

CHAPTER 1

PURPOSE AND NEED FOR ACTION

The National Environmental Policy Act (NEPA) was signed into law in 1970, in response to an overwhelming national sentiment that federal agencies should take the lead in providing greater protection for the environment. It established environmental policy for the nation, provided an interdisciplinary framework for federal agencies, and established procedures and a public process to ensure that federal agency decision-makers take environmental factors into account. NEPA requires preparation of Environmental Impact Statements for major federal actions significantly affecting the quality of the human environment.

In accordance with NEPA, an Environmental Impact Statement (EIS) is required because the implementation of the Coral Reef Ecosystems Fishery Management Plan (CRE-FMP) is a "major federal action significantly affecting the quality of the human environment." Its purpose is to disclose to decision-makers and the public alternative ways to manage coral reef resources in the U.S. Exclusive Economic Zone (EEZ) around the U.S. Pacific Islands and to aid the decision-makers in selecting a course of action. This EIS describes four alternatives, including a Preferred Alternative, for the future management of coral reef resources in the EEZ, and the affected environment and the environmental consequences of implementing the proposed action and alternatives.

This EIS also incorporates the environmental impact statement required for amending the existing Fishery Management Plans (FMPs) for crustaceans, bottomfish, precious corals, and pelagic fisheries. These four fisheries will continue to operate under their respective FMPs. However, they will also be required to comply with the no-take marine protected areas outlined in the CRE-FMP. Each of the four FMPs will be amended to ensure the no-take status of these areas. These include Amendment 7 to the Bottomfish and Seamount Groundfish FMP, Amendment 11 to the Crustaceans FMP, Amendment 10 to the Pelagics FMP and Amendment 5 to the Precious Corals FMP. These amendments specify where the no-take marine protected areas are located, and what management unit species are currently included in the existing FMPs. A summary description of the FMP fisheries and their FMPs is included in Section 3.3.2 of this EIS. An analysis of the impacts of these area closures on the four existing FMPs is included in section 5.9 of this document, describing the environmental consequences for existing fisheries and communities.

A related action that may affect the measures of the CRE-FMP is the recent establishment of the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve (CRE Reserve). In December 2000, President Clinton issued Executive Order (EO) 13178, establishing the Reserve. The EO

sets forth a number of conservation measures and creates specific Reserve Preservation Areas (RPAs), which were made permanent by EO 13196 on January 18, 2001. The conservation measures and locations of RPAs are detailed in Section 9.2 of the FMP.

Pursuant to this EO and the National Marine Sanctuaries Act (NMSA), National Oceanic and Atmospheric Administration (NOAA) is initiating the process to designate the Reserve as a National Marine Sanctuary. NOAA will prepare an environmental impact statement and management plan, which will examine the management, boundary, and regulatory alternatives associated with sanctuary designation (66 FR 5509, January 19, 2001). Because the final rules for the Reserve have not yet been published, and an EIS will be prepared for the marine sanctuary, a comprehensive analysis of the impact of the Reserve cannot be completed at this time. A preliminary assessment of the potential impacts to the human environment is included in Chapter 5 of this EIS. However, two alternatives considered by this EIS (3 and 4, described in Chapter 2) are consistent with the concept of establishing marine reserves in the NWHI, as described in the CRE-FMP.

The Coral Reef Ecosystems FMP was developed by the Western Pacific Regional Fishery Management Council (hereafter, the Council or WPRFMC), based on the ecosystem approach. A recent report to Congress by the Ecosystem Principals Advisory Panel (EPAP) recommends that FMPs be developed as "Fisheries Ecosystem Plans" covering the ecosystems under Council jurisdiction. This FMP represents the first fishery ecosystem plan developed in the United States.

In accordance with the policies recommended by EPAP in developing Fisheries Ecosystem Plans, the Council formulated eight objectives for the CRE-FMP. These objectives promote sustainable use of coral reef resources, especially by fishing communities and indigenous fishermen in the region; an adaptive management approach based on fishery-dependent and fishery-independent research; marine protected areas and habitat conservation; cooperative and coordinated management by the various agencies concerned with conservation of coral reef resources; and education to foster public support for management.

The FMP will address potential human impacts on coral reefs in the Western Pacific Region's EEZ. Although local regulations control many of the impacts of resource exploitation on nearshore coral reefs in settled areas, exploitation of coral reef ecosystems remains relatively uncontrolled in the federally-managed EEZ. Although these areas have been minimally exploited to date, there has been interest expressed for fisheries to expand in these areas. Adverse impacts to coral reef habitats may arise from expansion of current nearshore fisheries for coral reef species, new fisheries for the live fish markets in Southeast Asia, expanded fisheries for coral and "live rock" for the U.S. aquarium trade, and developing fisheries for pharmaceutical applications. In addition, the CRE-FMP will improve understanding of the impacts caused by natural environmental changes, other FMP managed fisheries, and non-fishing related impacts, such as dredging.

Certain gear types, or the ways in which they are used, can cause adverse impacts to habitat. For instance, a new method of reef fishing with tangle nets was recently introduced to Hawaii. When retrieved by hydraulically-powered reels from depths of 10 to 100 m, the nets snag and damage the bottom. Lobster tangle nets—used in nearshore areas around some of the main inhabited island groups—have a similar impact, breaking coral when they are retrieved. The State of Hawaii has taken action to control destructive gillnetting in state waters around the main Hawaiian Islands, and consistent measures are proposed for the EEZ by the CRE-FMP. The FMP will limit fishing gears and methods that will be allowed in the EEZ, and will exclude those which have the potential to significantly damage coral reef habitat. New underwater technologies (mixed gas scuba, rebreather, manned and unmanned submersibles) capable of greatly extending the depth at which reef habitats can be impacted were considered in determining allowable gear.

Destructive fisheries in Southeast Asia are known to target remote areas isolated from fishing communities and government patrols. Coral reefs in the Northwestern Hawaiian Islands (NWHI) generally lack the species most desired for the live reef fish trade and they are probably far enough from the major Asian markets so that live transport by boat would be uneconomical. The remote U.S. Pacific Island possessions (Palmyra Atoll, Howland, Baker, Johnston, and Wake Islands, and Kingman Reef; PRIAs hereafter) and the remote portions of the Commonwealth of the Northern Mariana Islands (CNMI) seem at the most risk from the live reef fish trade because some of the target species are present. The CNMI grounds are close enough to the Hong Kong live fish market so that the catch could be transported economically. Island government and National Wildlife Refuge regulations prohibit the use of poisons, explosives, and breaking of coral when fishing in nearshore areas, but there are no comparable regulations that would protect EEZ reef habitats. Furthermore, long-range surveillance and enforcement capabilities are inadequate to police remote coral reef areas. Hence, this threat is not adequately controlled under existing management systems. CRE-FMP management measures would control the use of destructive fishing methods in the EEZ around U.S. Pacific Islands.

Few marine ornamental products are collected from reef areas in the EEZ around U.S. Pacific Islands. The aquarium trade is trying to develop several education and conservation plans in order to improve fish survivability. These plans include captive breeding of fishes, propagation of corals, and education about advanced husbandry techniques; the goal is to significantly lower the number of species harvested from the wild. Nevertheless, the rapidly expanding reef ornamentals industry has the potential to expand into the EEZ in some areas of the U.S. Pacific Islands. The marine ornamentals trade involves numerous species of reef fish—especially angelfish, butterflyfish, and damselfish—and also a widening spectrum of invertebrates—including corals, anemones, crustaceans, molluscs, polychaetes, echinoderms, and sponges. The removal of “live rock” substratum unavoidably includes an incidental harvest of commensal and infaunal organisms, which are removed with the rock. Other coral reef resources that are highly endemic could be made locally extinct if heavily collected in their limited range of distribution. The FMP, therefore, would manage this activity from an ecosystem perspective.

Coral reef ecosystems in the EEZ around U.S. Pacific Islands are likely targets for the emerging industries for pharmaceutical and natural products. These emerging “fisheries” have the potential to harvest organisms about which little or nothing is known, whether of their particular life cycle, their place in the food web or their abundance and distribution. The most interesting chemicals are usually species-specific; these species may be rare or patchily distributed and the natural production of the active chemical may vary in time and space (Birkeland 1997a).

Pharmaceutical companies make their profit from synthesis of the active ingredients in their laboratories. Initial collections would involve small quantities of a broad spectrum of organisms for initial screening. Virtually any coral reef resource could become a target for bioprospecting, including species that are presently undescribed by science and for which there is no understanding of sustainable yield. Grants for millions of dollars have been given for medical bioprospecting of coral reef resources in the Pacific basin, although not yet in the U.S. Pacific Islands. Coral reef resources that have already attracted research interest include bryozoans, sponges, tunicates, coral, and seaweeds.

Bioprospectors are also searching for ingredients that could be used in products advertised as totally organic. Most of this interest is from cosmetic companies, who are seeking a regular supply of raw materials from wild harvest or aquaculture. Far greater quantities of target organisms would be collected in this “harvest model” than in the pharmaceutical-related “synthesis model” of bioprospecting.

The FMP anticipates that coral reef ecosystems in the EEZ around some of the U.S. Pacific Islands will attract bioprospecting activities. Because coral reef ecosystems comprise multi-species resources, which share a long co-evolutionary history, removal of some species can have undesirable secondary effects on others through predator-prey and other interactions.

In summary, the Coral Reef Ecosystems Fishery Management Plan is needed:

- To establish a management regime for the protection and sustainable use of coral reef ecosystems and their associated marine resources.
- To anticipate and avoid potential damage to essential and non-renewable coral reef habitat.
- To address the secondary effects of all reef-related fisheries on non-target coral reef resources, thereby encouraging ecosystem-scale management.
- To ensure that newly emerging coral reef fisheries are managed using precautionary principals and the best available information.
- To manage new underwater harvesting technologies that are extending the depth and time limits at which coral reef resources can be harvested.
- To encourage coherent and coordinated coral reef management, monitoring, and enforcement across jurisdictional boundaries.

- To facilitate consensual management that considers all types of stakeholders, and adaptive management that considers new data and unforeseen impacts.
- To allow sustained use of the coral reef resources, which are important for the continuity of indigenous cultures in the U.S. Pacific Islands.

Four alternatives, including a status quo or No-action alternative (1), were examined to address these issues. Alternative 3, the Preferred Alternative, employs four primary management measures: marine protected areas, permits and reporting requirements, fishing gear and methods, and other ecosystem-based management measures. Each of these measures in turn contain different components and options. The environmental effects of each of the alternatives, management measures, components, and options are analyzed in Chapter 5 of this EIS. In June 2000, the Council adopted a preferred alternative and management options. The alternatives and options considered are listed in Table 2.3.

CHAPTER 2

DESCRIPTION OF THE ALTERNATIVES

2.1 Introduction

Each of the alternatives analyzed in this EIS contains variations on four management (or control) measures. These four measures are: marine protected areas, permit and reporting requirements, allowable gear, and other miscellaneous requirements. Alternative 1 (No-action) would implement no new regulations. Alternative 2 (Minimal Additional Protection) would designate several low-use MPAs, and institute varying permit and gear requirements for the harvest of Coral Reef Ecosystem Management Unit Species (CRE MUS) throughout most of the Region's EEZ. It would also prohibit most live rock or live coral take in low-use MPAs. In addition to the measures contained in Alternative 2, Alternative 3 (Substantial Additional Protection - the Preferred Alternative) would designate several no-take MPAs, require all fishing vessels transiting MPAs to carry wreck cleanup and removal insurance, and prohibit the use of nighttime spearfishing for CRE MUS with scuba and/or hookah gear in the EEZs of the NWHI and the PRIAs. Finally, Alternative 4 (Maximum Additional Protection) would additionally establish no-take MPAs out to 100 fm around all of the region's islands and atolls and extend the Preferred Alternative's prohibition on spearfishing for CRE MUS with scuba and/or hookah gear to apply at all times and throughout most of the Region's EEZ. Brief definitions of important terms and a list of the CRE MUS follow. Then, the remainder of this chapter describes these four alternatives in detail. Several actions, which are not part of the Preferred Alternative, but may be implemented at a later date through a framework process, are also discussed. This chapter concludes by discussing the reasons for selecting Alternative 3 as the Preferred Alternative.

2.2 Definitions and Acronyms Applicable to the Coral Reef Ecosystem FMP

Coral reef ecosystem: those species, interactions, processes, habitats, and resources associated with all substrate from 0-50 fm deep.

Coral Reef Ecosystem Management Area (*CRE management area, or management area*): all Hawaii, PRIAs, American Samoa, CNMI and Guam EEZ waters (from surface to ocean floor) that are outside of state (see definition of state below) waters and within 200 miles from shore. Because the EEZ of the CNMI currently extends to the shoreline, it is separated into two zones: the inshore zone (0-3 miles from shore) and the offshore zone (3-200 miles from shore), with federal management of the coral reef ecosystem proposed for the offshore zone only. The inshore zone would continue to be managed by local authorities. The CNMI government should manage the inshore zone because: (1) cooperation between the local governments and the

Council relies on recognition of local management authority of nearshore waters; (2) the CNMI-based small vessel fishers are best managed by a local regime with hands-on interaction and knowledge of the issues; and, (3) this regime retains consistency with the other areas under Council jurisdiction.

No-Take MPA: an area in which no fishing or other harvest of marine species is allowed (except for scientific purposes under special permits).

Low-Use MPA: an area in which controlled harvests of coral reef MUS is allowed.

Coral reef ecosystem general permit (CRE general permit, or general permit): a permit that would be required under some alternatives if deemed necessary by the Council to harvest Currently Harvested Coral Reef Taxa from all non-MPA coral reef management areas. This permit would involve simple application procedures and reporting requirements.

Coral reef ecosystem special permit (CRE special permit, or special permit): a permit which would be required under some alternatives to (1) fish for any coral reef MUS (both Currently Harvested and Potentially Harvested Taxa) within low-use MPAs (with some exceptions), and (2) fish for any Potentially Harvested Coral Reef Taxa outside of MPAs. This permit would be approved and issued on a case-by-case basis and would have more complex application procedures and reporting requirements than the general permit.

State: Recognizing that the Council Region comprises several different political entities—a state, a commonwealth, two territories, and unincorporated federal territory—hereafter, as shorthand, these constituent parts (excluding federal territory) will be generically referred to as states.

Small vessel: a vessel less than 50 ft length overall. (These vessels are exempt from alternatives prohibiting anchoring on Guam's southern banks.)

Large vessel: a vessel equal to or greater than 50 ft length overall. (These vessels are prohibited from anchoring on Guam's southern banks.)

