These criteria are intended show how each alternative would contribute to a progressive and cooperative approach to the management of marine resources in the Northwestern Hawaiian Islands (NWHI). None of the screening criteria are specifically designed to remove an alternative from consideration, but rather to identify potential impacts, both positive and negative, that might result in the event they were put into action. Any negative impacts would have to be mitigated in order for an alternative to be considered consistent with the proposed sanctuary.

The results of this screening process are presented in Table 11. Each alternative was scored to determine the extent to which the alternative met the criteria. The scoring range was -1 (negative response), 0 (neutral response), and +1 (positive response). A negative total score indicates more limitations or potential negative ecological, cultural, or socioeconomic impacts that may be related to the alternative. A positive total score indicates more benefits than limitations related to the proposed alternative.

The status quo fishing alternative and fishing alternative 2 received negative total scores. Primary factors influencing the score of the no action fishing alternative were ambiguity regarding the longevity of Executive Orders 13178 and 13196 (EO) that established the Reserve and a possible lapse in authorization for funding of the Reserve after fiscal year 2005. The negative total score for fishing alternative 2 is related to the inclusion of commercial precious coral, coral reef species, and crustacean fisheries, which did not meet the screening criteria described in Section 6.0. In addition, both alternatives measure fishery performance using maximum sustainable yield (MSY) and 20 percent spawning potential ratio thresholds, which may not provide an adequate buffer for uncertainties or other anthropogenic or natural perturbations.



Fishing alternatives 1 and 6 received the lowest positive total scores. Fishing alternative 1 would result in fishing regulations and improved implementation of geographic zoning restrictions (e.g. Sanctuary Preservation Areas [SPAs]). Fishing alternative 6 would provide for the maximum protection of the ecosystem by prohibiting all forms of extractive activities, including Native Hawaiian cultural/subsistence uses. However, all social and socioeconomic benefits would be removed.

Fishing alternatives 3, 4, and 5 received the higher positive scores. Fishing alternative 3 received the highest positive score, with fishing alternatives 4 and 5 receiving somewhat lower positive scores. Fishing alternative 3 provides for social, cultural, and socioeconomic benefits while placing a premium on protecting large areas of high ecological value through zoning. Fishing alternative 4 provides for higher ecological protection with some reduction in socioeconomic benefits resulting from the eventual phase-out of commercial bottomfish/pelagic fishing activities in the Ho`omalu zone. Fishing alternative 5 continues in this trend, with higher ecological protection than fishing alternative 4; however, lower socioeconomic benefits would result from an accelerated phase-out of bottomfishing within 1 year of sanctuary designation.



Table 10. Screening Criteria Used to Evaluate Fishing Alternatives

National Marine Sanctuary Act: Purposes and Policies	Proposed Sanctuary Management Goals	Screening Criteria
<p>(1) Identify and designate as national marine sanctuaries areas of the marine environment which are of special national significance and manage these areas as the National Marine Sanctuary System.</p> <p>(3) Maintain the natural biological communities in the national marine sanctuaries, and protect, and, where appropriate, restore and enhance natural habitats, populations, and ecological processes.</p> <p>(9) Cooperate with global programs encouraging conservation of marine resources.</p>	<p><i>Goal 1:</i> Protect, preserve, maintain, and where appropriate restore, the natural biological communities, including habitats, populations, native species, and ecological processes of the Sanctuary as a public trust for current and future generations.</p>	<p>Does the proposed alternative protect, preserve, and restore multiple scales of the ecosystem (e.g. habitats, populations, and processes; material, energy, and genetic information flow)?</p> <p>Does the proposed alternative address present uncertainties in favor of long-term resource protection?</p> <p>Does the proposed alternative identify restoration measures for endangered or damaged ecosystem components?</p> <p>Does the proposed alternative identify mechanisms to enhance cooperation with global initiatives and programs to encourage conservation of marine resources?</p>
<p>(2) Provide authority for comprehensive and coordinated conservation and management of these marine areas, and activities affecting them, in a manner that complements existing regulatory authorities.</p> <p>(7) Develop and implement coordinated plans for the protection and management of these areas with appropriate federal agencies, State and local governments, Native American tribes and organizations, international organizations, and other public and private interests concerned with the continuing health and resilience of these marine areas.</p>	<p><i>Goal 2:</i> Provide for comprehensive and coordinated conservation and management that recognizes and complements existing jurisdictional boundaries and management regimes and involves stakeholder communities.</p>	<p>Does the proposed alternative provide mechanisms to achieve comprehensive and coordinated management?</p>



Table 10. Screening Criteria Used to Evaluate Fishing Alternatives (Continued)

National Marine Sanctuary Act: Purposes and Policies	Proposed Sanctuary Management Goals	Screening Criteria
<p>(6) Facilitate to the extent compatible with the primary objective of resource protection, all public and private uses of the resources of these marine areas not prohibited pursuant to other authorities.</p> <p>(8) Create models of, and incentives for, ways to conserve and manage these areas, including the application of innovative management techniques.</p>	<p><i>Goal 3:</i> Manage, minimize, or prevent negative human impacts by allowing access only for those activities that do not threaten the natural character or biological integrity of any ecosystem of the region.</p> <p><i>Goal 7:</i> Maintain ecosystem integrity by limiting and controlling fishing activities using an ecosystem-based management approach. Maximize ecosystem protection while minimizing adverse socioeconomic impacts. Limit fishing activities to areas that minimize or prevent interactions with corals, seabirds, endangered Hawaiian monk seals, and other protected wildlife, or that do not threaten the natural character or biological integrity of any ecosystem of the region.</p>	<p>Does the proposed alternative incorporate innovative management measures to protect Sanctuary resources from degradation or harm?</p> <p>Does the proposed alternative provide mechanisms to learn from experience and to develop models that can be used to inform management of marine resources in the main Hawaiian islands and elsewhere?</p> <p>Does the proposed alternative include activities currently providing socioeconomic benefits?</p> <p>Does the proposed alternative include fishing activities based on knowledge of life history and ecological characteristics of target species?</p> <p>Does the proposed alternative protect prey species of and minimize interactions with endangered species?</p> <p>Does the proposed alternative maintain existing range of social, cultural, and/or historical benefits?</p> <p>Does the proposed alternative target species resilient to natural and anthropogenic perturbations (e.g. climate change, invasive species, marine debris)?</p>
<p>(4) Enhance public awareness, understanding, appreciation, and wise and sustainable use of the marine environment, and the natural, historical, cultural, and archeological resources of the National Marine Sanctuary System.</p>	<p><i>Goal 4:</i> Enhance public awareness, understanding, and appreciation of the marine environment and cultural and maritime heritage resources.</p> <p><i>Goal 5:</i> Support Native Hawaiian cultural, religious, and subsistence practices that are consistent with the long-term conservation and protection of the region.</p>	<p>Does the proposed alternative provide measures to increase public awareness and understanding without increasing risks to ecosystem status?</p> <p>Does the proposed alternative maintain existing range of social, cultural, and historical benefits?</p>
<p>(5) Support, promote, and coordinate scientific research on, and long-term monitoring of, the resources of these marine areas.</p>	<p><i>Goal 6:</i> Support, promote, and coordinate research and long-term monitoring that improves management decision-making and is consistent with the conservation and protection of the region.</p>	<p>Does proposed alternative prioritize scientific research and long-term monitoring to improve management decision-making?</p> <p>Does the proposed alternative identify and minimize potential ecosystem impacts of research and monitoring?</p>