2.2.1 List of Acronyms

ARS:	Aquatic Resources Service
CPUE:	Catch per Unit Effort
CNMI:	Commonwealth of the Northern Mariana Islands
CRE:	Coral Reef Ecosystem
CRE-FMP:	Coral Reef Ecosystem Fishery Management Plan
CRE Reserve:	Coral Reef Ecosystem Reserve
CRE-PT:	Coral Reef Plan Team
CRTF:	Coral Reef Task Force
CHCRT:	Currently Harvested Coral Reef Taxa

CITES:	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CDP:	Community Development Plan
DAR:	Division of Aquatic Resources, DLNR, Hawaii
DEIS:	Draft Environmental Impact Statement
DLNR:	Department of Land and Natural Resources, Hawaii
DNA:	Deoxyribonucleic Acid
DOC:	Department of Commerce
DOD:	Department of Defense
DOI:	Department of the Interior
EEZ:	Exclusive Economic Zone
EFH:	Essential Fish Habitat
EIS:	Environmental Impact Statement
ENSO:	El Niño Southern Oscillation
EO:	Executive Order
EPA:	Environmental Protection Agency
EPAP:	Ecosystem Principals Advisory Panel
ESA:	Endangered Species Act
FAD:	Fish Aggregating Device
FDM:	Farallon de Medinilla, CNMI
FEIS:	Final Environmental Impact Statement
FEP:	Fishery Ecosystem Plan
FFS:	French Frigate Shoals, NWHI
FLPMA:	Federal Land Policy Management Act
fm:	fathoms
FMP:	Fisheries Management Plan
ft:	feet
HAPC:	Habitat Areas of Particular Concern
HINWR:	Hawaiian Islands National Wildlife Refuge
HIR:	Hawaiian Islands Reservation
HMSRT	Hawaiian Monk Seal Recovery Team
IRFA:	Initial Regulatory Flexibility Analysis
ITQs:	Individual Transferable Quota
IUCN:	Union for the Conservation of Nature
IWC:	International Whaling Commission
kg:	kilograms
lbs:	pounds
LORAN:	Long Range Navigation
m:	meters
mt:	metric tons
mm:	millimeters
MARPOL:	International Convention for the Prevention of Pollution from Ships
MHI:	Main Hawaiian Islands
MMC	Marine Mammal Commission

MMPA:	Marine Mammal Protection Act
MMRT	Marine Mammal Recovery Team
MPAs:	Marine Protected Areas
MSFCMA:	Magnuson-Stevens Fisheries Conservation and Management Act
MFMT:	Maximum Fishing Mortality Thresholds
MSY:	Maximum Sustainable Yield
MUS:	Management Unit Species
NDSA	Naval Defensive Sea Area
NEPA:	National Environmental Policy Act
NISA:	National Invasive Species Act
nm:	nautical miles
NMFS:	National Marine Fisheries Service
NMFS-HL:	National Marine Fisheries Service - Honolulu Laboratory
NMSA:	National Marine Sanctuaries Act
NPOA-s:	National Plan of Action for Seabirds
NOA:	Notice of Availability
NOAA:	National Oceanic and Atmospheric Administration
NOI:	Notice of Intent
NWHI:	Northwestern Hawaiian Islands
NWR:	National Wildlife Refuge
NWRSAA:	National Wildlife Refuge System Administration Act
OY:	Optimum Yield
PHCRT:	Potentially Harvested Coral Reef Taxa
PIAO:	Pacific Islands Area Office
PRIAs:	Pacific Remote Island Areas
RA:	Regional Administrator, NMFS
RFA:	Regulatory Flexibility Act
RIR:	Regulatory Impact Review
ROD:	Record of Decision
RPAs:	Reserve Preservation Areas
SLA:	Submerged Lands Act
SPR:	Spawning Potential Ratio
SSC:	Scientific and Statistical Committee
TSLA:	Territorial Submerged Lands Act
USFWS:	United States Fish and Wildlife Service
USCG:	United States Coast Guard
VMS:	Vessel Monitoring System
WPacFin:	Western Pacific Fisheries Information Network
WPRFMC:	Western Pacific Regional Fishery Management Council

2.2.2 Management Unit Species

Coral Reef Ecosystem Management Unit Species (*CRE MUS* or *MUS*): an extensive list of coral reef organisms, many only identified by membership in higher-level taxa such as family or

sub-family. It includes some management unit species from the Council's implemented Bottomfish and Seamount Groundfish, Crustaceans, and Precious Corals FMPs, but these species would be mainly managed under their respective FMPs. However, ecosystem effects would be addressed via the CRE-FMP. Coral reef MUS are separated into two categories:

Currently Harvested Coral Reef Taxa (CHCRT). Because these organisms are commercially harvested, fishery information for them is available, allowing more effective management. The species in this group have been reported on commercial fishery catch reports but are not MUS under any of the Council's already-implemented FMPs. Membership in this group is based on two criteria: (1) More than 1,000 lbs. annual harvest for all members of a taxon, based on commercial fishery catch reports (these taxa are families or subfamilies); and (2) within these taxa particular genera or species are identified, based on their appearance on catch reports. CHCRT are listed in Table 2.1, grouped by family or subfamily. Table 2.1 also lists aquarium taxa that are known to be harvested in the EEZ (discussed below).

Potentially Harvested Coral Reef Taxa (PHCRT). These are coral reef organisms that are not known to be currently caught, or for which very little fishery information is available. However, emerging coral reef fisheries—such as the rapidly expanding marine ornamental products trade and the emerging industries for pharmaceutical and natural products—may target them at some future date. Several family/subfamily taxa in the CHCRT list are also PHCRT. As noted in Table 2.2, which lists PHCRT, all genera or species in these taxa that are not listed as CHCRT are by default PHCRT.

Because fishing for coral reef resources is light to non-existent in the EEZ, the CHCRT list was developed as a functional means to facilitate data collection and monitoring of coral reef ecosystem species that are currently being harvested, both directly and incidentally in commercial fisheries in state/territorial and federal waters. It will also help fishery managers to develop harvest strategies and proxies so that they can begin managing the coral reef ecosystem as a whole. The CHCRT also includes a subgroup of species that aquarium fish collectors presently harvest. With the exception of the nearshore waters of West Hawaii (Big Island), the commercial collection of Aquarium Taxa is minimal throughout the management area. However, the taxa listed in this category represent individual species that have been harvested in the EEZ and will likely continue to be harvested in the EEZ. For this reason they are listed separately at the end of Table 2.1. Their inclusion in the CHCRT list will allow continuing data collection by existing local management programs. As a result, the impacts on resources and habitats by aquarium fish collectors in the EEZ can be better assessed.

The PHCRT list consists of literally thousands of taxa for which little to no catch or effort data exist. For a great majority of these species scientific knowledge about their life histories, habitat requirements, and other biological information is completely lacking. Therefore, to begin data collection for management purposes, special permits will be required to target the PHCRT listed in Table 2.2, and for any species that are not explicitly listed on the CHCRT list.

In 1999, the bottomfish plan team noted that a large number of species were currently being harvested in Guam, American Samoa and the CNMI using bottomfish gear and techniques. There regularity in catch has been documented since the onset of the WPacFIN creel surveys. They recommended the Council include these species under the bottomfish FMP to allow for future management measures as needed. The Council approved this revision to the BMUS list at the June 2000 Council meeting. The list of species is found in Table 2.2.a and will be part of the Bottomfish MUS upon approval of an amendment to be submitted to the NMFS at the same time as this document.

Table 2.1: Currently Harvested Coral Reef Taxa.

Acanthuridae (Surgeonfishes)	<p>Orange-spot surgeonfish (<i>Acanthurus olivaceus</i>) Yellowfin surgeonfish (<i>Acanthurus xanthopterus</i>) Convict tang (<i>Acanthurus triostegus</i>) Eye-striped surgeonfish (<i>Acanthurus dussumieri</i>) Blue-lined surgeon (<i>Acanthurus nigroris</i>) Whitebar surgeonfish (<i>Acanthurus leucopareius</i>) Blue-banded surgeonfish (<i>Acanthurus lineatus</i>) Blackstreak surgeonfish (<i>Acanthurus nigricauda</i>) Whitecheek surgeonfish (<i>Acanthurus nigricans</i>) White-spotted surgeonfish (<i>Acanthurus guttatus</i>) Ringtail surgeonfish (<i>Acanthurus blochii</i>) Brown surgeonfish (<i>Acanthurus nigrofuscus</i>) Elongate surgeonfish (<i>Acanthurus mata</i>) Mimic surgeonfish (<i>Acanthurus pyroferus</i>) Yellow-eyed surgeonfish (<i>Ctenochaetus strigosus</i>) Striped bristletooth (<i>Ctenochaetus striatus</i>) Twospot bristletooth (<i>Ctenochaetus binotatus</i>)</p> <p>Bluespine unicornfish (<i>Naso unicornus</i>) Orangespine unicornfish (<i>Naso lituratus</i>) Humpnose unicornfish (<i>Naso tuberosus</i>) Blacktounge unicornfish (<i>Naso hexacanthus</i>) Bignose unicornfish (<i>Naso vlamingii</i>) Whitemargin unicornfish (<i>Naso annulatus</i>) Spotted unicornfish (<i>Naso brevirostris</i>) Humpback unicornfish (<i>Naso brachycentron</i>) Barred unincornfish (<i>Naso thynnoides</i>) Gray unicornfish (<i>Naso caesius</i>)</p>
Balistidae (Triggerfishes)	<p>Titan triggerfish (<i>Balistoides viridescens</i>) Clown triggerfish (<i>B. conspicillum</i>) Orangestriped trigger (<i>Balistapus undulatus</i>) Pinktail triggerfish (<i>Melichthys vidua</i>) Black triggerfish (<i>M. niger</i>) Blue triggerfish (<i>Pseudobalistesfucus</i>) Picassofish (<i>Rhinecanthus aculeatus</i>) Wedge Picassofish (<i>B. rectangulus</i>) Bridled triggerfish (<i>Sufflamen fraenatus</i>)</p>
Carangidae (Jacks)	<p>Bigeye scad (<i>Selar crumenophthalmus</i>) Mackerel scad (<i>Decapterus macarellus</i>)</p>

Carcharhinidae (Sharks)	Grey reef shark (<i>Carcharhinus amblyrhynchos</i>) Silvertip shark (<i>Carcharhinus albimarginatus</i>) Galapagos shark (<i>Carcharhinus galapagensis</i>) Blacktip reef shark (<i>Carcharhinus melanopterus</i>) Whitetip reef shark (<i>Triaenodon obesus</i>)
Holocentridae (Soldierfish/Squirrelfish)	Bigscale soldierfish (<i>Myripristis berndti</i>) Bronze soldierfish (<i>Myripristis adusta</i>) Blotcheye soldierfish (<i>Myripristis murdjan</i>) Bricksoldierfish (<i>Myripristis amaena</i>) Scarlet soldierfish (<i>Myripristis pralinia</i>) Violet soldierfish (<i>Myripristis violacea</i>) Whitetip soldierfish (<i>Myripristis vittata</i>) Yellowfin soldierfish (<i>Myripristis chryseres</i>) Pearly soldierfish (<i>Myripristis kuntee</i>) (<i>Myripristis hexagona</i>) Tailspot squirrelfish (<i>Sargocentron caudimaculatum</i>) Blackspot squirrelfish (<i>Sargocentron melanospilos</i>) File-lined squirrelfish (<i>Sargocentron microstoma</i>) Pink squirrelfish (<i>Sargocentron tieroides</i>) Crown squirrelfish (<i>Sargocentron diadema</i>) Peppered squirrelfish (<i>Sargocentron punctatissimum</i>) Blue-lined squirrelfish (<i>Sargocentron tiere</i>) Ala'ihī (<i>Sargocentron xantherythrum</i>) (<i>Sargocentron furcatum</i>) (<i>Sargocentron spiniferum</i>) Spotfin squirrelfish (<i>Neoniphon spp.</i>)
Kuhliidae (Flag-tails)	Hawaiian flag-tail (<i>Kuhlia sandvicensis</i>) Barred flag-tail (<i>Kuhlia mugil</i>)
Kyphosidae (Rudderfish)	Rudderfish (<i>Kyphosus biggibus</i>) (<i>Kyphosus cinerascens</i>) (<i>Kyphosus vaigienses</i>)
Labridae (Wrasses)	Saddleback hogfish (<i>Bodianus bilunulatus</i>) Napoleon wrasse (<i>Cheilinus undulatus</i>) Triple-tail wrasse (<i>Cheilinus trilobatus</i>) Floral wrasse (<i>Cheilinus chlorourus</i>) Harlequin tuskfish (<i>Cheilinus fasciatus</i>) Ring-tailed wrasse (<i>Oxycheilinus unifasciatus</i>) Bandcheek wrasse (<i>Oxycheilinus diagrammus</i>) Arenatus wrasse (<i>Oxycheilinus arenatus</i>) Razor wrasse (<i>Xyrichtys pavo</i>) Whitepatch wrasse (<i>Xyrichtes aneitensis</i>) Cigar wrasse (<i>Cheilio inermis</i>) Blackeye thicklip (<i>Hemigymnus melapterus</i>) Barred thicklip (<i>Hemigymnus fasciatus</i>) Threespot wrasse (<i>Halichoeres trimaculatus</i>) Checkerboard wrasse (<i>Halichoeres hortulanus</i>) Weedy surge wrasse (<i>Halichoeres margaritaceus</i>) (<i>Halichoeres zeylonicus</i>) Surge wrasse (<i>Thalassoma purpureum</i>) Redribbon wrasse (<i>Thalassoma quinquevittatum</i>) Sunset wrasse (<i>Thalassoma lutescens</i>) Longface wrasse (<i>Hologymnosus doliatus</i>) Rockmover wrasse (<i>Novaculichthys taeniourus</i>)

Mullidae (Goatfishes)	Yellow goatfish (<i>Mulloidichthys</i> spp.) (<i>Mulloidichthys Pfluegeri</i>) (<i>Mulloidichthys vanicolensis</i>) (<i>Mulloidichthys flaviolineatus</i>) Banded goatfish (<i>Parupeneus</i> spp.) (<i>Parupeneus barberinus</i>) (<i>Parupeneus bifasciatus</i>) (<i>Parupeneus heptacanthus</i>) (<i>Parupeneus ciliatus</i>) (<i>Parupeneus ciliatus</i>) (<i>Parupeneus cyclostomas</i>) (<i>Parupeneus pleurostigma</i>) (<i>Parupeneus indicus</i>) (<i>Parupeneus multifasciatus</i>) Bantail goatfish (<i>Upeneus arge</i>)
Mugilidae (Mulletts)	Stripped mullet (<i>Mulgil cephalus</i>) Engel's mullet (<i>Moolgarda engeli</i>) False mullet (<i>Neomyxus leuciscus</i>) Fringelip mullet (<i>Crenimugil crenilabis</i>)
Muraenidae (Moray eels)	Yellowmargin moray (<i>Gymnothorax flavimarginatus</i>) Giant moray (<i>Gymnothorax javanicus</i>) Undulated moray (<i>Gymnothorax undulatus</i>)
Ocotpodidae	Octopus (<i>Octopus cyanea</i> ; <i>O. ornatus</i>)
Polynemidae	Threadfin (<i>Polydactylus sexfilis</i>) -Moi
Prichanthidae (Bigeye)	Glasseye (<i>Heteropriacanthus cruentatus</i>) Bigeye (<i>Priacanthus hamrur</i>)
Scaridae (Parrotfishes)	Humphead parrotfish (<i>Bulbometapon muracatum</i>) Parrotfishes (<i>Scarus</i> spp.) Pacific longnose parrotfish (<i>Hipposcarus longiceps</i>) Stareye parrotfish (<i>Catolomus carolinus</i>)
Scombridae	Dogtooth tuna (<i>Gymnosarda unicolor</i>)*
Siganidae (Rabbitfish)	Forktail rabbitfish (<i>Siganus aregentus</i>) Golden rabbitfish (<i>Siganus guttatus</i>) Gold-spot rabbitfish (<i>Siganus punctatissimus</i>) Randall's rabbitfish (<i>Siganus randalli</i>) Scribbled rabbitfish (<i>Siganus spinus</i>) Vermiculate rabbitfish (<i>Signa us vermiculatus</i>)
Sphyraenidae (Barracuda)	Heller's barracuda (<i>Sphyraena helleri</i>) Great Barracuda (<i>Sphyraena barracuda</i>)
Turbinidae (Turban shells/green snails)	Green snails (<i>Turbo</i> spp.)