Table 11. Results of Screening Fishing Alternatives

Screening Criteria	No Action Fishing Alternative (Status Quo)	Fishing Alternative 1	Fishing Alternative 2	Fishing Alternative 3	Fishing Alternative 4	Fishing Alternative 5	Fishing Alternative 6
1. Does the proposed alternative protect, preserve, maintain, and restore multiple scales of the ecosystem (e.g. habitats; populations and processes; material, energy, and genetic information flow)?	EO could be repealed at anytime with no notice (-1)	Moderate protection through zoning (0)	Minimal protection (-1)	High protection through zoning (+1)	High protection through zoning (+1)	Full protection (+1)	Full protection (+1)
2. Does proposed alternative address uncertainties in favor of long-term resource protection?	No measures identified to address uncertainties (-1)	No measures identified to address uncertainties (-1)	Inclusion of fishing activities without adequate information (-1)	Prohibits fishing activities lacking adequate information (+1)	Prohibits fishing activities lacking adequate information (+1)	Prohibits fishing activities lacking adequate information (+1)	Prohibits fishing activities lacking adequate information (+1)
3. Does the proposed alternative identify restoration measures for endangered or damaged ecosystem components?	No measures identified (-1)	Implementation of SPA may provide for restoration (0)	No measures identified (-1)	Zoning to protect monk seal foraging areas (+1)	Zoning to protect monk seal foraging areas (+1)	Zoning to protect monk seal foraging areas (+1)	Zoning to protect monk seal foraging areas (+1)
4. Does the proposed alternative identify mechanisms to enhance cooperation with global initiatives and programs to encourage conservation of marine resources	Considered but not detailed at this stage (0)	Considered but not detailed at this stage (0)	Considered but not detailed at this stage (0)	Considered but not detailed at this stage (0)	Considered but not detailed at this stage (0)	Considered but not detailed at this stage (0)	Considered but not detailed at this stage (0)
5. Does the proposed alternative provide mechanisms to achieve comprehensive and coordinated management?	Collaborative mechanisms required (0)	Collaborative mechanisms required (0)	Collaborative mechanisms required (0)	Collaborative mechanisms required (0)	Collaborative mechanisms required (0)	Collaborative mechanisms required (0)	Collaborative mechanisms required (0)
6. Does the proposed alternative incorporate innovative management measures to protect Sanctuary resources from degradation or harm?	Zoning serves as a mechanism (0)	Zoning serves as a mechanism (0)	Zoning serves as a mechanism (0)	Use of multiple zones, ecosystem-based indicators (+1)	Use of multiple zones, ecosystem-based indicators (+1)	Limits innovation (-1)	Limits innovation (-1)
7. Does the proposed alternative provide mechanisms to learn from experience and to develop models that can be used to inform management of marine resources in the main Hawaiian Islands and elsewhere?	Potential for transfer of lessons learned with targeted research and monitoring (0)	Potential for transfer of lessons learned with targeted research and monitoring (0)	Potential for transfer of lessons learned with targeted research and monitoring (0)	Prioritizes model development and transfer (+1)	Prioritizes model development and transfer (+1)	Limited transfer of models associated with limited resource use (0)	Limited transfer of models associated with no resource use (0)
8. Does the proposed alternative include activities currently providing socioeconomic benefits?	Only considers existing fishing activities (+1)	Only considers existing fishing activities (+1)	Considers new and closed fisheries (-1)	Only considers existing fishing activities (+1)	Only considers existing fishing activities (+1)	Only considers existing fishing activities (+1)	All fishing prohibited (0)



Table 11. Results of Screening Fishing Alternatives (Continued)

Screening Criteria	No Action Fishing Alternative (Status Quo)	Fishing Alternative 1	Fishing Alternative 2	Fishing Alternative 3	Fishing Alternative 4	Fishing Alternative 5	Fishing Alternative 6
9. Does the proposed alternative include fishing activities based on knowledge of life history and ecological characteristics of target species?	Some characteristics known (0)	Some characteristics known (0)	Limited knowledge of characteristics for precious corals and coral reef species (-1)	Some characteristics known (0)	Some characteristics known (0)	Some characteristics known (0)	All fishing prohibited (0)
10. Does the proposed alternative protect prey species of and minimize interactions with endangered species?	Minimal protection (-1)	Moderate protection through zoning (0)	Minimal protection (-1)	High protection through zoning (+1)	High protection through zoning (+1)	Full protection (+1)	Full protection (+1)
11. Does the proposed alternative maintain existing range of social, cultural, and benefits?	Maintains existing benefits from (1)	Maintains existing benefits from (1)	Maintains existing benefits (1)	Maintains existing benefits (1)	Some benefits lost through zoning (0)	Some benefits lost through zoning (0)	All existing benefits lost (-1)
12. Does the proposed alternative target species resilient to other natural and anthropogenic perturbations (e.g. climate change, invasive species, marine debris)?	Bottomfish and pelagic species fairly resilient (0)	Bottomfish and pelagic species fairly resilient (0)	Precious corals, coral reef species, and crustaceans potentially affected (-1)	Bottomfish and pelagic species fairly resilient (0)	Bottomfish and pelagic species fairly resilient (0)	Pelagic species fairly resilient (0)	Fishing prohibited, no target species (0)
13. Does the proposed alternative provide measures to increase public awareness and understanding without increasing risks to ecosystem status?	Considered but not detailed at this stage (0)	Considered but not detailed at this stage (0)	Considered but not detailed at this stage (0)	Considered but not detailed at this stage (0)	Considered but not detailed at this stage (0)	Considered but not detailed at this stage (0)	Considered but not detailed at this stage (0)
14. Does the proposed alternative maintain existing range of social, cultural, and historical benefits?	Access provided for (+1)	Access provided for (+1)	Access provided for (+1)	Access provided for (+1)	Access provided for (+1)	Access provided for (+1)	No access provided (-1)
15. Does the proposed alternative prioritize scientific research and long-term monitoring to improve management decision-making?	Considered but not detailed at this stage (0)	Considered but not detailed at this stage (0)	Considered but not detailed at this stage (0)	Requirement for research and monitoring in support of ecosystem-based management (+1)	Requirement for research and monitoring in support of ecosystem-based management (+1)	Considered but not detailed at this stage (0)	Considered but not detailed at this stage (0)
16. Does the proposed alternative identify and minimize potential ecosystem impacts of research and monitoring?	Considered but not detailed at this stage (0)	Considered but not detailed at this stage (0)	Considered but not detailed at this stage (0)	Considered but not detailed at this stage (0)	Considered but not detailed at this stage (0)	Considered but not detailed at this stage (0)	Considered but not detailed at this stage (0)
Total Score	-1	2	-5	10	9	5	1

Notes:

1 – Screening criteria based on provisions of NMSA, EO, and management goals of proposed sanctuary from Table 10

2 – Scoring Range: -1=negative response; =neutral response; +1=positive response

3 – Total Score: negative total score means alternative does not meet screening criteria; positive total score means proposed alternative does meet screening criteria



Evaluation of Zoning Options Based on Habitat, Resource Protection, and Socioeconomic Impact

The following summary and tables describe an additional evaluation of zoning options associated with fishing alternatives that considers the types of resources and habitats protected, compared with the socioeconomic impacts to commercial bottomfish and pelagic fishing. To develop these comparisons, resource data was collected over the past year using all data sets currently available for the NWHI. In addition, the analysis utilizes information from the *Socio-Economic Assessment of Commercial Bottomfishing in the Northwestern Hawaiian Islands* report (Ehler 2004) and reporting data from the Hawaii Department of Land and Natural Resources, Division of Aquatic Resources (Hawaii DLNR/DAR) commercial marine license catch reports and information collected in one-on-one interviews with active bottomfishermen.

Table 12 summarizes several key ecological statistics for the zoning options associated with each alternative, including information on the protection afforded to shallow water coral reef habitat, habitat within 100 fathoms⁴ (fm), monk seal foraging ranges, and lobster habitat. These parameters represent the resource issues that are central to the proposed sanctuary. Together the shallow water coral reef habitat and the habitat found within 100 fm provide a good index of the amount of the coral reef ecosystem included in each alternative's zoning option.

Although only one alternative contemplates the harvest of lobster, it is important to note the extent to which this resource could be affected by various management scenarios. An understanding of the extent and location of lobster habitat may also be important to the protection of one species that prey on it to some extent, such as the endangered Hawaiian monk seal.

Knowledge of the foraging biogeography of the endangered monk seal is critical to developing an appropriate management response to threats to this animal. Although National Oceanic and Atmospheric Administration (NOAA) Fisheries maintains the primary responsibility for protecting the monk seal, the National Marine Sanctuary Program (NMSP) has recently begun to work jointly with NOAA Fisheries to assist in processing the data necessary to continue these efforts. The spatial distribution of the monk seal spreads widely across the NWHI, and the protection afforded to this important resource varies considerably among alternatives.

The detailed resource assessment conducted by the NMSP is summarized in Section 4 of this document. This assessment provides insight into the relationship between socioeconomic and ecological values associated with each island and atoll in the NWHI. The assessment combined the results of a socioeconomic analysis of fishing activities in the region with detailed ecological resource data collected on corals, fish, seabirds, and protected species, among others.

⁴ 100 fm serves as a proxy for generalized bottomfish habitat; previous monk seal studies indicated this could be used as a general indicator of monk seal range (Abernathy 1998, 1999). As a result of this information, the NWHI Coral Reef Ecosystem Reserve established no-take Reserve Preservation Areas based on this depth contour at French Frigate Shoals, Pearl and Hermes Atoll, and Kure Atoll.



The results of the resource assessment indicate that the ecological value associated with the islands and atolls of the NWHI chain tends to increase traveling northwest from Nihoa Island. Conversely, the socioeconomic value derived from the northwest portion of the archipelago (Lisianski Island to Kure Atoll) is virtually nonexistent due to a lack of fishing activity at the far end of the chain.

French Frigate Shoals provides an exception to these trends. French Frigate Shoals and surrounding banks, located roughly in the middle of the chain, have been recognized as one of the most important areas in the NWHI, because of its large populations of monk seals, sea turtles, and sea birds, and coral diversity. While the bottomfish catch at French Frigate Shoals has been relatively large, surveys of the fishermen indicated that they do not depend on the area for fishing, and they recommend it be afforded additional protection (Ehler 2004).

An appropriate management alternative could provide additional protection for the significant ecological locations within the NWHI while allowing existing fishing activities at those places where conflicts do not occur. Areas that could be afforded additional protection without precluding a viable bottomfish/pelagic industry include locations northwest of Lisianski Island and the area around French Frigate Shoals.

Table 12 summarizes the habitat protected and the socioeconomic impact resulting from the enactment of various management alternatives. The socioeconomic impact on various alternatives was calculated by identifying the amount of area reported to be actively fished, that would be closed by the fishing alternatives (Ehler 2004). The impact of various zoning options on the bottomfish/pelagic trolling fishing activity were based upon the DLNR/DAR dataset and fishing survey results provide by Rod Ehler. Each alternative's area boundaries were overlaid with Hawaii DLNR/DAR grids. Fishing track lines digitized from survey data were then used to determine the likelihood of current fishing effort and fishing impact on each grid. Grids that were found to be impacted by the alternative boundaries were selected, and total fishing values were summed. Where information existed to differentiate between bottomfish species (for example, where it was know what percentage of the total bottomfish landing was due to individual species) this was used to further refine the potential impacts. Where such information did not exist, impacts erred on the conservative side.

The percentage of resource areas covered by various zoning options was calculated using ArcMap (8.3) software for zoning options. These resource and use statistics will be presented in later sections on fishing alternatives and zoning options. Boundaries of existing jurisdictional areas and proposed zones (Sanctuary Preservation Areas and Ecological Reserves) were created for each fishing alternative. Using the Geoprocessing Tool 'Clip' in ArcMap, individual resource layers were clipped by each alternative area, producing polygons of individual resources contained within every jurisdiction. Area calculations for each polygon were generated using a VB script, and exported to Excel spreadsheets for percentage of total calculations (Attachment D).



Table 12. Comparison of the Percentage of Habitat Protected and Impacts to Commercial Bottomfish and Pelagic Catch by Alternative¹

Resource	Habitat Protected				Socioeconomic Impact	
	Shallow Water Coral Reef Habitat	Habitat within 100 fm	Monk Seal Foraging Ranges	Lobster Habitat (less than 35fm)	Reduction of Bottomfish Catch	Reduction of Pelagic Fish Catch ²
Total	3,687 km ²	13,548 km ²	48,156 km ²	9,475 km ²	1,937,521 lbs	580,641 lbs
Status Quo	41%	70%	27%	76%	28%	13%
Alternative 1	39%	48%	18%	60%	28%	13%
Alternative 2	11%	6%	2%	4%	0.4%	0%
Alternative 3	88%	53%	43%	58%	24%	4%
Alternative 4	90%	83%	77%	87%	62%	10%
Alternative 5	100%	100%	100%	100%	100%	100%
Alternative 6	100%	100%	100%	100%	100%	100%

Notes:

1 - Refer to Attachment D for more detailed comparisons across the various alternatives

2 - Pelagic fish catch associated with bottomfish/pelagic trolling fishing

The results are briefly discussed below.

Status Quo Alternative/Zoning Option: This alternative/zoning option protects 41 percent of the shallow water coral reef habitat, 70 percent of the habitat found within 100 fm, 27 percent of the monk seal foraging ranges, and 76 percent of the lobster habitat found in the region. The EO provisions and Reserve Preservation Area (RPA) boundaries (along with prescribed caps) intend to limit bottomfish/pelagic trolling compared to pre-EO levels. Therefore, fishing effort and levels under the status quo would result in a 28 percent reduction in pounds landed for bottomfish/pelagic trolling catch, and 13 percent reduction for pelagic species compared to pre-EO levels based on full implementation of the EO.

Alternative/Zoning Option 1: This alternative/zoning option would protect 39 percent of the shallow water coral reef habitat, 48 percent of the habitat found within 100 fm, 18 percent of the monk seal foraging ranges, and 18 percent of the lobster habitat found in the region. These are slightly lower than the protection afforded by the status quo due to the effect of creating straight-



line boundaries around the SPAs. The straight lines are based on the fathom contours that establish the RPAs and would be implemented to ease enforcement in an area. Impacts to commercial fishing activities resulting from this alternative include a 28 percent reduction in pounds landed for bottomfish/pelagic trolling catch, and 13 percent reduction in the pelagic catch associated with bottomfishing, as compared with the pre-EO levels. This alternative would, in effect, also protect 100 percent of the lobster habitat due to zoning and sanctuary-wide regulations that would prohibit crustacean harvest.

Alternative/Zoning Option 2: This alternative/zoning option would protect 11 percent of the shallow water coral reef habitat, 6 percent of the habitat found within 100 fm, 2 percent of the monk seal foraging ranges, and 4 percent of the lobster habitat found in the region. These numbers represent a significant reduction in the protection afforded to the region through geographic zoning compared to all other alternatives. In addition, the impacts to commercial bottomfish catch compared to pre-EO levels would result in a 0 percent reduction in pounds landed. This is also the only alternative that allows for crustacean harvest. With only 4 percent of the total lobster habitat protected, a significant amount of habitat would remain open to extraction.

Alternative/Zoning Option 3: This alternative/zoning option would protect 88 percent of the shallow water coral reef habitat, 53 percent of the habitat found within 100 fm, 43 percent of the monk seal foraging ranges, and 58 percent of the lobster habitat found in the region. This represents a net gain in resource protection compared to the status quo and zoning option 1. Impacts to commercial bottomfish catch compared to pre-EO levels would result in a 24 percent reduction in bottomfish landed and a 13 percent reduction in the pelagic landings. This represents 4 percent less impact to the bottomfish landings and a 9 percent reduction in pelagic landings compared to zoning option 1 (status quo with regulations option). The impact on landings to bottomfish and pelagics may change slightly for this alternative during the time that a new ecosystem-based management plan is being developed. During this time, the caps described in the EO would be put into place. This alternative would, in effect, also protect 100 percent of the lobster habitat due to zoning and sanctuary-wide regulations.

Alternative/Zoning Option 4: This alternative/zoning option would protect 90 percent of the shallow water coral reef habitat, 83 percent of the habitat found within 100 fm, 77 percent of the monk seal foraging ranges, and 87 percent of the lobster habitat found in the region. This represents a marked gain in resource protection compared to the previous alternatives. From an ecosystem protection standpoint, this option would provide the most protection for natural resources while still providing some level of commercial bottomfishing. While immediate impacts to commercial bottomfish catch would mimic that of zoning option 3, eventually bottomfish catch compared to pre-EO levels would be reduced by 62 percent, and pelagic catch would be lowered by 10 percent due to the phase-out of bottomfishing planned for the Ho`omaluu zone. This alternative would, in effect protect 100 percent of the lobster habitat due to zoning and sanctuary-wide regulations.

Alternative/Zoning Option 5: This alternative/zoning option would protect 100 percent of the ecological parameters discussed in the previous zoning options. For the first year that this



alternative is in place, some bottomfish/pelagic trolling would be permitted. However, this alternative contemplates the complete phase-out of this industry within 1 year. Therefore, the impacts to these fisheries are reported as 100 percent.

Alternative/Zoning Option 6: This alternative/zoning option closes the entire region to extractive use. This alternative provides complete protection to the resources of the region and excludes all commercial fishing.

Comparison of Fishing Alternatives

A summary of the material discussed above is provided in Figures 7 and 8. Figure 7 compares the amount of habitat protected by each alternative. This figure demonstrates that marked increases in the protection of shallow water coral reef habitat and monk seal foraging locations are gained by considering alternatives 3 through 6, as each of these alternatives includes state waters. All of the alternatives, except alternative 2, provide reasonably high protection of habitat within 100 fm and the lobster habitat. However, as noted earlier, lobster harvest is only proposed as a viable fishing activity in alternative 2.

Figure 8 compares the impact of each alternative and their associated zoning components with respect to bottomfish/pelagic trolling landings. One important conclusion that can be drawn from this figure is that the no action alternative and alternative 1 (Sanctuary based on Reserve) would create more impact to the pounds landed than alternatives 2 and 3.