*Moved from Pelagic MUS list as part of this FMP.

Aquarium Taxa/Species	Acanthuridae Yellow tang (<i>Zebrasoma flavescens</i>) Yellow-eyed surgeon fish (<i>Ctenochaetus strigosus</i>) Achilles tang (<i>Acanthurus achilles</i>) Muraenidae Dragon eel (<i>Enchelycore pardalis</i>) Zanclidae Morrish idol (<i>Zanclus cornutus</i>) Pomacanthidae Angelfish (<i>Centropyge shepardi</i> and <i>C. flavissimus</i>) Cirrhitidae Flame hawkfish (<i>Neocirrhitis armatus</i>) Chatodontidae Butterflyfish (<i>Chaetodon auriga</i> , <i>C. lunula</i> , <i>C. melannotus</i> and <i>C. ephippium</i>) Pomacentridae Damselfish (<i>Chromis viridis</i> , <i>Dascyllus aruanus</i> and <i>D. trimaculatus</i>) Sabellidae Featherduster worm (<i>Sabellidae</i>)
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Table 2.2: Potentially Harvested Coral Reef Taxa (PHCRT). Several taxa in the CHCRT list appear below. As noted in the table, all species in these taxa that are not listed as CHCRT are by default PHCRT.

Other Labridae spp. (wrasses) (Those species not listed on CHCRT list)	Ephippidae (batfish)
Other Carcharhinidae, Sphyrnidae (Those species not listed on CHCRT list)	Monodactylidae (mono)
Dasyatidae, Myliobatidae, Mobulidae (rays)	Haemulidae (sweetlips)
Other Serranidae spp. (groupers) (Those species not managed under the Bottomfish FMP or included in the bottomfish amendment)	Echineidae (remoras)
Carangidae (jacks/trevallies) (Those species not listed on CHCRT list or managed under Bottomfish FMP or included in the bottomfish amendment)	Malacanthidae (tilefish)
	Acanthoclinidae (spiny basslets)
Other Holocentridae spp. (soldierfish/squirrelfish) (Those species not listed on CHCRT list)	Pseudochromidae (dottybacks)
Other Mullidae spp. (goatfish) (Those species not listed on CHCRT list)	Plesiopidae (prettyfins)
Other Acanthuridae spp. (surgeonfish/unicornfish) (Those species not listed on CHCRT list)	Tetrarogidae (waspfish)
Other Lethrinidae spp. (emperors) (Those species not managed under the Bottomfish FMP or included in the bottomfish amendment)	Caracanthidae (coral crouchers)

Chlopsidae, Congridae, Moringuidae, Ophichthidae (eels) Other Muraenidae (moray eels) (Those species not listed on CHCRT list)	Grammistidae (soapfish)
Apogonidae (cardinalfish)	<i>Aulostomus chinensis</i> (trumpetfish)
Other Zaclidae spp. (moorish idols)	<i>Fistularia commersoni</i> (coronetfish)
Other Chaetodontidae spp. (butterflyfish)	Anomalopidae (flashlightfish)
Other Pomacanthidae spp. (angelfish)	Clupeidae (herrings)
Other Pomacentridae spp. (damselfish)	Engraulidae (anchovies)
Scorpaenidae (scorpionfish)	Gobiidae (gobies)
Blenniidae (blennies)	Lutjanidae (Those species not managed under Bottomfish FMP or included in the bottomfish amendment)
Other Sphyrnidae spp. (barracudas)	Other Ballistidae/Monacanthidae spp. (Those species not listed on CHCRT list)
Pinguipedidae (sandperches)	Other Siganidae spp. (Those species not listed on CHCRT list)
<i>Gymnosarda unicolor</i>	Other Kyphosidae spp.
Bothidae/Soleidae/Pleuronectidae (flounder/sole)	Caesionidae
Ostraciidae (trunkfish)	Cirrhitidae
Tetradontidae/Diodontidae (puffer/porcupinefish)	Antennariidae (frogfishes)
Stony corals	Syngnathidae (pipefishes/seahorses)
Heliopora (blue)	Echinoderms (e.g., sea cucumbers, sea urchins)
Tubipora (organpipe)	Mollusca
Azooxanthellates (non-reefbuilders)	Sea snails (gastropods)
Fungiidae (mushroom corals)	Trochus spp.
Sm/Lg Polyped Corals (endemic spp.)	Opisthobranchs (sea slugs)
Tunicates (solitary/colonial)	<i>Pinctada margaritifera</i> (black lipped pearl oyster)
Millepora (firecorals)	Tridacnidae
Soft corals and Gorgonians	Other Bivalves
Anemones (non-epifaunal)	Cephalopods
Zooanthids	Crustaceans (Lobsters, shrimps/mantis, true crabs and hermit crabs) (Those species not managed under the Crustacean FMP)
Sponges (non-epifaunal)	Stylasteridae (lace corals)
Hydrozoans	Solanderidae (hydroid fans)

Bryozoans	Annelids
Live rock	Algae
All other coral reef ecosystem marine plants, invertebrates and fishes not listed under existing FMPs	

Table 1.4 Proposed Bottomfish Species for Bottomfish Management Unit Species List

Carangidae <i>Carangoides orthogrammus</i> <i>Carangoides caeruleopinnatus</i> <i>Caranx melampygus</i> <i>Caranx papuensis</i> <i>Caranx sexfasciatus</i> <i>Caranx lugubris</i> <i>Seriola rivoliana</i>	yellow-spotted trevally coastal trevally bluefin trevally brassy trevally bigeye trevally black jack almaco jack/amberjack
Lethrinidae <i>Gnathodentex aurolineatus</i> <i>Gymnocranius microdon</i> <i>Gymnocranius rivulatus</i> <i>Lethrinus atkinsoni</i> <i>Lethrinus erythacanthus</i> <i>Lethrinus harak</i> <i>Lethrinus kalliopterus</i> <i>Lethrinus obsoletus</i> <i>Lethrinus olivaceus</i> <i>Lethrinus xanthochilus</i> <i>Monotaxis grandoculus</i>	yellowspot emperor, striped large eye bream blue-spotted large-eye bream blue-line, large-eye bream Pacific yellowtail emperor orange-spotted emperor thumbprint emperor, blackspot emperor orange-spotted emperor orange-striped emperor longnose emperor yellowlip emperor humphose bigeye bream, bigeye emperor
Lutjanidae <i>Aphareus furca</i> <i>Lutjanus bohar</i> <i>Lutjanus fulvus</i> <i>Lutjanus gibbus</i> <i>Lutjanus monostigmus</i> <i>Lutjanus rufolineatus</i> <i>Lutjanus sanguineus</i> <i>Paracaesio kusakarii</i> <i>Paracaesio stonei</i> <i>Paracaesio xanthurus</i> <i>Pristipomoides argyrogrammicus</i> <i>Pristipomoides multidens</i>	blue smalltooth jobfish twinspot snapper, red snapper flametail snapper humpback snapper onespot snapper rufous snapper blood snapper kusakar snapper stone's snapper deepwater bream blue gindai multidens snapper

Serranidae <i>Cephalopholis argus</i> <i>Cephalopholis igarashiensis</i> <i>Cephalopholis sonnerati</i> <i>Cephalopholis urodeta</i> <i>Epinephelus hexagonatus</i> <i>Epinephelus howlandi</i> <i>Epinephelus lanceolatus</i> <i>Epinephelus macrospilos</i> <i>Epinephelus maculatus</i> <i>Epinephelus merra</i> <i>Epinephelus microdon</i> <i>Epinephelus morrhua</i> <i>Epinephelus octofasciatus</i> <i>Epinephelus polyphekadion</i> <i>Epinephelus timorensis</i> <i>Plectropomus laevis</i> <i>Saloptia powelli</i> <i>Variola albimarginata</i>	peacock grouper yellow-banded grouper tomato grouper flagtail grouper hexagon grouper blacksaddle grouper giant grouper snubnose grouper highfin grouper honeycomb grouper smalltooth grouper striped grouper eightbar grouper camouflaged grouper yellowspotted grouper giant coral grouper pink grouper white-margined lyretail grouper
Scorpaenidae <i>Pontinus macrocephala</i>	hogo

2.3 Description of Alternatives by Management Measure

Each of the alternatives analyzed in this EIS would implement four management measures to varying degrees. Tables 2.3a-d summarize how each of the four measures would be implemented in each of the four alternatives. A more in-depth discussion follows, organized by management measure: (1) marine protected areas; (2) permits and reporting requirements; (3) allowable gear; and, (4) other miscellaneous measures. For each measure the way in which they would be implemented under the four alternatives is described.

2.3.1 Management Measure 1: Marine Protected Areas

Marine protected areas (MPAs) are an attractive option for ecosystem-based fisheries management because they do not require detailed knowledge of the management unit species, but nevertheless holistically conserve multi-species resources and the functional attributes of marine ecosystems. They can also provide “insurance” against periods of poor recruitment of individual stocks.

MPAs can vary in scope and extent. They can be areas designated for seasonal or limited use (low-use), or areas that are completely restricted from consumptive use (no-take). Although completely restricted areas are thought to provide the highest degree of protection to marine ecosystems, less restrictive areas can achieve a balance between protection and consequent economic and social impacts.

The optimum size of an MPA depends on many factors, including the resources managed, management goals, enforcement capabilities, and social and economic constraints. However,

researchers do not yet fully understand the relationship between the area covered by an MPA and resulting benefits in the form of ecologically complete coral reef ecosystem protection. To be useful to fisheries and to promote the conservation of coral reef resources on a broader scale, MPAs should serve as sources of reproductive output to replenish larger surrounding or down-current areas. Small and/or isolated MPAs may be inadequate for this purpose.

Few, if any, studies have sought to verify whether MPAs established in the U.S. Pacific Islands do actually benefit nearby fisheries. Clearly, fish populations that build up in small areas temporarily closed to fishing are quickly reduced when fishing is resumed, as evidenced by studies in Hawaii and the Philippines. Existing MPAs in the U.S. Pacific Islands have been criticized for being either too small and fragmented, or for not encompassing sufficient depth range and high quality habitat to provide broad coral reef ecosystem protection or recruitment benefits to fisheries. As a result, it has been suggested that populations in MPAs should be linked over a broad area in order to assure long-term sustainability of coral reef fisheries. Some argue for complete protection from fishing, whereas others believe MPAs are more valuable when they can serve as natural laboratories for fishing experiments and testing of adaptive management strategies.

Table 2.3a: Management measure 1- marine protected areas.

Alternative	No-take MPAs (no harvest of coral reef ecosystem management unit species permitted)	Low-use MPAs (controlled harvest of coral reef ecosystem management unit species permitted)
Alternative 1 No Action	Under existing FMPs there is: no longline fishing within 50 miles of all NWHI; no lobster fishing within 0-10 fathoms around all NWHI and within 20 nm of Laysan Island; and no bottomfishing around Hancock seamount.	None.
Alternative 2 Minimal Additional Protection	No new no-take MPAs.	0-50 fathoms around all NWHI and PRIA.
Preferred Alternative 3 Substantial Additional Protection	0-10 fathoms around all NWHI plus, 0-50 fathoms around FFS, Laysan, northern half of Midway Atoll, Rose Atoll, Jarvis, Howland, and Baker Islands, and Kingman Reef. This will total 12% of the region's EEZ coral reefs.	10-50 fathoms around all other NWHI, 0-50 fathoms around Palmyra, Johnston, and Wake. 0-50 fathoms around the southern half of Midway Atoll.
Alternative 4 Maximum Additional Protection	0-100 fathoms around all islands and atolls throughout the region's EEZs. This will total 100% of the region's EEZ coral reefs.	None.

Table 2.3b: Management measure 2- permit requirements.

Alternative	CRE general permit (simple application and reporting requirements)	CRE special permit (more complex application and reporting requirements, approved and issued on a case-by-case basis)
Alternative 1 No Action	None.	None.
Alternative 2 Minimal Additional Protection	None.	Required for all take of any CRE MUS within low-use MPAs, and for all take of PHCRT within the EEZ except by: (1) other FMP permit holders; (2) any take within 3 miles of CNMI.
Preferred Alternative 3 Substantial Additional Protection	None at this time but may be implemented at a later date via a framework process, in which case it would likely be required for all remaining take of CHCRT within the EEZ (outside of the no-take MPAs) except by: (1) other FMP permit holders; (2) any take with 3 miles of CNMI.	Required for all take of any CRE MUS within low-use MPAs, and for all take of PHCRT within the EEZ except by: (1) other FMP permit holders; (2) any take within 3 miles of CNMI.
Alternative 4 Maximum Additional Protection	Required for all remaining take of CHCRT within the EEZ (outside of the no-take MPAs) except by other FMP permit holders.	Required for all EEZ scientific research and management activities which could affect any CRE MUS. Required for all take of any PHCRT within the EEZ except by: (1) other FMP permit holders; (2) any take within 3 miles of CNMI.