Figure 7. Comparison of Percent of Various Habitats Protected by Fishing Alternative

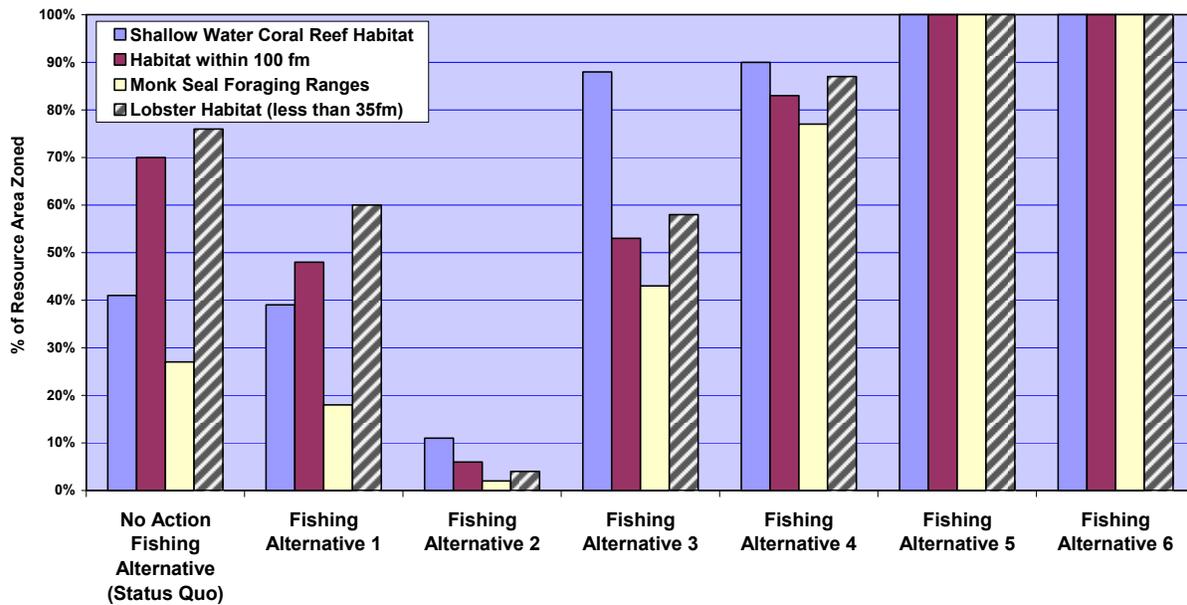
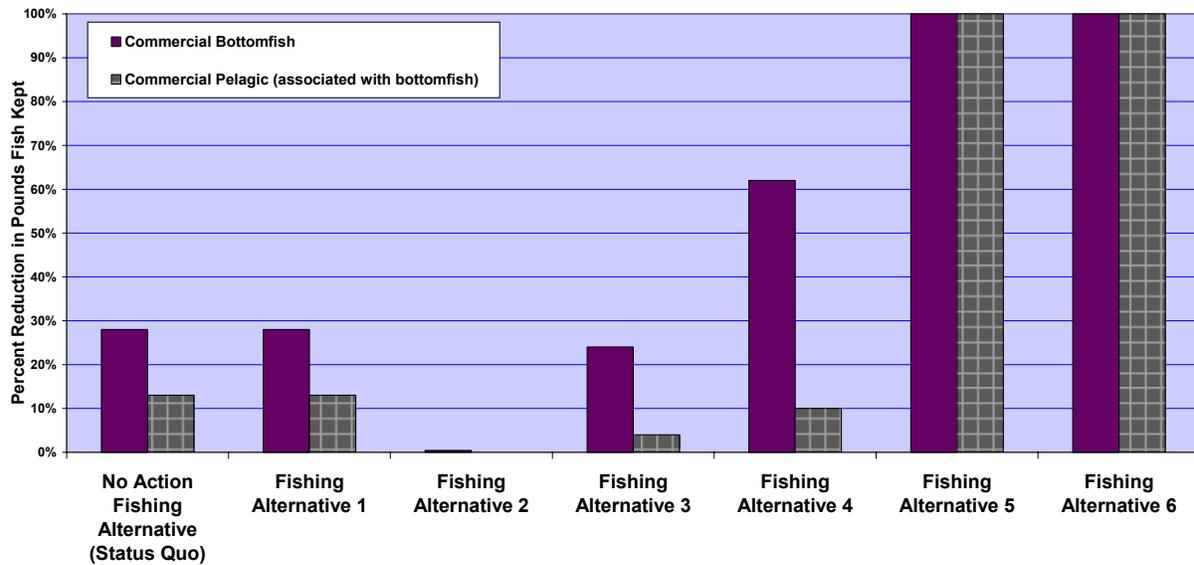


Figure 8. Comparison of Estimated Percent Reduction in Fish Catch by Fishing Alternative (% of total pounds kept from 1996 – 2002)



Evaluation of Alternatives Based on Management Goal 7 Objectives

A final evaluation of the fishing alternatives and zoning options was conducted based on the objectives of management goal 7. Management goal 7 objectives are shown in Table 13. The results of this evaluation are provided in Table 14. Fishing alternatives 3 and 4 are the only ones consistent with G&O Statement for the proposed sanctuary. The NMSP believes fishing alternative 3 is most likely to achieve the maximum ecological protection while minimizing adverse socioeconomic impacts.

Table 13. Management Goal 7 and Objectives for the Proposed Sanctuary

<p>Goal 7: Maintain ecosystem integrity by limiting and controlling fishing activities using an ecosystem-based management approach. Maximize ecosystem protection while minimizing adverse socioeconomic impacts. Limit fishing activities to areas that minimize or prevent interactions with corals, seabirds, endangered Hawaiian monk seals, and other protected wildlife, or that do not threaten the natural character or biological integrity of any ecosystem of the region.</p>
<p>Objectives: As appropriate to maintain the natural character or biological integrity of any ecosystem of the region:</p> <ul style="list-style-type: none"> 7a. Prohibit non-subsistence crustacean fishing. 7b. Prohibit commercial precious coral fishing. 7c. Prohibit harvest of all coral species, live rock, all aquaria species and live fish trade species, and algae, sponges, and other invertebrates. 7d. Allow recreational fishing for pelagic species except within sensitive habitats. 7e. Allow bottomfish fishing to continue except within sensitive habitats. 7f. Allow commercial pelagic fishing using handline, pole and line and trolling gear except within sensitive habitats. 7g. Prohibit subsistence use within the sanctuary except for Native Hawaiian subsistence use. 7h. Allow sustenance fishing for pelagic and bottomfish species using pole and line, trolling and handline methods within the Sanctuary except within sensitive habitats. 7i. Allow spearfishing without the use of SCUBA for pelagic species except within sensitive habitats. 7j. All fishing not specifically allowed shall be prohibited. 7k. When there is uncertainty in available information regarding the potential impacts of any fishing activity, err on the side of resource protection.



Table 14. Evaluation of Alternatives Based on Management Goal 7 Objectives

Goal 7 Objectives	Zoning Option Score						
	STATUS QUO	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6
Does the proposed management approach prohibit non-subsistence crustacean fishing?	Yes	Yes	No	Yes	Yes	Yes	Yes
Does the proposed management approach prohibit commercial precious coral fishing?	Yes	Yes	No	Yes	Yes	Yes	Yes
Does the proposed management approach prohibit harvest of all coral species, live rock, all aquaria species and live fish trade species, and algae, sponges, and invertebrates?	Yes	Yes	No	Yes	Yes	Yes	Yes
Does proposed management approach allow recreational fishing for pelagic species except within sensitive habitats?	Yes	Yes	No	Yes	Yes	Yes	No
Does proposed management approach allow bottomfish fishing to continue except within sensitive habitats?	Yes	Yes	No	Yes	Yes	No	No
Does the proposed management approach allow commercial pelagic fishing using handline, pole and line, and trolling gear except within sensitive habitats?	Yes	Yes	Yes	Yes	Yes	Yes	No
Does the proposed management approach prohibit subsistence use except for Native Hawaiian subsistence use (within the proposed sanctuary)?	Yes	Yes	Yes	Yes	Yes	Yes	No
Does the proposed management approach allow sustenance fishing for pelagic and bottomfish species using pole and line, trolling, and handline methods within the Sanctuary except within sensitive habitats?	Yes	Yes	Yes	Yes	Yes	Yes	No
Does the proposed management approach allow non-SCUBA spearfishing for pelagic species except within sensitive habitats?	Yes	Yes	Yes	Yes	Yes	n/a	No
Does the proposed management approach prohibit all fishing not specifically allowed above?	No	Yes	No	Yes	Yes	Yes	Yes
When there is uncertainty in available information regarding the potential impacts of any fishing activity, does management approach err on the side of resource protection?	No	No	No	Yes	Yes	Yes	Yes
Is the alternative consistent with all the objectives of management goal 7?	No	No	No	Yes	Yes	No	No



9.0 Fishing Alternative Considered Most Consistent With the NMSA and the G&O Statement

Fishing Activity and Geographic Zoning Restrictions for Fishing Alternative 3

Fishing alternative 3 prohibits several fishing activities throughout the sanctuary and specifies geographic zoning restrictions for others (Table 15 presents a summary of fishing activity prohibitions and zoning restrictions for alternative 3). Sanctuary-wide fishing activity prohibitions include commercial pelagic longline, precious coral, coral reef species, and crustacean fishing.