Table 2.3c: Management measure 3- allowable gear types and methods.

Alternative	Listing of gears allowed for harvest of coral reef ecosystem management unit species
Alternative 1 No Action	All of the region's FMPs are regulated by a common list of allowable gears, which consist of: allowable chemical gear (e.g., awa/kava root), barrier net, dip net, gillnet, hand harvest, seine, slurp gun, trap, spear, rod and reel, and hook-and-line. Drift gillnets are specifically prohibited for use under the Pelagics FMP, and certain restrictions exist for traps used under the Crustaceans FMP. In addition, the Bottomfish and Seamount Groundfish FMP prohibits the use of bottom trawls, bottom set gillnets, poisons, explosives, and intoxicating substances for the harvest of bottomfish species. This alternative would not impose any new gear restrictions.
Alternative 2 Minimal Additional Protection	Allow the use of only the following gears throughout the regions EEZs for the harvest of any CRE MUS: hand harvest, spear, slurp gun, hand/dip net, hoop net for kona crab, throw net, barrier net for aquarium fish, surround/purse set for targeted schools (e.g. akule, baitfish, weke) with a minimum of bycatch, hook-and-line (powered and unpowered handlines, rod and reel, and trolling), traps (with conditions), and remote operating vehicles/submersibles.
Preferred Alternative 3 Substantial Additional Protection	Allow the use of only the following gears throughout the regions EEZs for the harvest of any CRE MUS: hand harvest, spear, slurp gun, hand/dip net, hoop net for kona crab, throw net, barrier net for aquarium fish, surround/purse set for targeted schools (e.g. akule, baitfish, weke) with a minimum of bycatch, hook-and-line (including powered and unpowered handlines, rod and reel, and trolling), traps (with conditions), and remote operating vehicles/submersibles. Prohibit nighttime spearfishing for CRE MUS with scuba/hookah in the EEZ of the NWHI and PRIAs.
Alternative 4 Maximum Additional Protection	Allow the use of only the following gears throughout the regions EEZs for the harvest of any CRE MUS: hand harvest, spear, slurp gun, hand/dip net, hoop net for kona crab, throw net, barrier net for aquarium fish, surround/purse set for targeted schools (e.g., akule, baitfish, weke) with a minimum of bycatch, hook-and-line (powered and unpowered handlines, rod and reel, and trolling), traps (with conditions), and remote operating vehicles/submersibles. Prohibit all spearfishing for CRE MUS with scuba/hookah throughout the region's EEZs.

Table 2.3.d: Management measure 4- miscellaneous measures.

Alternative	Measures affecting the take of live rock and coral, and vessel anchoring and insurance requirements
Alternative 1 No Action	None.
Alternative 2 Minimal Additional Protection	No take of live rock or live coral in low-use MPAs except for: (1) incidental take by other FMP permit holders; (2) take by indigenous people for traditional/ceremonial use; (3) use by aquaculture operations as seed stock; (4) science and management; (5) bioprospecting. All of these (except #1) would require a CRE special permit. No anchoring zone on Guam's offshore southern banks by fishing vessels > 50 feet.
Preferred Alternative 3 Substantial Additional Protection	No take of live rock or live coral throughout the region's EEZs except for: (1) incidental take by other FMP permit holders; (2) take by indigenous people for traditional/ceremonial use; (3) use by aquaculture operations as seed stock; (4) science & management; (5) bioprospecting. All of these (except #1) would require a CRE special permit. Require insurance for all fishing vessels (including existing FMP fisheries) transiting all MPAs. No anchoring zone on Guam's offshore southern banks by fishing vessels > 50 feet.
Alternative 4 Maximum Additional Protection	No take of live rock or live coral throughout the region's EEZs. Require insurance for all fishing vessels transiting all MPAs.

Alternative 1, No Action: No new MPAs of any type would be implemented.

Alternative 2, Minimal Additional Protection to Coral Reef Resources: Low-use MPAs would be established for EEZ waters from 0-50 fm around each of the NWHI and each of the PRIAs. Midway Island, which is located in the NWHI, would be exempted from these MPAs.

Alternative 3, Substantial Additional Protection to Coral Reef Resources (Preferred Alternative): No-take MPAs would be established for EEZ waters from 0-10 fm around all NWHI as well as EEZ waters from 0-50 fm around French Frigate Shoals, Laysan Island, and the northern half of Midway Atoll. No-take MPAs would also be established for EEZ waters from 0-50 fm around American Samoa's Rose Atoll, and Jarvis, Howland, Baker and Kingman, in the PRIAs. In addition, low-use MPAs would be established in EEZ waters from 10-50 fm around the remaining NWHI (including 0-50 fm around the southern half of Midway Atoll), as well as EEZ waters from 0-50 fm around Palmyra, Johnston, and Wake Islands. Sustainable use of coral reef resources for customary and traditional purposes would be permitted in the low-use MPAs of the NWHI.

Alternative 4, Maximum Additional Protection to Coral Reef Resources: No-take MPAs would be established for EEZ waters from 0-100 fm around all of the Region's islands and atolls. Due to the broad extent of these areas, there would be no low-use MPAs under this alternative.

Figures 2.1-2.13, found at the end of this chapter, detail the location and extent of these MPAs.

2.3.2 Management Measure 2: Permits and Reporting Requirements

Permits are a fundamental management tool, used as a basis for participation in many U.S. domestic fisheries. Permits establish the legal rights, privileges, and obligations of fishermen. Reporting requirements allow collection of data for fishery monitoring and management. In addition, permit holders' compliance with permit requirements can be evaluated and a register maintained that lists those in good standing. Performance standards can then be established as criteria for renewing permits.

A permit process that allows for monitoring of participation, effort, and catch contributes to seven of the eight FMP objectives outlined in Section 1.4 of the FMP. Permitting, particularly addresses Objective 4, which calls for minimization of adverse human impacts. Permits focus management attention on the specific reef resources and areas to be exploited and the harvest methods to be used. Periodic analysis of catch and effort data collected through mandatory reporting facilitates adaptive management. CRE special permits included in some of the alternatives would be issued on a case-by-case basis. This would encourage applicants to more carefully consider their proposed activities and the potential impacts of those activities. More specifically, special permit conditions allow managers to carefully monitor emerging coral reef fisheries throughout the region's EEZs. The CRE-FMP provides more details of the application and approval process for both the CRE special and general permits.

Alternative 1, No Action: No permit or reporting requirements would be implemented.

Alternative 2, Minimal Additional Protection to Coral Reef Resources: CRE special permits would be required for the harvest of both CHCRT and PHCRT within low-use MPAs, with an exception for vessel operators holding permits and targeting species managed under the Council's already implemented Bottomfish and Seamount Groundfish, Crustaceans, Pelagics, or Precious Corals FMPs.

Alternative 3, Substantial Additional Protection to Coral Reef Resources (Preferred Alternative): CRE special permits would be required for the harvest of both CHCRT and PHCRT within low-use MPAs, with an exception for vessel operators holding permits and targeting species managed under the Council's already implemented Bottomfish and Seamount Groundfish, Crustaceans, Pelagics or Precious Corals FMPs. In addition, CRE special permits would be required for all take of PHCRT throughout the Region's EEZ, with an exception for the inshore area of CNMI's EEZ. This alternative would also establish a framework process to allow future implementation of a CRE general permit requirement for the EEZ harvest of both CHCRT and PHCRT outside of low-use MPAs with the same just mentioned exceptions. Permitting and reporting for harvest of CHCRT outside of low-use MPAs will be conducted through existing local permit and reporting systems.

Alternative 4, Maximum Additional Protection to Coral Reef Resources: CRE special permits would be required to harvest PHCRT outside of the no-take MPAs throughout the Region's EEZ. As with the other alternatives, other FMP permit holders and harvests within CNMI's inshore

area would be excepted. This alternative would also implement a CRE general permit requirement for the EEZ harvest of CHCRT outside of the no-take MPAs, with the same exceptions mentioned above. Finally, this alternative would require a CRE special permit for any EEZ research or management activities that could affect any CRE MUS.

2.3.3 Management Measure 3: Allowable Gear Types and Methods

Pacific Islanders have fished on coral reefs for several thousand years. Sustainability resulted in part from the selectivity of the gear that they used and their management practices. Many of these traditional methods are still used in contemporary fisheries, although the introduction of manufactured gear and population growth have increased the impacts. Today's fishers employ a wide variety of gear and methods to harvest extremely diverse resources numbering hundreds of species. Most of these methods are very inefficient when compared to industrial fishing technology, such as bottom trawls, all-terrain trawls, bottom dredges, or industrial netting—used in U.S. continental shelf fisheries but prohibited in many benthic fisheries around the Pacific. However, several potential threats to coral reef resources in the EEZ around U.S. Pacific Islands remain, due to the use of destructive fishing methods.

Controls are needed to prevent the possession or use of destructive gear to harvest coral reef resources. These include poisons, explosives, intoxicating substances, and unattended gillnets that damage coral reef ecosystems. Bioprospectors may also seek to harvest coral reef resources. Despite their potential benefits to society, these harvests must be carried out in a controlled manner. The collection of these organisms, many of which are still unknown, may utilize novel techniques that are difficult to anticipate. Unregulated live reef fish harvesters for food and ornamental markets, already a problem in Southeast Asia, could find their way to U.S. EEZ waters, especially in remote, difficult to monitor areas.

Gear restrictions are also needed in order to address several other issues. Non-selective gears and methods often result in substantial incidental catch (non-targeted catches) or bycatch (discards). In addition, some highly selective methods, such as scuba-assisted spearfishing, prevent fish from seeking refuge.

Placing limits on allowable gear types addresses FMP Objective 1: sustainable use of resources, and Objective 4: minimizing adverse human impacts.

Alternative 1, No Action: No new gear requirements would be implemented.

Alternative 2, Minimal Additional Protection to Coral Reef Resources: Only the following gears would be allowed throughout the region's EEZs for the harvest of any CRE MUS: (1) hand harvest; (2) spear; (3) slurp gun; (4) hand/dip net; (5) hoop net for Kona crab; (6) throw net; (7) barrier net for aquarium fish; (8) surround/purse set for targeted schools (e.g., akule, baitfish, weke) with a minimum of bycatch; (9) hook-and-line (including powered and unpowered handlines, rod and reel, and trolling); (10) traps (with conditions); and, (11) remote operating vehicles/submersibles. Other FMP permit holders would be required to comply with the gear restrictions of that FMP.

Alternative 3, Substantial Additional Protection to Coral Reef Resources (Preferred Alternative): This alternative would include the same list of allowable gears as Alternative 2, but would also specifically prohibit nighttime spearfishing for CRE MUS with scuba or hookah gear in all EEZ waters surrounding the NWHI and the PRIAs. Other FMP permit holders would be required to comply with the gear restrictions of that FMP.

Alternative 4, Maximum Additional Protection to Coral Reef Resources: This alternative would include the same list of allowable gears as Alternative 2, but would also specifically prohibit all spearfishing for CRE MUS with scuba or hookah gear in all EEZ waters throughout the region. Other FMP permit holders would be required to comply with the gear restrictions of that FMP.

2.3.4 Management Measure 4: Other (Miscellaneous) Measures

Two issues of concern specifically addressed by this FMP include the take of live rock and live coral, and the impacts of vessel wrecks on coral reef resources. Both have potential to significantly impact essential fish habitat.

Alternative 1, No Action: No new restrictions on the harvest of live rock and live coral, or requirements for vessel insurance would be implemented.

Alternative 2, Minimal Additional Protection to Coral Reef Resources: The take of live rock and live coral in low-use MPAs would be prohibited except for: (1) incidental take by other FMP permit holders; (2) take by indigenous people for traditional/ceremonial use; (3) use by aquaculture operations as seed stock; (4) science and management; and, (5) bioprospecting. Except for the first category, all of these groups would require a CRE special permit. In addition, no anchoring by large vessels would be allowed on Guam's offshore southern banks.

Alternative 3, Substantial Additional Protection to Coral Reef Resources (Preferred Alternative): This alternative contains the same management measures as outlined for Alternative 2. In addition, fishing vessels longer than 50 ft would also be prohibited to anchor on Guam's offshore southern banks. This alternative would also require all fishing vessels transiting MPAs to carry wreck and cleanup insurance in case of an accident or fuel spill.

Alternative 4, Maximum Additional Protection to Coral Reef Resources: All take of live rock and live coral would be prohibited throughout the Region's EEZ. In addition, this alternative would require all fishing vessels transiting MPAs to carry wreck and cleanup insurance in case of an accident or fuel spill.

2.4 Future Measures That Could be Implemented through Framework Actions

Because the status of coral resources and their exploitation can change, any management regime must be able to adapt to those changing conditions. This is known as adaptive management and, depending on circumstances, rapid responses to natural or anthropogenic changes may be necessary. In comparison to amending the CRE-FMP, certain management changes can be

implemented in an expedited manner using a framework process. Several measures are identified for possible later implementation using this procedure, including restrictions on anchoring in MPAs, and requiring vessels operating in MPAs to carry a satellite-based vessel monitoring system (VMS). The framework procedure would also simplify reassignment of MUS between the currently harvested taxa and potentially harvested taxa categories. In general, other measures can be implemented through the framework process if their impacts have been previously evaluated, in this FMP or in amendments, for example. Otherwise, an FMP amendment is required. The framework process is discussed in greater detail in Section 5.5 of the FMP. Analyses of framework measures considered in the CRE-FMP are found below. The particular characteristics of the resource, and the desire to take an ecosystem approach to management, make the framework procedure a particularly appropriate component of the CRE-FMP. It should be noted that framework procedures have been included in all of the Council's already-implemented FMPs.

2.4.1 Potential Framework Measures

This section describes changes to the FMP that may be made based on recommendations identified in the annual report, or at Council or other advisory body meetings. Current options being considered for future framework action are: (1) mooring buoy installation and an anchoring prohibition; (2) an electronic vessel monitoring system (VMS) requirement for vessels operating in specific coral reef areas; (3) implementation of the general permit and reporting regime; (4) moving MUS on the PHCRT list to the CHRCT list; and, (5) designating indigenous sub-zones within low-use MPAs. Additional measures could be implemented through the framework process too, if their impacts have been evaluated in this FMP or in amendments; otherwise a full amendment is required.