Fishing activities allowed by permit in this alternative but restricted through zoning include commercial bottomfish/pelagic trolling, commercial pelagic trolling, several forms of recreational fishing, and Native Hawaiian subsistence use. Sustenance fishing would be allowed sanctuary wide, except in Sanctuary Preservation Areas (SPAs). Geographic zoning employs the use of SPA and Ecological Reserves (ER) as shown on Map 4.

Sanctuary Preservation Areas (SPA): areas of the proposed sanctuary that encompass discrete, biologically important areas within which uses are subject to conditions, restrictions and prohibitions, including access restrictions, to avoid concentrations of uses that could result in declines in species populations or habitat, to reduce conflicts between uses, to protect areas that are critical for sustaining important marine species or habitats, or to provide opportunities for scientific research.

Ecological Reserves (ER): areas of the proposed sanctuary consisting of contiguous, diverse habitats within which uses are subject to conditions, restrictions and prohibitions, including access restrictions, intended to minimize human influences, to provide natural spawning, nursery, and permanent residence areas for the replenishment and genetic protection of marine life, and also to protect and preserve natural assemblages of habitats and species within the sanctuary.

All commercial, recreational, and sustenance fishing would be prohibited inside a SPA with the exception of the SPA located around Midway Atoll pursuant to Midway National Wildlife Refuge regulations. SPAs cover 13,999 square kilometers (sq km) or 4 percent of the total proposed sanctuary area (Table 16). SPAs are largely based on existing Reserve Preservation Area (RPA) boundaries modified as deemed appropriate to provide for enforceable and viable bottomfish/pelagic fishing.

All commercial fishing would be prohibited in ERs. Recreational catch and release fishing would be allowed pursuant to Midway National Wildlife Refuge Regulations. Ecological Reserve 1 (ER1) is located between 173.5° W and 179.7° W longitude. This Ecological Reserve covers an area of 115,368 sq km, or 32 percent of the total proposed sanctuary, and provides an important level of protection to the Northwestern atolls in the chain from Lisianski to Kure Atoll (Table 16). This area includes Pearl and Hermes Atoll, an area that ranked highest in ecological value (at the same rank as French Frigate Shoals).



Table 15. Fishing Activities Allowed or Prohibited in Alternative 3

	Activity Type	Allowed/ Prohibited?	Where?	Socioeconomic Impact
FISHING	Commercial Pelagic Long-line	Prohibit	Sanctuary-wide	None
	Precious Coral	Prohibit	Sanctuary-wide	None
	Coral Reef Species, Live Rock, Aquaria, Live Trade	Prohibit	Sanctuary-wide	None
	Crustacean	Prohibit	Sanctuary-wide	None. Impacts occurred in 2000 when the fishery was closed by court order.
	Commercial Bottomfish/Pelagic	Allow by Federal Bottom/Groundfish and Sanctuary Access Permits (with ecosystem-based approach developed as part of management plan).	East of 165° W longitude, except within Sanctuary Preservation Areas (SPA), and between 167.5° W and 173.5° W longitude, except within SPAs	Improved. Compared to the status quo, this option would open up important fishing grounds in the Mau zone by establishing smaller SPAs.
		Prohibit	In Ecological Reserves (1) between 173.5° W and 179.7° W longitude and (2) between 165° W and 167.5° W longitude.	Total of 28% decrease in total bottomfish/pelagic catch compared to pre-EO levels. (This is 13% less than the decrease under Alternative 1).
	Commercial Pelagic (trolling)	Allow by permit (with ecosystem-based approach developed as part of management plan).	East of 165° W longitude, except within SPAs.	None
		Prohibit	West of 165° W longitude.	None. This activity has historically occurred in the southern part of the NWHI. Unclear how much, if any, of this activity still occurs.
	Recreational (Catch and Release)	Allow by permit for pelagics and <i>Caranx</i> and <i>Seriola</i> genera only.	East of 165° W longitude, except within SPAs	None
		Conditionally allow for pelagics and <i>Caranx</i> and <i>Seriola</i> genera only.	Northwest of 173.5° W longitude, except within SPAs, and at Midway, consistent with USFWS regulations	Likely none. Some impact would occur if U.S. Fish and Wildlife Service prohibits in the future.
		Prohibit	Between 165° and 173.5° W longitude	Very limited, if at all. Not clear how much of this activity has occurred.
	Recreational (Catch and Keep)	Allow by permit for pelagics only using troll, handline, and pole and line methods. Also allow non-SCUBA assisted spearfishing for pelagics only.	East of 165° W longitude, except within SPAs.	None
		Prohibit	West of 165° W longitude.	None
	Sustenance	Allow by permit for pelagics and bottomfish via trolling, handline, or pole and line.	Sanctuary-wide, except in SPAs.	None
	Native Hawaiian Subsistence	Allow by permit	Sanctuary-wide	None



The proposed sanctuary would include submerged lands and waters of the NWHI, extending approximately 1,200 nautical miles (nm) long and 100 nm wide. The sanctuary shall be adjacent to the mean high water mark of the State of Hawaii and Midway National Wildlife Refuge and shall overlay the Hawaiian Islands National Wildlife Refuge. The outer boundary of the Reserve would also be expanded at the most northwestern extent (northwest of Kure Atoll) to include newly identified precious coral beds and monk seal foraging areas.

Table 16. Percent of Total Area of Proposed Sanctuary Zoned in Fishing Alternative 3

Area	Area (in sq km)	Percent of Total Proposed Sanctuary Area Zoned
Sanctuary Preservation Area	13,999	4%
Ecological Reserve 1 (Lisianski Island and areas NW)	115,368	32%
Ecological Reserve 2 (French Frigate Shoals and surrounding banks)	51,121	14%
Ecological Reserves and SPA's (Total)	166,488	47%
Total Proposed Sanctuary Area (with modified outer boundary)	355,687	-

Ecological Reserve 2 (ER2) is located between 165° W and 167.5°W longitude and encompasses the region referred to as the French Frigate Shoals complex. ER2 covers an area of 51,121 sq km or 14 percent of the total proposed sanctuary and provides an important level of protection to the area with the most vulnerable population of endangered Hawaiian monk seals. The National Marine Sanctuary Program (NMSP) dock surveys, conducted in 2003 with the commercial fishing boat operators currently permitted to fish in the region, agree that the French Frigate Shoals complex has such important and unique characteristics that it should be afforded an increased level of protection. As described in the ranking process, French Frigate Shoals has the highest ecological ranking and largest population of monk seals and green sea turtles in the entire Hawaiian archipelago.

The combination of ERs and SPAs provides significant protection for highly sensitive and vulnerable resource areas (Table 17). Of the 3,867 sq km of shallow water coral habitat, 88 percent is included in ER and SPA zones. Of the 13,548 sq km of habitat with 100 fm, 53 percent is included in ER and SPA zones. Monk seal foraging ranges are extensive, covering 48,156 sq km, of which 43 percent is included in ER and SPA zones. Similarly, 58 percent of the lobster habitat is protected for foraging monk seals. The foraging range for highly vulnerable juvenile boobies is completely protected in the ER and SPA zones.

Table 17. Percent of Resource Areas Zoned in Fishing Alternative 3

Resource	Resource Area (sq km)	Percent of Resource Area Zoned (ER/SPA)
Shallow Water Coral Habitat (less than 30 meters in depth)	3,687	88%
Habitat within 100 fm	13,548	53%
Monk Seal Foraging Ranges	48,156	43%
Lobster Habitat (less than 35 fathoms in depth)	9,929	58%
Juvenile Booby Foraging Ranges (distance of 3 nautical miles around islands)	1,083	100%