These five measures are not slated for immediate implementation for several reasons. Details for actions 1, 2 and 5 still need to be worked out. For action 1, mooring buoy locations have not yet been determined, although all parties agree on their importance. For action 2, a closer look at the needs of vessels operating in MPAs and a better understanding of EFH, and habitat areas of particular concern (HAPC) will be required. It has not yet been determined whether the federal government will pay for the installation and operation of a VMS in this fishery. For action 5, the size and location of indigenous sub-zones have not been decided and legal issues were not fully explored.

Framework Action 1: Designate zones in the EEZ where mooring buoys will be installed in order to protect EFH from anchor damage. In areas with approved mooring buoys, prohibit anchoring of fishing vessels within a radius indicated on the buoy.

Rationale: "No anchor zones" in specific habitat areas would protect coral reefs from devastating anchor damage. Mooring buoys have been used successfully in Hawaii and elsewhere in the Pacific as an alternative to anchoring, particularly in high use areas. The use of these buoys by fishers and others would reduce habitat damage caused by anchoring. The buoys would be used on a first-come-first-served basis and allowed time limits would be specified so that no one boat

monopolizes a buoy. This process would ensure that the use of these buoys and the concomitant access to the resources would be fair and equitable to all fishers, consistent with National Standard 4. Only one boat would be allowed to moor at a time at each buoy. The prohibition of anchoring would limit the number of secured boats fishing an area to the number of mooring buoys at the site. While this may concentrate fishing effort around the buoys, it would also limit the number of vessels fishing at one time, increasing vessel safety and minimizing fishing pressure on coral reef resources.

Beneficial Impacts:

- Prevents anchor damage to reef habitats and allows anchoring for safety reasons in EFH and/or HAPC.
- Limits number of vessels fishing on the banks at one time, increasing vessel safety and minimizing fishing pressure on coral reef resources.
- Increases safety of fishers by making anchoring (and its hazards) unnecessary and reducing risk of anchor dragging.
- Is consistent with requirements of the Sustainable Fisheries Act by minimizing degradation of coral reef habitats.

Adverse Impacts:

- Limits number of vessels able to fish in a designated mooring zone at one time.
- Mooring buoy maintenance may be difficult.
- May concentrate fishing effort in areas with buoys.
- Includes a cost for installation and maintenance of buoys.
- May encourage “rafting” of vessels at each mooring buoy (even though it would be prohibited under the measure), which is a safety concern.

Framework Action 2: Require fishing vessels to carry remote VMS as part of an effective monitoring and enforcement system for state and federal agencies. This requirement could be applied to coral reef fisheries in specific geographical areas (e.g., the NWHI). This measure will only be enacted if the cost of such a system is fully subsidized with federal funding.

Rationale: VMS is an effective system for managing vessels operating in areas with different use zones, such as the MPAs, and with different licenses/permits, and for encouraging and documenting compliance with permit conditions. A vessel’s precise location would be transmitted via satellite to a Land Earth Station and from there to a computerized monitoring station where the information would be kept in a secure and confidential database. If the vessel enters a designated buffer zone or MPA, an automatic signal is sent to both the ship’s captain and the appropriate management agency. Such a system may prove to be a cost-effective compliance tool for realtime and accurate positioning of vessels and instant recognition of a breach of permitted activities, as well as a tool to locate vessels in distress. VMS also has been shown to be an effective tool for monitoring vessels’ locations in relation to navigational hazards and, when used in conjunction with automated buffer zones, may serve as an additional warning mechanism to prevent vessel groundings.

Beneficial Impacts:

- Protects coral reef resources by providing early warning of a vessel approaching too close to a reef slope, thereby protecting both the reef and the vessel from grounding damage.
- Protects coral reef resources by providing a tool that can dramatically improve compliance with FMPs.
- Is consistent with the requirements of the Sustainable Fisheries Act.
- Provides precise location information to assist in emergencies and rescues.
- Provides documentation on vessel movements, which can be used to clear up misunderstandings regarding liability or accusations of responsibility for environmental damage.
- Requires no input by captain or crew to run the automatic system.
- Can make enforcement easier and potentially much less costly.

Adverse Impacts:

- Cost of implementation may be burdensome to federal government.
- Implementation will require fiscal and personnel resources.
- Fishermen are concerned over the use of VMS information (security and confidentiality of data).

Framework Action 3: Require general permits to fish for CHCRT MUS outside of MPAs in the EEZ, in the event that regional management is determined inadequate to protect the species and/or ecosystem.

Rationale: This framework measure is described in Section 5.3.1 of the FMP in the subsection outlining the general permit and reporting regime. Initially, general permits will not be required for existing CRE fisheries. This option to implement a general permit requirement would allow fishery managers to assess individual fishing effort and methods for a given target species and associated bycatch before any vessel begins fishing. This more detailed data collection and mandatory reporting would facilitate more effective and adaptive management. This framework measure can be enacted if the Council determines that a locally administered permit and reporting regime does not adequately address CRE-FMP objectives. A general permit, issued by NMFS Pacific Islands Area Office (PIAO), would then be required to harvest CHCRT MUS in the EEZ outside of MPAs.

A number of methods could be used to instigate this framework procedure: (1) as a result of the Council reviewing the Coral Reef Ecosystem Annual Report for adequate data collection, overfishing or potential for overfishing, and other relevant scientific data which reflects the need for additional management measures; (2) the Coral Reef Plan Team issuing a report outlining concerns to the Council to be addressed at the following scheduled Council meeting; or, (3) regional management authorities bringing their concerns to the attention of the Council at any time.

American Samoa can be used as an example of how a general permit and reporting regime could be implemented and applied, using framework procedures. This example is particularly apposite because reef fisheries occur both in territorial and federal waters. The American Samoa Department of Aquatic and Wildlife Resources issues permits to fish for coral reef species and collects data through both creel surveys and commercial purchases reporting. These reef fisheries are small-scale operations, with individuals catching a few to a couple hundred pounds of fish on a given day. If one or more large-scale operations began efficiently targeting these species in the EEZ, increasing the total catch substantially, regional management might not be sufficient to address this development. The Council could then initiate the framework process to require a general permit for reef fisheries in the EEZ of American Samoa.

While details about who would be affected and how the measure would affect fishing are unique and unforeseeable, general procedures can be outlined here. Federal regulation 50 CFR 660.13 details current permitting procedures, which would also apply to this CRE general permit. Permits would be valid only for the fishery management subarea specified on the permit and remain valid for the period specified unless transferred, revoked, suspended, or modified. A permittee first requests an official Southwest Region Federal Fisheries application form. After filling out all required information and attaching necessary documents (see example form in Section 8.2 of the FMP), the permittee returns the application along with any fees, as specified. The PIAO will review and process all completed applications within 15 business days. Permittees will be notified of incomplete or incorrect applications. If deficiencies are not corrected within 30 days following notification, the application will be considered abandoned. Within 15 business days after receiving a completed application, the administrator of the PIAO will issue a permit to the applicant under the CRE-FMP or send a written notification of denial, which will include the reasons for the denied application.

Beneficial Impacts:

- Requires specific data reporting of catch, effort, area, and method of fishing.
- Allows for a thorough understanding of the total fishing effort for given areas and given target species.
- Provides information on bycatch and protected species.
- Allows for standardization of reporting, assisting fishery manager's assessment of impacts.
- Makes fishermen more aware of concerns of impacts from fishing through completing both permit form and logbooks.
- Assists adaptive management with crucial data on fishery.

Adverse Impacts:

- Increases administrative burdens (time and costs) due to the permit process.
- Increases burdens to fishermen not used to completing this type of paperwork.
- Removes management from regional authority which had traditionally managed these fisheries.

Framework Action 4: Allow particular MUS on the PHCRT list to be moved to the CHCRT list when sufficient information has been gathered for less restrictive management.

Rationale: If a market develops for potentially-harvested species, fishers will request to fish those species under the special permit. The special permit embodies the precautionary approach. Permit approval requires a thorough description and evaluation of all aspects of the fishing method for each applicant. Additionally, strict reporting requirements, including bycatch and discards, must be submitted. The data gathered from the vessels will help managers determine MSY, OY, and potential for overfishing. When enough data has been gathered for a given species or species complex and its associated bycatch to understand cumulative impacts on the species and the ecosystem, the Council can determine whether to lessen the stringent requirements by moving such species to the currently harvested list. This reduces administrative and regulatory burdens at the appropriate time without causing risk to the resource.

Beneficial Impacts:

- Relieves unnecessary administrative burdens on species for which management is better understood.
- Reduces burden to the Council and the PIAO Administrator for permit approval.
- Eases burdens on fishermen who have complied with regulations, allowing for given species to be re-listed as CHCRT.
- Procedure to re-list MUS prompts fishery managers to better understand species and the ecosystem to facilitate effective management.

Adverse Impacts:

- Has the potential to put species at risk, which could require more stringent management measures.
- Could facilitate additional fishing pressure for given species due to less stringent permit requirements for allowed harvesting.

Framework Action 5: Designate a set percentage within low-use MPAs for sole use by indigenous people, with the percentage based upon the percentage of indigenous population in the area around the low-use MPA.

Rationale: Discussions during the planning process centered around access for Native Hawaiians to the NWHI for traditional and ceremonial purposes. Later on, other island cultures were included in these discussions, with details to be worked out in the future as new MPAs were designated in their EEZs. Not all of the details, however, were worked out for the NWHI either. Yet to be determined are where these locations would be, the exact percentage of low-use MPA that would be set aside, and also the legal issues surrounding the proposal. Nevertheless, the CRE Plan Team and other groups strongly believe in the premise.

As discussed in Section 1.3.5, the indigenous people of the Samoa, Hawaii and Mariana islands have a close historical and cultural relation with the marine environment and coral reef resources.

Increasing restrictions on customary and traditional uses of marine resources are jeopardizing cultural continuity in many areas of the U.S. Pacific. The designation of no-take zones in the NWHI could result in some negative impact on the Hawaii fishing community by causing a loss of earning potential, investment value, and lifestyle for some bottomfish and lobster fisheries participants.

A 1993 survey of participants in the NWHI bottomfish fishery found that half of the respondents who fish in the Ho`omalau Zone were motivated to fish by a long-term family tradition (Hamilton 1994). This sense of continuity is also reflected in the importance placed on the process of learning about fishing from “old timers” and transmitting that knowledge to the next generation. Hawaii’s commercial fishing industry dates back nearly 200 years and closure of some fishing grounds in the NWHI would also likely have a negative impact on those who value the continued existence of Hawaii’s maritime tradition and culture. In view of the historic and cultural importance of fishing over the last 2,000 years for Native Hawaiians, this deprivation of the right to make a living at *koa* (see Kahaulelio 1902, pp. 22, 24), which they have been accustomed to frequent in the NWHI, is an especially onerous penalty. The two events have exacerbated this situation. First, annexation of Hawaii by the U.S. opened access to fishery resources to any U.S. citizen (Kosaki 1954). Second, this action increased fishing pressure on resources customarily used by Native Hawaiians and weakened cultural norms that controlled the proper conduct of fishing.

Beneficial Impacts:

- Helps preserve and reestablish island cultures and families whose history of traditional and ceremonial use of coral reef resources dates back thousands of years.
- Adds additional protection within low-use MPAs, by effectively limiting the amount of users in the area.
- Will make the permitting process for certain activities simpler because usage in these areas can be expected to be uniform across these select user groups.
- Potentially supports subsistence fishing.

Adverse Impacts:

- Could be challenged legally on grounds of discrimination.
- Locations and size of the sub-zones could cause contention between user groups.

Concerns have been expressed regarding what constitutes cultural take. For example, modern gear and techniques could alter the purpose of the sub-zone.

2.4.2 Procedure for New Measures (Amendments)

These procedures apply to regulatory measures that have not been included in previous regulations and/or whose impacts have not been analyzed previously in the FMP. These new measures include, but are not limited to, catch limits, resource size limits, closures, and effort limitations. New regulatory measures will follow the procedure outlined for amendments in

NMFS' *Operational Guidelines, Fishery Management Plans* (May 1, 1997 revision).

A *Federal Register* notice will be published describing any proposed new management measure. The notice will solicit public comment. At the subsequent Council meeting, the Council will formally address the specific measure for which they will consider recommendations. A *Federal Register* notice will be prepared summarizing the Council's deliberations, rationale, and analysis of the preferred action, and include the time and place for any other Council meetings to consider the measure. At subsequent meetings, the Council will consider public comments and other information received and will draft a document with a recommendation to the NMFS Regional Administrator (RA).

The RA will propose regulations to carry out the action or offer a written explanation supporting the denial of the recommendation within two weeks of the decision. The Council may appeal a denial by writing to the Assistant Administrator. The Assistant Administrator must respond to the Council within 30 days. If the RA agrees with the recommendation, the RA and the Assistant Administrator will make their decision in accordance with the MSFCMA and other applicable laws. Finally, NMFS may implement any recommendation made by the Council by rule-making, if approved by the Regional Administrator.

2.5 Measures to Address Ecosystem Impacts of Existing FMP Fisheries

A formal process will be established (under the Council's Standard Operating Procedures and Practices) to coordinate the CRE-FMP with the Council's already-implemented Pelagics, Bottomfish, Crustaceans, and Precious Corals FMPs. Under this process, the Coral Reef Ecosystem Plan Team (CRE-PT) would coordinate with the existing FMP Plan Teams to recommend methods for minimizing identified impacts to the coral reef ecosystem (e.g., lobster trap impacts to reef habitat). The process is detailed in Section 5.5.3 of the CRE-FMP.

2.6 Management Measures Considered But Not Analyzed Further

Catch Restrictions Including Harvest Quotas: A harvest quota, which limits the amount of fish that may be landed within some time period (typically, a year) is the most common type of quantity control. Quotas can be set for all participants in a fishery or individual quotas can be assigned to fishermen or fishing groups. Bag or per-trip limits are a third type of catch restriction that limit individual catches during a narrowly defined time period, such as a fishing trip. These controls can be applied to species groups or to individual species. The underlying concept of allowable catches has been applied widely; as a result managers have conducted a lot of research on its effects. However, this approach is most widely implemented in temperate zone single-species fisheries.