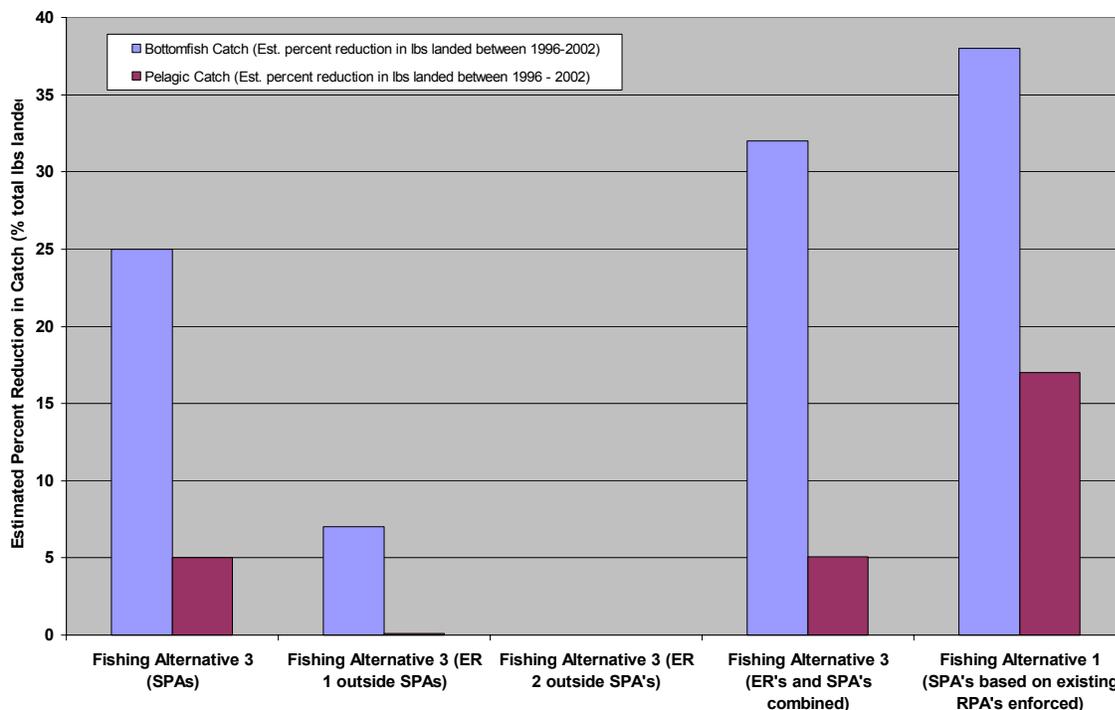


ER1 and ER2, together with SPA, prohibit all forms of commercial fishing in 47 percent of the total area of the proposed sanctuary. The impact of zoning associated with fishing alternative 3 on bottomfish/pelagic fishing was estimated by calculating the percent change in pounds landed in each zone, based on 1996 to 2002 trip report data from Hawaii Department of Land and Natural Resources, Division of Aquatic Resources (Figure 9).

The SPAs in alternative 3 represent an estimated 24 percent and 4 percent reduction in bottomfish and pelagic catch, respectively (Figure 9). The area of ER1 outside of the SPA represents minimal reduction: 7 percent and 0.1 percent reduction in bottomfish and pelagic catch, respectively. The area of ER2 outside of the SPA represents no reduction in either bottomfish or pelagic catch.

The estimated total reduction in bottomfish and pelagic catch resulting from zoning (ER1, ER2, and SPAs), is 32 percent and 5 percent of the total pounds landed between 1996 and 2002, respectively. This percent reduction is based on a comparison to fishing alternative 1 where fishing has historically occurred and continues to occur inside certain RPA boundaries. If the change in bottomfish and pelagic catch were compared to fishing alternative 1, an estimated increase in fish catch of 6 percent and 12 percent, respectively, would occur by implementing fishing alternative 3.

Figure 9. Comparison of Reduction in Bottomfish/Pelagic Catch Resulting from Zoning





Opportunity for Innovative Ecosystem-Based Fishery Management

As recognized by recent amendments to the Magnuson-Stevens Fishery Conservation and Management Act and Sustainable Fisheries Act of 1996 and other recent reports, improved fisheries management should adopt an ecosystem-based approach that extends beyond a focus on target species to address impacts on non-target species, trophic interactions, and other ecosystem parameters (Ecosystem Principles and Advisory Panel 1998). The National Marine Sanctuaries Act (NMSA) similarly envisions maintaining biological communities to protect and, where appropriate, restore and enhance natural habitats, populations, and ecological processes. In order for fisheries management in the proposed sanctuary to be consistent with these policy directions and legal mandates, the management approach needs to emphasize ecosystem values and recognize the importance of species interactions and conservation of habitats, and to permit resource utilization in a manner that is fully consistent with the primary objective of resource protection.

Fishing in the Northwestern Hawaiian Islands (NWHI) must be carefully considered and evaluated in the context of an ecosystem approach to management in order to achieve and maintain a healthy, functional, and resilient ecosystem. The transition from target species-focused or even ecosystem-based fisheries management to an ecosystem approach that considers biodiversity and functionality will occur gradually; however, as incremental steps are taken, lessons are learned, and management approaches are adapted and refined. The designation of the NWHI as a national marine sanctuary provides an excellent opportunity to continue to move in the direction of an ecosystem approach to management through collaboration with jurisdictional partners and other stakeholders.

Overall Objectives of Ecosystem-Based Fisheries Management
(adapted from Pikitch et al. 2004)

- Avoid degradation of ecosystems, as measured by indicators of environmental quality and system status
- Minimize the risk of irreversible change to natural assemblages of species and ecosystem processes
- Obtain and maintain long-term socioeconomic benefits without compromising the ecosystem
- Generate knowledge of ecosystem processes sufficient to understand the likely consequences of human actions
- Adopt management measures that favor the ecosystem protection where knowledge is insufficient,

In order to take advantage of this opportunity, the NMSP has identified a fishing alternative that it believes to be the most consistent with the provisions of the NMSA and final goals and objectives of the proposed sanctuary with this alternative, the NMSP also charts a course for a collaborative and adaptive ecosystem approach to management. Fishing alternative 3 incorporates fishing activities that are considered consistent with the provisions of the NMSA and Goals and Objectives (G&O) Statement for the proposed sanctuary and a zoning option that strives to protect areas with the highest ecological value while minimizing socioeconomic and cultural impacts on existing commercial, recreational, and Native Hawaiian subsistence use and fishing.

Following is an expanded description of fishing alternative 3, building on the rationale and analyses presented in previous sections.



Development of an Ecosystem-Based Management Strategy for Fishing Alternative 3

The development and implementation of an ecosystem approach to fisheries management requires making a long-term commitment to a multi-species perspective, understanding ecosystem processes, and monitoring the effects that fishing activities have, not only on target species but to all components of the ecosystem. Such an approach requires initiating a unified, multi-agency collaboration within and between National Oceanic and Atmospheric Administration (NOAA), the State, and U.S. Fish and Wildlife Service, and drawing upon all relevant scientific, management and technical expertise.

In order to move toward this management approach, a task force will be formed to develop an ecosystem-based fishery management strategy where limited commercial and recreational fishing will be allowed using ecosystem-based principles to consider impacts to non-target species, trophic interactions, community composition, habitat impacts, and other ecosystem parameters. The task force will be temporary in nature and dissolved once the strategy is developed. A mechanism will need to be put in place to ensure that amendments developed and approved by the sanctuary are done in collaboration with partner agencies and stakeholder groups. The task force will include but will not be limited to representatives from the following agencies and organizations:

- NOAA Fisheries
- Western Pacific Regional Fishery Management Council
- State of Hawaii
- U.S. Fish and Wildlife Service
- U.S. Coast Guard
- Organizations and institutions with relevant expertise

The ecosystem-based fishery management strategy would address necessary changes to fishery management practices in order to achieve the following:

- Maintenance of the natural character of the ecosystem and ecosystem processes and functions (e.g., ecological integrity with indicators that include maintenance of full age structure of population for all fished species and discards)
- Minimal alteration of fished habitats, with indicators that include observations to establish baseline and monitoring to compare fished and unfished areas
- Minimization of interactions with listed species, with indicators that include not exceeding incidental takes or other measures stated in biological opinions prepared pursuant to the Endangered Species Act

The task force would identify necessary changes in fisheries management practices and recommend solutions. Some of the changes that must be evaluated include but are not limited to the following:



- Changing the goal of fishery management from maximizing yield to managing for fish abundance and long-term conservation and protection of coral reef ecosystems in the NWHI
- Significantly altering fisheries management indicators to address not only target species but other components of the ecosystem, including life history stages of target and non-target species, trophic interactions, community composition, biodiversity, and other measures of ecosystem status
- Increasing the level of “insurance,” especially in the face of uncertainties, by providing thresholds for fisheries and ecosystem indicators upon which management decisions can be made and action taken
- Identifying innovative management and marketing approaches, including cultural and socioeconomic incentives to promote and sustain higher standards for fishing through a fisheries cooperative approach among permittees; exploring share-based fishery management systems under specified catch limits; exploring purchase of fishing rights and/or vessels and gear in the event a vessel owner chooses to exit the fishery; and identifying alternative uses for fishing vessels consistent with the proposed sanctuary
- Ensuring that heritage, inheritance, and bequest values (future opportunity for sustenance, subsistence, cultural practices) are met and sustained
- Evaluating the effectiveness of marine protected areas as a management tool

Within 1 year of the designation of the proposed sanctuary, the task force will be responsible for developing recommendations on research and management priorities, ecosystem and fisheries indicators, and annual and 5-year fishing action thresholds for management decision-making. Based on these recommendations, the NMSP, with advice from the Sanctuary Advisory Council, will determine whether to recommend modifications to Sanctuary fishery regulations. The task force shall 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.