Some managers favor catch quotas based on the premise that other ecological factors and interdependent stocks can be controlled through careful application of catch restrictions, but this type of quota requires a lot of information about the status of stocks. They are also complicated and expensive to enforce. These problems seriously limit their application to complexes, such as coral reef ecosystems, where fish assemblages are diverse and management agency budgets are often tight (Roberts and Polunin 1991). The high diversity of coral reef species and the variable

selectivity of fishing methods would require that catch quotas either be applied to the total catch from a given area or to selected species. Unless expensive biological surveys are conducted to set quotas, the average catch limit for a particular season or year is either reached within an unduly short time (after good recruitment) or it is never attained (after poor recruitment). Leaving aside limits on agency resources, the cost entailed in measuring all the relevant variables needed to calculate quotas for multi-resource, multi-gear, and data-poor coral reef fisheries would exceed any realistic capabilities or budget. Furthermore, quotas based on equilibrium yield models of particular resources would not necessarily prevent ecosystem overfishing.

Seasonal/Time Closures: A “rest period,” when fishing for particular species is temporarily suspended, is a traditional resource management practice in Pacific Island fishing communities. This period can range from hours (prohibiting night fishing when fish are particularly vulnerable to capture, for example) to several months (coinciding with peak spawning periods, for example). Seasonal closures are most effective for species that fishermen can avoid capturing out of season or for species that can survive capture and release. Rather than directly monitoring fishing, seasonal closures for particular species can be enforced at fish landing sites and markets. Despite these advantages, more information is needed on the biology of many coral reef species in order to determine both rest period duration and locality, and the resulting benefits. Furthermore, complementary nearshore regulations, which would have to be implemented by states, would be necessary for effective enforcement.

Harvest Size Restrictions: Setting minimum or maximum sizes for landed organisms is another popular management tool. This approach is only enforceable when regulations apply to possession or sale, rather than harvesting itself. Minimum size restrictions discourage harvesting fish before they reach reproductive size. Maximum size restrictions, on the other hand, discourage taking the most fecund sizes, which contribute disproportionately to reproduction. Size limits may also postpone harvesting resident species that have a limited range. If a fish stock is depleted, increasing the spawning population has a clear benefit. If a stock is not depleted, the benefit of a minimum size limit is less predictable because the connection between spawning population size and future recruitment success is very tenuous. Size limits are enforced by monitoring landing sites. More information on life histories and other biological parameters (e.g., size at maturity) is needed before the proper size limits can be established for most reef species. Setting minimum/maximum sizes is difficult due to the multi-species nature of most coral reef fisheries. This management tool is most appropriate for monospecific stocks and less applicable to the ecosystem management approach.

Harvest Moratorium in all EEZ waters: Because the FMP review, approval, and implementation process is lengthy, there is some concern that in the interim there will be little control over harvesting of coral reef resources in the EEZ. A moratorium on harvesting would protect reef ecosystems until the FMP is implemented. The Secretary of Commerce has the authority to impose a moratorium, but such an action would require as much (and possibly more) justification as an FMP. Even if eventually approved, a moratorium would be controversial and approval could take as long or longer than the FMP approval and implementation.

2.7 Discussion of the Preferred Alternative

There is poor understanding of the basics, much less the intricacies, of coral reef ecosystems. Ecosystem-based management, therefore, can only be achieved over time as new information allows management to improve. It should be recognized that the technical data available for management decisions are almost always uncertain and incomplete. Hence, the group of control measures in Alternative 3, Substantial Additional Protection (the Preferred Alternative) was arrived at using the precautionary approach. The Council chose this combination of options by comparing different possible management measures. At each decision step, options bracketing different solutions and potential environmental, social and economic impacts were considered and preferred options were selected. If approved by the Secretary of Commerce, implementation of Alternative 3 would result in the four major regulatory actions just described: (1) designating "no-take" and "low-use" MPAs in parts of the EEZ; (2) permit and reporting requirements for harvesting EEZ coral reef resources (3) defining allowable gear and methods of fishing for coral reef resources in the EEZ; and, (4) applying other miscellaneous measures. These measures, taken together, reflect the ecosystem approach that has guided plan development. Recommendations made by the Ecosystem Principles Advisory Panel (EPAP 1999), in turn, guided this approach. For a full discussion of the FMP's management approach, see Section 1.5 in that document.

In selecting the management measures contained in this Preferred Alternative, the Council considered trade-offs of costs and benefits to various resources. These trade-offs can be summarized as: (1) between utilization of coral reef resources by controlled fishing versus preservation of coral reef ecosystems by minimal consumptive use; (2) between sustainable use of multi-resource coral reef ecosystems versus sustainable use of particular target resources; (3) between prevention of adverse fisheries impacts versus mitigation of damage; (4) between management actions now versus later; and, (5) between regulatory burdens on potential new coral reef fisheries versus burdens on existing fisheries. In general, the Council selected management measures that provide a balance between these often-conflicting concepts in a manner that meets the objectives of the CRE-FMP as outlined below.

- Objective 1:** To foster sustainable use of multi-species resources in an ecologically and culturally sensitive manner, through the use of the precautionary approach and ecosystem-based resource management.
- Objective 2:** To provide a flexible and responsive management system for coral reef resources that can rapidly adapt to changes in resource abundance, new scientific information, and changes in fishing patterns among user groups or by area.
- Objective 3:** To establish integrated resource data collection and permitting systems, establish a research and monitoring program to collect fishery and other ecological information, and to collect scientific data necessary to make informed management decisions about coral reef ecosystems in the EEZ.

- Objective 4:** To minimize adverse human impacts on coral reef resources by establishing new—and improving existing—marine protected areas, managing fishing pressure, controlling wasteful harvest practices, reducing other anthropogenic stressors directly affecting coral reef resources, and allowing the recovery of naturally-balanced reef systems. This objective includes the conservation and protection of essential fish habitats.
- Objective 5:** To improve public and government awareness and understanding of coral reef ecosystems and their vulnerability and resource potential in order to reduce adverse human impacts and foster support for management.
- Objective 6:** To collaborate with other agencies and organizations concerned with the conservation of coral reefs, in order to share in decision-making and to obtain and share data and resources needed to effectively monitor this vast and complex ecosystem.
- Objective 7:** To encourage and promote improved surveillance and enforcement to support the plan's management measures.
- Objective 8:** To provide for sustainable participation by fishing communities in coral reef fisheries and, to the extent practicable, minimize the adverse economic impacts on such communities.

2.7.1 Marine Protected Areas

No-take Marine Protected Areas

No-take marine protected areas are a powerful tool for ecosystem management because detailed knowledge of the management unit species is unnecessary in order to achieve conservation of multi-species resources, diverse habitats, and the functional attributes of marine ecosystems. The designation of no-take MPAs proposed by the FMP combines preferences for: (1) their location, (2) their extent, and (3) how seaward boundaries for no-take areas are best defined. As shown in Table 2.4, the CRE-FMP would designate a significant proportion of the Region's EEZ as no-take MPAs. If the State of Hawaii takes parallel action, so designating adjacent nearshore reefs around the NWHI, MPA coverage would almost double in that sub-region. (As federal jurisdiction extends to the shoreline in the PRIAs, the values in both columns of Table 2.4 remain the same for that sub-region.) Taken together, these designations represent an important step towards meeting the U.S. Coral Reef Task Force's goal of restricting access to 20% of the region's coral reefs over the next 10 years.

Table 2.4: Preliminary estimates of no-take MPAs as a percent of total reef area.

Area	Percent in Federal Waters	Percent in all waters (State and Federal)
NWHI	14%	24%
PRIAs	10%	10%
All WP Region	12%	15%

The Preferred Alternative's no-take areas were chosen to protect ecologically sensitive areas while allowing continued carefully controlled commercial bottomfish and lobster fisheries in the NWHI, as well as recreational fishing by visitors to Midway Atoll. The desire for continued recreational fishing by residents of Johnston Atoll and Wake Island, and establishing a recreational fishing program at Palmyra, were also taken into account in locating no-take MPAs.

Under the Preferred Alternative (3), the relevant isobath, or depth contour, would be used to delineate the seaward boundaries for no-take MPAs. Basing these seaward boundaries on either the closest State of Hawaii commercial catch reporting grid square inclusive of the relevant contours (for the NWHI) or on circles drawn around islands or banks that are inclusive of these areas was considered but was rejected due to the significantly larger closed area that would result. These approaches to boundary delineation would have a major impact on fisheries, and most of this additional closed area would be beyond the depth of coral reefs.

Amendments to Already-Implemented FMPs

The CRE-FMP designates no-take MPAs within the management area. Commercial, recreational, subsistence, or cultural take of any marine species within these areas is prohibited. No described or undescribed gear is exempt from this designation. Fisheries managed under the Council's four already-implemented FMPs ¹ are mostly exempt from the regulations outlined in this CRE-FMP and will observe the management regime of their respective FMPs. No-take marine protected areas are the main exception; they will apply to all Council-managed fisheries. To ensure designated no-take MPAs effectively apply to all of the fisheries managed under Council FMPs, each of the four already-implemented FMPs must be amended to ensure the no-take status of these areas. The following four subsections describe these amendments.

¹ The Bottomfish and Seamount Groundfish, Crustaceans, Pelagics, and Precious Corals FMPs. Additionally, the Council is currently developing an amendment to the to include the CNMI and the PRIA under Council-developed FMPs and designating 26 additional bottomfish MUS. These FMPs and their fisheries are summarized in Chapter 3 of the EIS.

Amendment 7 to the Bottomfish and Seamount Groundfish FMP

It is prohibited to harvest the bottomfish management unit species listed in Table 2.5, and all future additions to the bottomfish MUS list, in no-take marine protected areas designated in the Coral Reef Ecosystem FMP, and in any marine protected areas that may be designated by amendment to the Coral Reef Ecosystem FMP. The locations of the no-take MPAs are:

- (1) federal waters shallower than 10 fm in the Northwestern Hawaiian Islands;
- (2) federal waters shallower than 50 fm around Jarvis Island (0°23' S, 160°01' W), Howland Island (0°48' N, 176° 38' W), Baker Island (0° 13' N, 176°38' W), Kingman Reef (6°23' N, 162°24' W), Laysan Island (25° 45' N, 171°45' W), French Frigate Shoals (23° 45' N, 166°15' W), the Northern half of Midway Atoll (28° 14' N, 177° 22' W), and Rose Atoll (14° 33' S, 168°09' W).

Table 2.5: Bottomfish management unit species list.

Scientific Name	English Common Name	Scientific Name	English Common Name
<i>Aphareus rutilans</i>	red snapper/silvermouth	<i>Pristipomoides auricilla</i>	yellowtail snapper
<i>Aprion virescens</i>	gray snapper/jobfish	<i>P. filamentosus</i>	pink snapper
<i>Caranx ignobilis</i>	giant trevally/jack	<i>P. flavipinnis</i>	yelloweye snapper
<i>C. lugubris</i>	black trevally/jack	<i>P. seiboldi</i>	pink snapper
<i>Epinephelus fasciatus</i>	blacktip grouper	<i>P. zonatus</i>	snapper
<i>E. quernus</i>	sea bass	<i>Pseudocaranx dentex</i>	thicklip trevally
<i>Etelis carbunculus</i>	red snapper	<i>Seriola dumerili</i>	amberjack
<i>E. coruscans</i>	red snapper	<i>Variola louti</i>	lunartail grouper
<i>Lethrinus amboinensis</i>	ambon emperor	<i>Beryx splendens</i>	alfonsin
<i>L. rubrioperculatus</i>	redgill emperor	<i>Hyperoglyphe japonica</i>	ratfish/butterfish
<i>Lutjanus kasmira</i>	blueline snapper	<i>Pseudopentaceros richardsoni</i>	armorhead

Amendment 11 to the Crustaceans FMP

It is prohibited to harvest the crustacean management unit species listed in Table 2.6, and all future additions to the crustacean MUS list, in no-take marine protected areas designated in the Coral Reef Ecosystem FMP, and in any marine protected areas that may be designated by amendment to the Coral Reef Ecosystem FMP. The locations of the no-take MPAs are:

- (1) federal waters shallower than 10 fm in the Northwestern Hawaiian Islands;
- (2) federal waters shallower than 50 fm around Jarvis Island (0°23' S, 160°01' W), Howland Island (0°48' N, 176° 38' W), Baker Island (0° 13' N, 176°38' W), Kingman Reef (6°23' N,

162°24' W), Laysan Island (25° 45' N, 171°45' W), French Frigate Shoals (23° 45' N, 166°15' W), the Northern half of Midway Atoll (28° 14' N, 177° 22' W), and Rose Atoll (14° 33' S, 168°09' W).

Table 2.6: Crustacean management unit species list.

Scientific Name	English Common Name
<i>Panulirus marginatus</i>	Spiny lobster
<i>Panulirus penicillatus</i>	Spiny lobster
Family <i>Scyllaridae</i>	Slipper lobster
<i>Ranina ranina</i>	Kona crab

Amendment 10 to the Pelagics FMP

It is prohibited to harvest the pelagic management unit species listed in Table 2.7, and all future additions to the pelagic MUS list, in no-take marine protected areas designated in the Coral Reef Ecosystem FMP, and in any marine protected areas that may be designated by amendment to the Coral Reef Ecosystem FMP. The locations of the no-take MPAs are:

- (1) federal waters shallower than 10 fm in the Northwestern Hawaiian Islands;
- (2) federal waters shallower than 50 fm around Jarvis Island (0°23' S, 160°01' W), Howland Island (0°48' N, 176° 38' W), Baker Island (0° 13' N, 176°38' W), Kingman Reef (6°23' N, 162°24' W), Laysan Island (25° 45' N, 171°45' W), French Frigate Shoals (23° 45' N, 166°15' W), the Northern half of Midway Atoll (28° 14' N, 177° 22' W), and Rose Atoll (14° 33' S, 168°09' W).

The Council also recommends that the Pelagic FMP be amended to specifically identify only the nine pelagic shark species that are to remain as Pelagic MUS. In doing so, all other oceanic sharks belonging to the families Alopiidae, Carcharhinidae, Sphyrnidae, and Lamnidae will be removed from the Pelagic MUS list at this time. The Council further recommended that all coastal shark species belonging to these families are to be managed under the CRE-FMP. Therefore, the Pelagic FMP is amended to:

- (1) Remove all species of shark belonging to the families Alopiidae, Carcharhinidae, Sphyrnidae, and Lamnidae from the Pelagic MUS list except for the nine shark species listed in Table 2.7;
- (2) Remove dogtooth tuna (*Gymnosarda unicolor*) from the Pelagic MUS list. (*Gymnosarda unicolor* is to be managed under the CRE-FMP.)

Table 2.7: Pacific Pelagic management unit species list, as amended.

Scientific Name	English Common Name	Scientific Name	English Common Name
<i>Coryphaena</i> spp.	Mahimahi (dolphinfishes)	<i>Isurus oxyrinchus</i>	Shortfin mako shark
<i>Acanthocybium solandri</i>	Wahoo	<i>Isurus paucus</i>	Longfin mako shark
<i>Makaira mazara</i> : <i>M. indica</i>	Indo-Pacific blue marlin Black marlin	<i>Lamna ditropis</i>	salmon shark
<i>Tetrapturus audax</i>	Striped marlin	<i>Thunnus alalunga</i>	Albacore
<i>T. angustirostris</i>	Shortbill spearfish	<i>T. obesus</i>	Bigeye tuna
<i>Xiphias gladius</i>	Swordfish	<i>T. albacares</i>	Yellowfin tuna
<i>Istiophorus platypterus</i>	Sailfish	<i>T. thynnus</i>	Northern bluefin tuna
<i>Alapias pelagicus</i>	Pelagic thresher shark	<i>Katsuwonus pelamis</i>	Skipjack tuna
<i>Alopias superciliosus</i>	Bigeye thresher shark	<i>Euthynnus affinis</i>	Kawakawa
<i>Alopias vulpinus</i>	Common thresher shark	<i>Lampris</i> spp.	Moonfish
<i>Carcharhinus falciformis</i>	Silky shark	Gempylidae	Oilfish family
<i>Carcharhinus longimanus</i>	Oceanic whitetip shark	family Bramidae	Pomfret
<i>Prionace glauca</i>	Blue shark	<i>Auxis</i> spp., <i>Scomber</i> spp.; <i>Allothunus</i> spp.	Other tuna relatives

Amendment 5 to the Precious Corals FMP

It is prohibited to harvest the precious corals management unit species listed in Table 2.8, and all future additions to the precious corals MUS list, in no-take marine protected areas designated in the Coral Reef Ecosystem FMP, and in any marine protected areas that may be designated by amendment to the Coral Reef Ecosystem FMP. The locations of the no-take MPAs are:

- (1) federal waters shallower than 10 fm in the Northwestern Hawaiian Islands;
- (2) federal waters shallower than 50 fm around Jarvis Island (0°23' S, 160°01' W), Howland Island (0°48' N, 176° 38' W), Baker Island (0° 13' N, 176°38' W), Kingman Reef (6°23' N, 162°24' W), Laysan Island (25° 45' N, 171°45' W), French Frigate Shoals (23° 45' N, 166°15' W), the Northern half of Midway Atoll (28° 14' N, 177° 22' W), and Rose Atoll (14° 33' S, 168°09' W).

Table 2.8: Precious corals management unit species list.

Scientific Name	English Common Name	Scientific Name	English Common Name
<i>Corallium secundum</i>	Pink coral (also known as red coral)	<i>Lepidisis olapa</i>	Bamboo coral
<i>Corallium regale</i>	Pink coral (also known as red coral)	<i>Acanella</i> spp.	Bamboo coral
<i>Corallium laauense</i>	Pink coral (also known as red coral)	<i>Antipathes dichotoma</i>	Black coral
<i>Gerardia</i> spp.	Gold coral	<i>Antipathes grandis</i>	Black coral
<i>Narella</i> spp.	Gold coral	<i>Antipathes ulex</i>	Black coral
<i>Calyptrophora</i> spp.	Gold coral		

Low-use Marine Protected Areas

Zone-based management, where particular areas are designated for prescribed uses, is an important principal in ecosystem-based fishery management (EPAP 1999). The Preferred Alternative designates all the coral reefs in the EEZ around the NWHI (to a depth of 50 fm), which are not already designated no-take MPAs, as low-use MPAs. Low-use MPAs are also designated for coral reefs in the EEZ around Palmyra, Johnston and Wake atolls.

The seaward boundaries for all low-use MPAs would extend to a uniform depth of 50 fm. Generally, the inner boundary of low-use MPAs coincides with the outer boundary of no-take MPAs, or at 10 fm, and to a depth of 50 fm. (In those areas where no-take MPAs extend to 50 fm, no-take MPAs are not designated.) Low-use MPAs would begin at the shoreline at the southern half of Midway Atoll, and Palmyra, Johnston and Wake.

Summary: Marine Protected Areas

A zone-based management approach is applied to MPA design and designation. Under the Preferred Alternative, all EEZ coral reefs in unpopulated areas—that is, in the NWHI, PRIAs, and Rose Atoll in American Samoa—would be designated MPAs. The outer boundary for these MPAs is the 50 fm isobath. Two types of MPAs are proposed: no-take and low-use. This recommendation is incorporated in the CRE-FMP through low-use marine protected areas. The designation of marine protected areas combines preferences for: (1) their location; (2) their extent; and, (3) how seaward boundaries for low-use MPAs are best defined. No fishing is allowed in no-take MPAs, including that by existing FMP fisheries. No-take MPAs are delineated by the 10 fm isobath except for certain ecologically sensitive areas where the boundary is extended to the 50 fm isobath. These areas are French Frigate Shoals, Laysan Island, the northern half of Midway Atoll and Jarvis, Howland and Baker Islands, Kingman Reef, and Rose Atoll. The remaining EEZ waters around the NWHI and PRIAs (within the 50 fm isobath) would become low-use MPAs, where fishing is tightly controlled by special permits and conditions.

All extractive activities would be prohibited in no-take MPAs, except for small harvests related to scientific research and resource management. In low-use MPAs existing fishing activities, including other FMP fisheries and recreational fisheries by residents on certain remote islands, would be allowed. The permit regime and its specific exemptions, outlined below, would regulate these activities but allow certain indigenous or cultural uses.

Using the framework process, vessel anchoring areas may be designated in MPAs at a future date. The only immediate restriction proposed in the CRE-FMP would be an anchoring ban for large fishing vessels at Guam's southern banks. (This area is not designated an MPA, however.) Fishing vessels transiting MPAs would be required to carry insurance in order to pay for the costs of vessel removal and habitat damage mitigation in the event of a grounding. The Council felt that prohibiting large non-fishing vessels, and in particular cruise ships, from entering MPAs would be beneficial. However, the Council does not have the authority to regulate these vessels. Several longer term, cooperative efforts are proposed to manage the potential impacts of these vessels.

2.7 Permits and Reporting

The Preferred Alternative (3) would implement permit requirements for the harvest of coral reef resources in the low-use MPAs that would be designated in the EEZ around the NWHI, Palmyra Atoll, Johnston Atoll, and Wake Island. Vessels regulated and targeting species managed by other FMPs would be exempt from this requirement. However, they would continue to report any incidental harvest of coral reef ecosystem MUS. Permit and reporting requirements for the region's remaining EEZ waters would be administered by local jurisdictions. They would also continue permitting and monitoring the harvest of CHCRT in areas adjacent to inhabited islands since these areas are managed under local laws and regulations.

However, the Preferred Alternative (3) would also require detailed permit and reporting for PHCRT throughout the Region's EEZ. In this manner, the expanding marine ornamentals fishery and emerging bioprospecting industries, which target a broader spectrum of coral reef resources including species about which little is known, can be controlled and managed appropriately.

Due to their ecological vulnerability, the Preferred Alternative (3) would prohibit the collection of live stony coral or live rock for commercial purposes, except small amounts to be collected under a special permit for use as seed stock for aquaculture and for traditional and ceremonial purposes by indigenous peoples.

Summary: Permits and Reporting

In populated areas, permitting and reporting of CHCRT would be conducted through existing local monitoring programs, although under the Preferred Alternative's framework provisions, a general permit could be developed and implemented for all EEZ coral reef resources at a later date, if needed. In unpopulated areas where MPAs would be designated, special permits would regulate the harvest of these resources. Additionally, special permits would also be required to

harvest any PHCRT. However, permit holders in other FMP-managed fisheries would not have to obtain an additional permit for the incidental catch of coral reef taxa. Scientific collection of coral reef resources in both no-take and low-use MPAs could occur, if approved by the NMFS RA. These scientific permits are separate from the special permit regime that would be implemented by the CRE-FMP.

In addition, the harvest of live rock and coral would also be specifically prohibited. However, limited harvest of live rock and coral could be allowed via the special permit for traditional and ceremonial indigenous purposes and seed stock for aquaculture operations. They could also be collected under the aforementioned scientific permit.

2.7.3 Allowable Gears and Methods

Adverse impacts from fishing gear may include physical, chemical or biological alterations of the substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other components of the ecosystem. Controls on fishing gear and methods are an effective tool for mitigating such impacts.

The Preferred Alternative's list of allowable gears is based first on a consideration of the potential of the gear to minimize damage to EFH. Use of poisons, explosives and intoxicating substances, methods of choice for harvesting live reef fish in Southeast Asia, would not be allowed. Nets would be allowed only if they are tended and if their retrieval does not break coral and damage bottom habitat (e.g., purse nets/surround nets for baitfish, akule, weke). Traps would be allowed in areas and under conditions where there is low potential for damage to EFH and gear loss. (Traps must also be permanently marked to identify their owners.) Manned and remotely-operated submersibles have minimal adverse effects on EFH and they too are allowed.

A second criterion for allowable gear is its catch selectivity. Hand harvest, spear, slurp gun, hand net, dip net, hoop net (for Kona crab), throw net, barrier net (for aquarium fish) are selective types of gear that would be allowed. Manned and remotely-operated submersibles are also highly selective, producing negligible bycatch. Surround nets and seines can be used to target schooling fish species (e.g., akule, weke, taape, baitfish) with a minimum of non-target catch and would be allowed for this purpose. The selectivity of traps varies with fishing techniques and species preferences by seafood consumers in the different island groups of the U.S. Pacific. Non-targeted species of fish can be released alive if carefully handled. The selectivity of hook-and-line gear (including handlines, electrically and hydraulically retrieved lines, rod-and-reel and trolling) varies enormously, depending on the skill and knowledge of the individual fisherman. Amateur fishermen casting from shore will catch a variety of wanted and unwanted fish species. Bottomfishing vessels are often equipped with electronic navigational devices to relocate fishing areas, and sonar devices to target productive habitat and fish aggregations. This gear is relatively selective, with the ability to successfully target particular species groups depending on the skill of the vessel captain. Experienced vessel crew have the ability to catch the desired species with little non-target catch. It is, however, impossible to completely avoid non-target species with most hook-and-line fishing methods. Despite variations in selectivity, all types of hook-and-line methods are allowed because of their low impact.

Although spearfishing is a highly selective method of fishing that has little adverse impact on EFH, the Preferred Alternative (3) would allow scuba-assisted fishing in the EEZ around the NWHI and PRIAs only during daylight hours. This is because, when used at night, this method allows no refuge for target species, which are captured while sleeping.

Summary: Allowable Gears and Methods

In order to minimize resource and habitat impacts, three conditions on gear use are incorporated into the Preferred Alternative (3). There is a list of allowable gear types, which includes the following:

1. hand harvest;
2. spear;
3. slurp gun;
4. hand/dip net;
5. hoop net (for Kona crab);
6. throw net;
7. barrier net for aquarium fish;
8. surround/purse set net for targeted schooling fish (e.g., akule, baitfish, weke) with a minimum of bycatch and must be attended by swimmers or divers at all times;
9. hook-and-line (powered and unpowered handlines, rod and reel, and trolling);
10. traps (with conditions); and,
11. remote operating vehicles/submersibles.

There are several gears specifically prohibited for the harvest of coral reef ecosystem management unit species: gillnets, trawls, dredges, tanglenets, longlines, explosives, and poisons. Scuba-assisted spear fishing is prohibited at night in EEZs of the PRIAs and the NWHI.

Submersible supported studies conducted in 2001 at precious coral beds in the MHI and bottomfishing banks in the NWHI have reported minimal evidence of fishing impacts to habitat (R. Grigg pers comm. 2001 and C. Kelley pers comm. 2001). However, the Council remains concerned with issues regarding gear impacts on habitat. Therefore, the Council has proposed habitat and stock assessment projects to obtain information regarding coral reef habitats, including impacts of benthic fisheries on coral reef ecosystems (see section 7 of the FMP). Additionally, a Council appointed Coral Reef Ecosystem Plan Team will prepare annual reports to assess coral reef ecosystem-level impacts associated with fishing activities regulated under this and other plans.

2.7.4 Other (Miscellaneous) Management Measures

As discussed above, the Preferred Alternative would allow only small collections of coral reef organisms for aquaculture seed stock, scientific research, bioprospecting, and cultural or indigenous uses. A special permit would be required for these activities. In addition, fishing vessels transiting through MPAs would be required to carry insurance to cover the cost of wreck removal and pollution liability in the event of grounding. Finally, it would create a no-anchoring zone on offshore banks south of the island of Guam for fishing vessels longer than 50 ft.

2.7.5 Summary of the Preferred Alternative

The Preferred Alternative's combination of management measures should provide more protection and enable better management of the region's coral reef ecosystem resources. The Coral Reef Ecosystem FMP would use harvest controls and careful monitoring in use of these vital resources.

Figure 2.1: NWHI Marine Protected Area (MPA) Map legend.

Map Legend for the Northwestern Hawaiian Islands Marine Protected Areas

●	Land
—	3 mile boundary around land
- - -	Current closed lobster zone (20 mile radius)
▨	Proposed coral reef resource no-take zone (0-10 fm)
▩	Proposed coral reef resource no-take (kapu) zone (0-50 fm) (Laysan, French Frigate Shoals and the north half of Midway Atoll)
▬	Proposed coral reef resource low-use special permit zone (10-50 fm)
■	50-100 fm bathymetric contour
▤	Deepwater precious coral permitted zones
▥	Potential deep water precious coral habitat (150-750 fm)

* For Midway Atoll, the proposed coral reef resource low-use special permit zone encompasses all benthic substrates (0-50 fm)

Figure 2.2 : Nihoa to Necker Island Marine Protected Area.