In the interim between designation and the adoption of a revised fishery management plan, the Sanctuary will manage fishing based on a formula for individual fishing caps as provided for by the Executive Orders 13178 and 13196 (EO). The formula will be based on the recommendations of the Reserve Advisory Council, which takes the 5-year period prior to the EO, removes the highest and lowest-year catch data, and averages the remaining years fished during that period. The formula would not penalize fishermen who entered the fishery within 5 years prior to the issuance of the EO; instead, the formula would account for the fact that they were recent entrants into the fishery.

Summary

The NMSP considers fishing alternative 3 the most consistent with the provisions of the NMSA and G&O Statement for the proposed sanctuary. This alternative addresses ecosystem protection mandates of the NMSA, while maintaining a viable commercial bottomfish/pelagic trolling fishery that supplies local markets. Large ecosystem areas are protected through Ecological Reserves encompassing islands with the highest ecological values, including French Frigate



Shoals and associated banks, Lisianski Island, and Pearl and Hermes Atoll. Socioeconomic impacts are minimized by defining SPA boundaries to allow limited and enforceable commercial bottomfish/pelagic fishing and some pelagic trolling. The harvest of target species sensitive to other human and natural perturbations, such as crustaceans and coral reef species, would be prohibited in the proposed sanctuary. The requirement for an ecosystem-based management strategy and ecological and fisheries indicators with action thresholds will provide safeguards against uncertainties and establish higher standards that must be met for fishing to continue. The proposed collaborative multi-agency approach to strategy development and implementation sets the stage for innovative management measures and models that can be applied in the proposed sanctuary, and exported to the main Hawaiian Islands and other areas.



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ATTACHMENT D

PROPOSED NORTHWESTERN HAWAIIAN ISLANDS NATIONAL MARINE SANCTUARY

Additional Resource and Use Statistics





Status Quo
Reserve includes Federal waters (3 to 50nm). State waters not included.

	Area (in sq km)	% of total
NWHICRER	351,195	100%
No-take RPA (no State waters)	9,314	3%
Limited-Take RPA	7,255	2%

Resource	Total Area (in sq km)	Included in No-Take RPA		Included in Limited-Take RPA		Total
		Area (sq km)	% of total	Area (in sq km)	% of total	
Shallow Water Coral Habitat (~30m) Center for biological diversity and primary productivity* Includes: -Rare Corals -Coral bleaching sites -Corals resistant to bleaching -All NOWRAMP dive sites	3,687	1,456	39%	55	2%	41%
Habitat within 100f	13,548	6,479	48%	3,016	22%	70%
Monk Seal Foraging Ranges	48,156	8,472	18%	4,426	9%	27%
Lobster Habitat (less than 35f)	9,475	5,688	60%	1,509	16%	76%
Juvenile Booby Foraging Ranges (3 miles)	1,083	4	0.4%	0	0%	0.4%
Dolphin Resting Areas (Kure, Midway and Pearl and Hermes)	450	5	1%	0	0%	1%
Pearl Oysters (surveyed population at Pearl and Hermes)	1,056	117	11%	0	0%	11%

*Atlas of the Shallow-Water Benthic Habitats of the Northwestern Hawaiian Islands

Bottomfish Data (1996-2002)	Total	Impact of No-Take RPA		Impact of Limited-Take RPA		Total
			% of total		% of total	
Pounds Kept	1,937,521	541,324	28%	0	0%	28%
Value (\$2000)	6,017,389	1,430,483	24%	0	0%	24%
Number Kept	232,891	54,892	24%	0	0%	24%

Pelagic Fish Data (1996-2002)	Total	Impact of No-Take RPA		Impact of Limited-Take RPA		Total
			% of total		% of total	
Pounds Kept	580,641	75,483	13%	0	0%	13%
Value (\$2000)	940,744	117,524	12%	0	0%	12%
Number Kept	23,098	2,854	12%	0	0%	12%



Alternative 1

RPAs are straight-lined to create SPAs. State Waters are not included.

	Area (in sq km)	% of total
NWHICRER	351,195	100%
SPA	12,128	3%

Resource	Total Area (in sq km)	Included in SPA	
		Area (sq km)	% of total
Shallow Water Coral Habitat (~30m) Center for biological diversity and primary productivity* Includes: -Rare Corals -Coral bleaching sites -Corals resistant to bleaching -All NOWRAMP dive sites	3,687	1,452	39%
Habitat within 100f	13,548	6,479	48%
Monk Seal Foraging Ranges	48,156	8,430	18%
Lobster Habitat (less than 35f)	9,929	5,959	60%
Juvenile Booby Foraging Ranges (3 miles)	1,083	4	0.4%
Dolphin Resting Areas (Kure, Midway and Pearl and Hermes)	450	5	1%
Pearl Oysters (surveyed population at Pearl and Hermes)	1,056	117	11%

*Atlas of the Shallow-Water Benthic Habitats of the Northwestern Hawaiian Islands

Note: this Alternative assumes the following fisheries will be impacted: all bottomfish at currently closed no-take RPAs and FFS; all bottomfish at Lisianski, Gardner Pinnacles and Necker except ehu, kalekale, onaga, opakapaka and hapuupuu, which are typically found outside the 25f depth range. No impacts are calculated for Nihoa, Laysan, Maro and Pearl and Hermes as the current data shows no fishing activities within SPA boundaries. Given that 75-125fm represents the primary depth targeted by bottomfishers, we have estimated a 50% impact to bottomfishing at the 100f RPA at FFS. This calculation may likely underestimated total impact.

Bottomfish Data (1996-2002)	Total	Impact of SPA	
			% of total
Pounds Kept	1,937,521	541,324	28%
Value (\$2000)	6,017,389	1,430,483	24%
Number Kept	232,891	54,892	24%

Pelagic Fish Data (1996-2002)	Total	Impact of SPA	
			% of total
Pounds Kept	580,641	75,483	13%
Value (\$2000)	940,744	117,524	12%
Number Kept	23,098	2,854	12%



Alternative 2	
Western Pacific Regional Fishery Management Council Proposed Marine Protected Areas	

	Area (in sq km)	% of total
NWHICRER	351,195	100%
No-Take (kapu) zone	845	0.2%
No-Take lobster and coral reef resources, (excluding Laysan)	324	0.1%
No-Take lobster, at Laysan (20 miles)	3,970	1%
Coral Reef resource low-use special permit zone	9,868	3%

Resource	Total Area (in sq km)	Included in No-Take (kapu) zone (0-50f at FFS, Laysan, North Midway)		Included in lobster and coral reef resource no-take zone (0-10f, 20 mile radius around Laysan for lobster no-take)		Included in low-use special permit zone (10-50f)	
		Area (sq km)	% of total	Area (sq km)	% of total	Area (sq km)	% of total
Shallow Water Coral Habitat (~30m) Center for biological diversity and primary productivity* Includes: -Rare Corals -Coral bleaching sites -Corals resistant to bleaching -All NOWRAMP dive sites	3,687	396	11%	282	8%	1,638	44%
Habitat within 100f	13,548	842	6%	318	2%	8,762	65%
Monk Seal Foraging Ranges	48,156	845	2%	318	1%	9,296	19%
Lobster Habitat (less than 35f)	9,929	359	4%	757	8%	7,210	73%
Juvenile Booby Foraging Ranges (3 miles)	1,083	0	0.0%	0	0.0%	153	14%
Dolphin Resting Areas (Kure, Midway and Pearl and Hermes)	450	0	0%	0	0%	61	13%
Pearl Oysters (surveyed population at Pearl and Hermes)	1,056	0	0%	0	0%	116	11%

*Atlas of the Shallow-Water Benthic Habitats of the Northwestern Hawaiian Islands

Note: This alternative assumes the only impact to fishing is uku at FFS

Bottomfish Data (1996-2002)	Total	Impact of Kapu Zone	
			% of total
Pounds Kept	1,937,521	7,941	0.4%
Value (\$2000)	6,017,389	17,354	0.3%
Number Kept	232,891	677	0.3%

Pelagic Fish Data (1996-2002)**	Total	Impact of in Kapu Zone	
			% of total
Pounds Kept	580,641	0	0%
Value (\$2000)	940,744	0	0%
Number Kept	23,098	0	0%



Alternative 3

ER's established west of 173.5 degrees west and around FFS. SPAs expanded at Lisianski, Laysan and Maro out to 75 fathoms. SPAs created out to three miles at Gardner, Necker, and Nihoa. SPAs include State waters. Bottomfishing still active in part of Hoomalu zone.

	Area (in sq km)	% of total
Proposed Sanctuary (with modified outer boundary)	355,687	100%
SPA	13,999	4%
ER - total	166,488	47%
ER at FFS	51,121	14%
ER includes Lisianski	115,368	32%

Resource	Total Area (in sq km)	Included in SPA		Included in ER (outside of SPA)				Total
		Area (sq km)	% of total	FFS		West of 173.5		
				Area (in sq km)	% of total	Area (in sq km)	% of total	
Shallow Water Coral Habitat (~30m) Center for biological diversity and primary productivity* Includes: -Rare Corals -Coral bleaching sites -Corals resistant to bleaching -All NOWRAMP dive sites	3,687	3,228	88%	0	0%	0	0%	88%
Habitat within 100f	13,548	6,653	49%	0	0%	500	4%	53%
Monk Seal Foraging Ranges	48,156	12,139	25%	5,333	11%	8,604	18%	43%
Lobster Habitat (less than 35f)	9,929	5,518	56%	0	0%	185	2%	58%
Juvenile Booby Foraging Ranges (3 miles)	1,083	1,083	100%	0	0%	0	0%	100%
Dolphin Resting Areas (Kure, Midway and Pearl and Hermes)	450	450	100%	0	0%	0	0%	100%
Pearl Oysters (surveyed population at Pearl and Hermes)	1,056	949	90%	0	0%	0	0%	90%

*Atlas of the Shallow-Water Benthic Habitats of the Northwestern Hawaiian Islands

Note: This alternative assumes the following fisheries will be impacted: All fishing at the FFS complex and uku at Lisianski. No impacts are assumed at Nihoa, Necker, and Gardner as SPAs are reduced to 3 miles. No impacts are assumed at Maro, Laysan, and Pearl and Hermes as current data indicates no activity inside proposed SPA boundary.

Bottomfish Data (1996-2002)	Total	Included in SPAs		Included in ER, outside of SPAs				Total
			% of total	FFS		West of 173.5		
					% of total		% of total	
Pounds Kept	1,937,521	328,848	17%	0	0%	134,100	7%	24%
Value (\$2000)	6,017,389	1,030,250	17%	0	0%	377,088	6%	23%
Number Kept	232,891	38,528	17%	0	0%	16,709	7%	24%

Pelagic Fish Data (1996-2002)	Total	Included in SPA		Included in ER, outside of SPAs				Total
			% of total	FFS		West of 173		
					% of total		% of total	
Pounds Kept	580,641	23,508	4%	0	0%	155	0.0%	4%
Value (\$2000)	940,744	44,414	5%	0	0%	0	0.0%	5%
Number Kept	23,098	1,192	5%	0	0%	11	0.0%	5%



Alternative 4

ER's established west of 173.5 degrees west and around FFS. SPAs expanded at Lisianski, Laysan and Maro out to 75 fathoms. SPAs created out to three miles at Gardner, Necker, and Nihoa. SPAs include State waters. Eventual phase-out of bottomfishing in Hoomalu zone via attrition.

	Area (in sq km)	percent of total
Proposed Sanctuary (with modified outer boundary)	355,687	100%
SPA	13,999	4%
ER (Hoomalu)	283,184	80%

Resource	Total Area (in sq km)	Included in SPA		Included in ER		Total
		Area (sq km)	% of total	Area (in sq km)	% of total	
Shallow Water Coral Habitat (~30m) Center for biological diversity and primary productivity* Includes: -Rare Corals -Coral bleaching sites -Corals resistant to bleaching -All NOWRAMP dive sites	3,687	3,228	88%	68	2%	90%
Habitat within 100f	13,548	6,653	49%	4,658	34%	83%
Monk Seal Foraging Ranges	48,156	12,139	25%	25,136	52%	77%
Lobster Habitat (less than 35f)	9,929	5,518	56%	3,146	32%	87%
Juvenile Booby Foraging Ranges (3 miles)	1,083	1,083	100%	0	0%	100%
Dolphin Resting Areas (Kure, Midway and Pearl and Hermes)	450	450	100%	0	0%	100%
Pearl Oysters (surveyed population at Pearl and Hermes)	1,056	949	90%	107	10%	100%

*Atlas of the Shallow-Water Benthic Habitats of the Northwestern Hawaiian Islands

Bottomfish Data (1996-2002)	Total	Impact of SPAs		Impact of ER, outside of SPAs		Total
			% of total		% of total	
Pounds Kept	1,937,521	328,848	17%	879,903	45%	62%
Value (\$2000)	6,017,389	1,030,250	17%	2,751,263	46%	63%
Number Kept	232,891	38,528	17%	103,919	45%	61%

Pelagic Fish Data (1996-2002)	Total	Included in SPA		Included in ER, outside of SPAs		Total
			% of total	FFS		
					% of total	
Pounds Kept	580,641	23,508	4%	34,804	6%	10%
Value (\$2000)	940,744	44,414	5%	71,378	8%	12%
Number Kept	23,098	1,192	5%	1,238	5%	11%



Alternative 5
Reserve Advisory Council Recommendations

Reserve Preservation Areas become Sanctuary Preservation Area. A limited entry zone is created approximately 20 nautical miles from center of all islands. Bottomfishing phased out in one year.

	Area (in sq km)	% of total
NWHICRER	351,195	100%
No-take SPA (no State waters)	9,314	3%
Limited-Take SPA (no State Waters)	7,255	2%
Limited Entry Zone	100,314	29%

Resource	Total Area (in sq km)	Included in No-Take SPA		Included in Phase-Out		Total
		Area (sq km)	% of total	Area (sq km)	% of total	
Shallow Water Coral Habitat (~30m) Center for biological diversity and primary productivity* Includes: -Rare Corals -Coral bleaching sites -Corals resistant to bleaching -All NOWRAMP dive sites	3,687	1,456	39%	2,231	61%	100%
Habitat within 100f	13,548	6,479	48%	7,068	52%	100%
Monk Seal Foraging Ranges	48,156	8,472	18%	39,685	82%	100%
Lobster Habitat (less than 35f)	9,475	5,688	60%	3,787	40%	100%
Juvenile Booby Foraging Ranges (3 miles)	1,083	4	0.4%	1,078	99.6%	100%
Dolphin Resting Areas (Kure, Midway and Pearl and Hermes)	450	5	1%	445	99%	100%
Pearl Oysters (surveyed population at Pearl and Hermes)	1,056	117	11%	939	89%	100%

*Atlas of the Shallow-Water Benthic Habitats of the Northwestern Hawaiian Islands

Note: this alternative assumes bottomfishing to be phased out in one year.

Bottomfish Data (1996-2002)	Total	Impacted by limited entry zone		Impact of 1 year phase-out		Total
			% of total		% of total	
Pounds Kept	1,937,521	1,092,730	56%	844,791	44%	100%
Value (\$2000)	6,017,389	3,488,725	58%	2,528,665	42%	100%
Number Kept	232,891	130,011	56%	102,881	44%	100%

Pelagic Fish Data (1996-2002)	Total	Impacted by limited entry zone		Impact of 1 year phase-out		Total
			% of total		% of total	
Pounds Kept	580,641	102,841	18%	477,800	82%	100%
Value (\$2000)	940,744	214,925	23%	725,819	77%	100%
Number Kept	23,098	4,485	19%	18,613	81%	100%



Alternative 6
All Sanctuary is closed.

	Area (in sq km)	percent of total
Proposed Sanctuary (with modified outer boundary)	355,687	
SPA	13,999	4%
ER (Hoomalu)	283,184	80%

Resource	Total Area (in sq km)	Included in Sanctuary	
		Area (sq km)	% of total
Shallow Water Coral Habitat (~30m) Center for biological diversity and primary productivity* Includes: -Rare Corals -Coral bleaching sites -Corals resistant to bleaching -All NOWRAMP dive sites	3,687	3,687	100%
Habitat within 100f	13,548	13,548	100%
Monk Seal Foraging Ranges	48,156	48,156	100%
Lobster Habitat (less than 35f)	9,929	9,929	100%
Juvenile Booby Foraging Ranges (3 miles)	1,083	1,083	100%
Dolphin Resting Areas (Kure, Midway and Pearl and Hermes)	450	450	100%
Pearl Oysters (surveyed population at Pearl and Hermes)	1,056	1,056	100%

*Atlas of the Shallow-Water Benthic Habitats of the Northwestern Hawaiian Islands

Bottomfish Data (1996-2002)	Total	Included in Sanctuary	
			% of total
Pounds Kept	1,937,521	1,937,521	100%
Value (\$2000)	6,017,389	6,017,389	100%
Number Kept	232,891	232,891	100%

Pelagic Fish Data (1996-2002)	Total	Included in Sanctuary	
			% of total
Pounds Kept	580,641	580,641	100%
Value (\$2000)	940,744	940,744	100%
Number Kept	23,098	23,098	100%