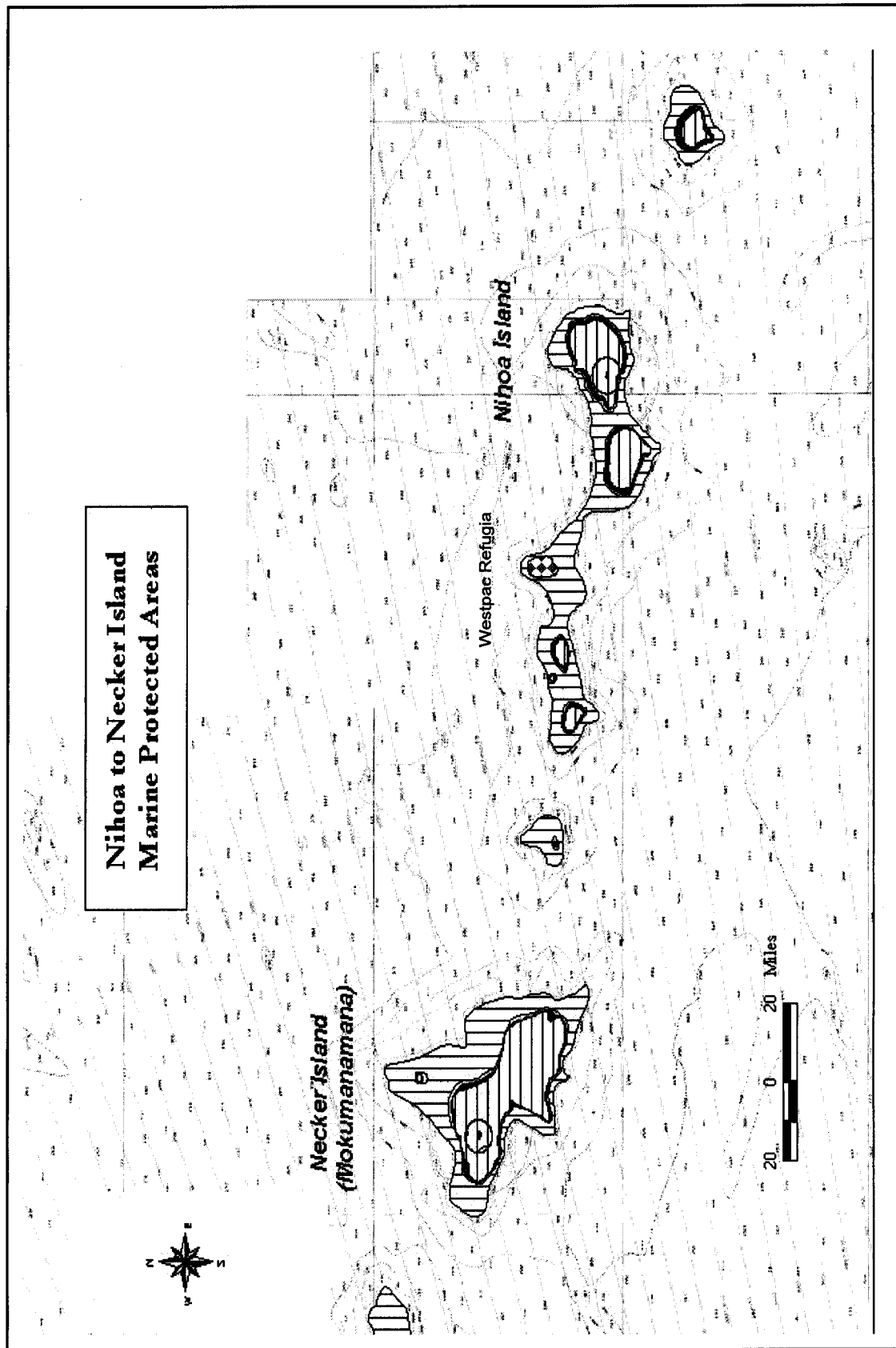


Figure 2.3: French Frigate Shoals to Raita Bank Marine Protected Area.

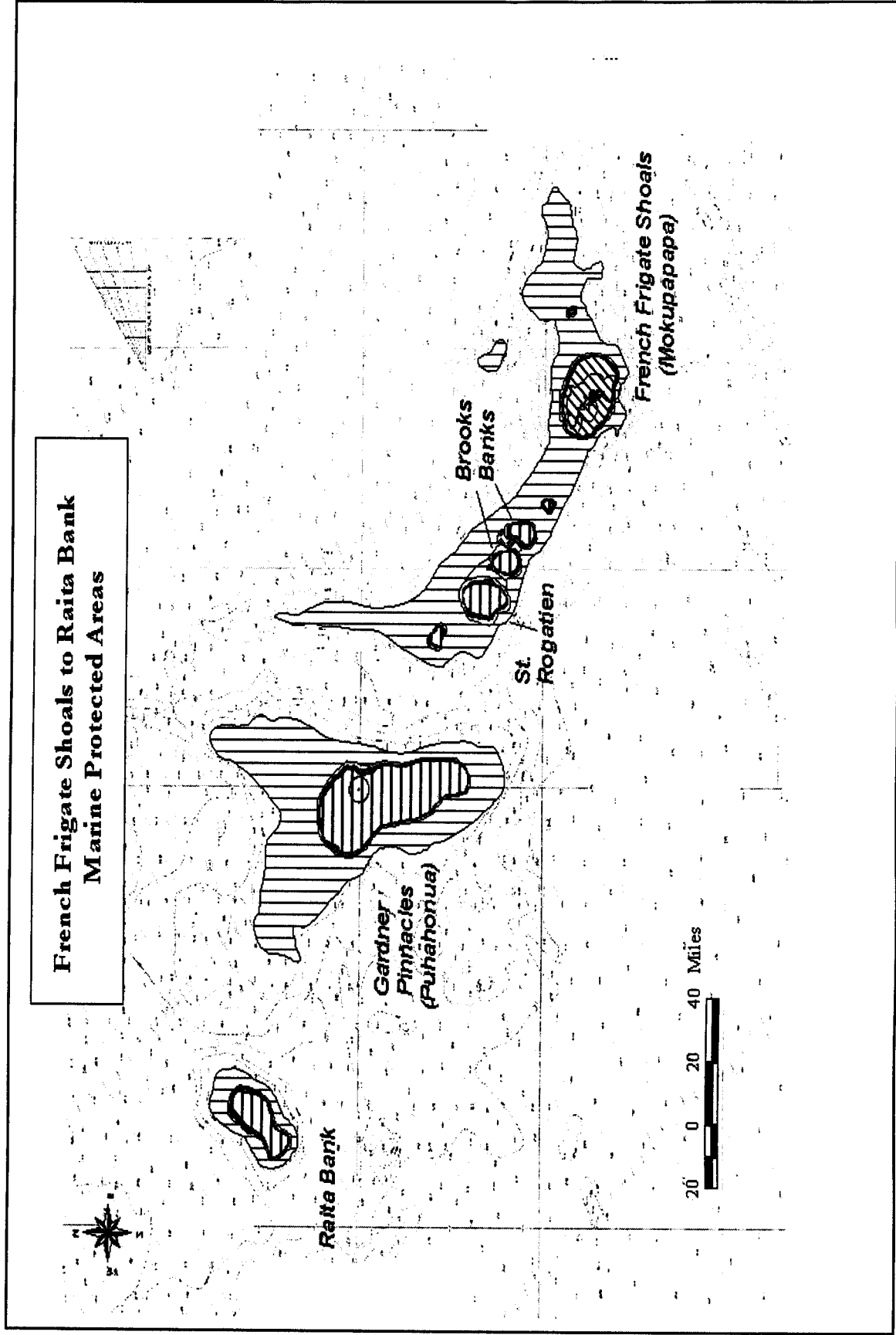


Figure 2.4: Maro Reef to Lisianski Island Marine Protected Area.

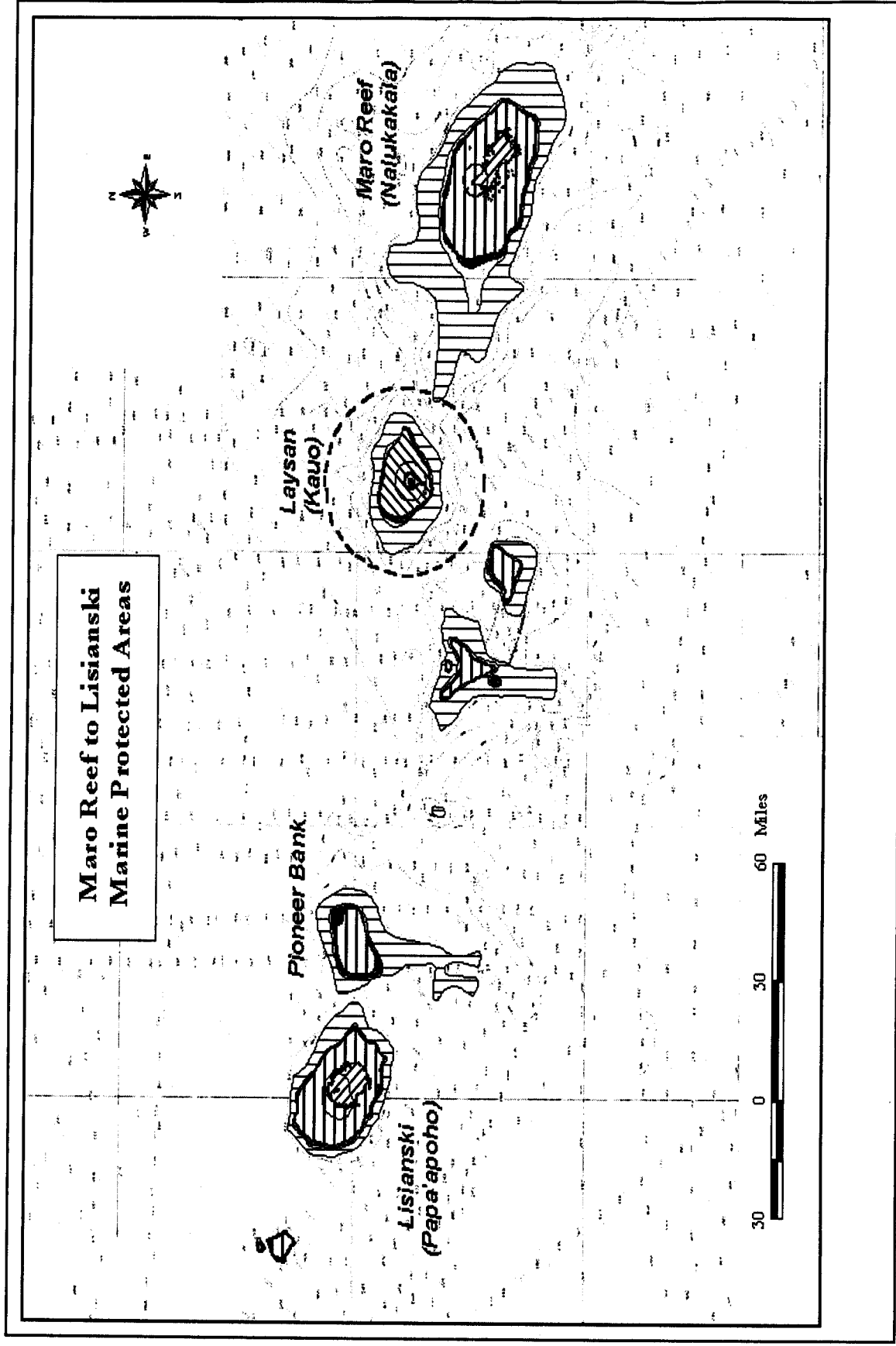


Figure 2.5: Pearl and Hermes Reef to Midway Atoll Marine Protected Area.

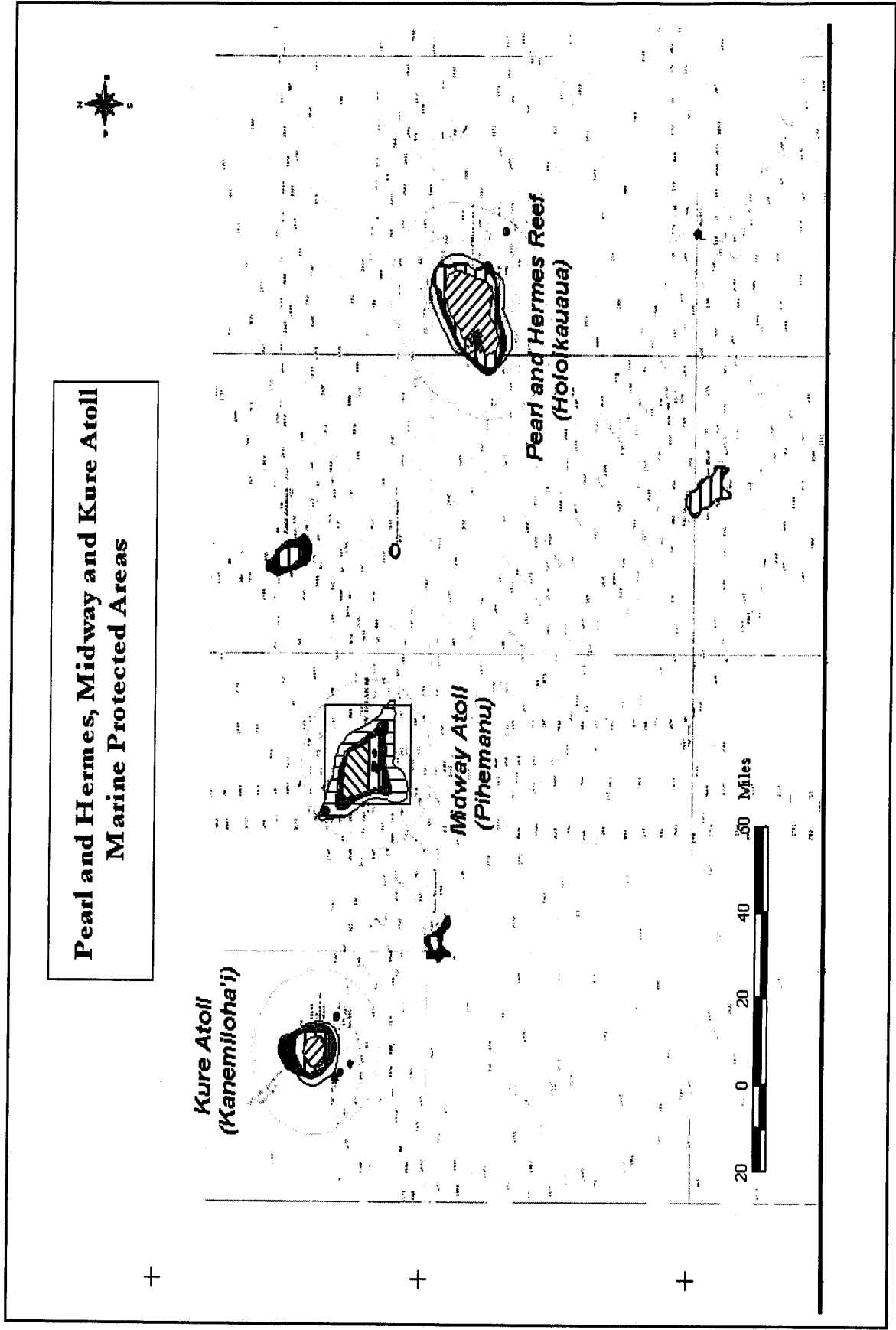


Figure 2.6: Rose Atoll Marine Protected Area.

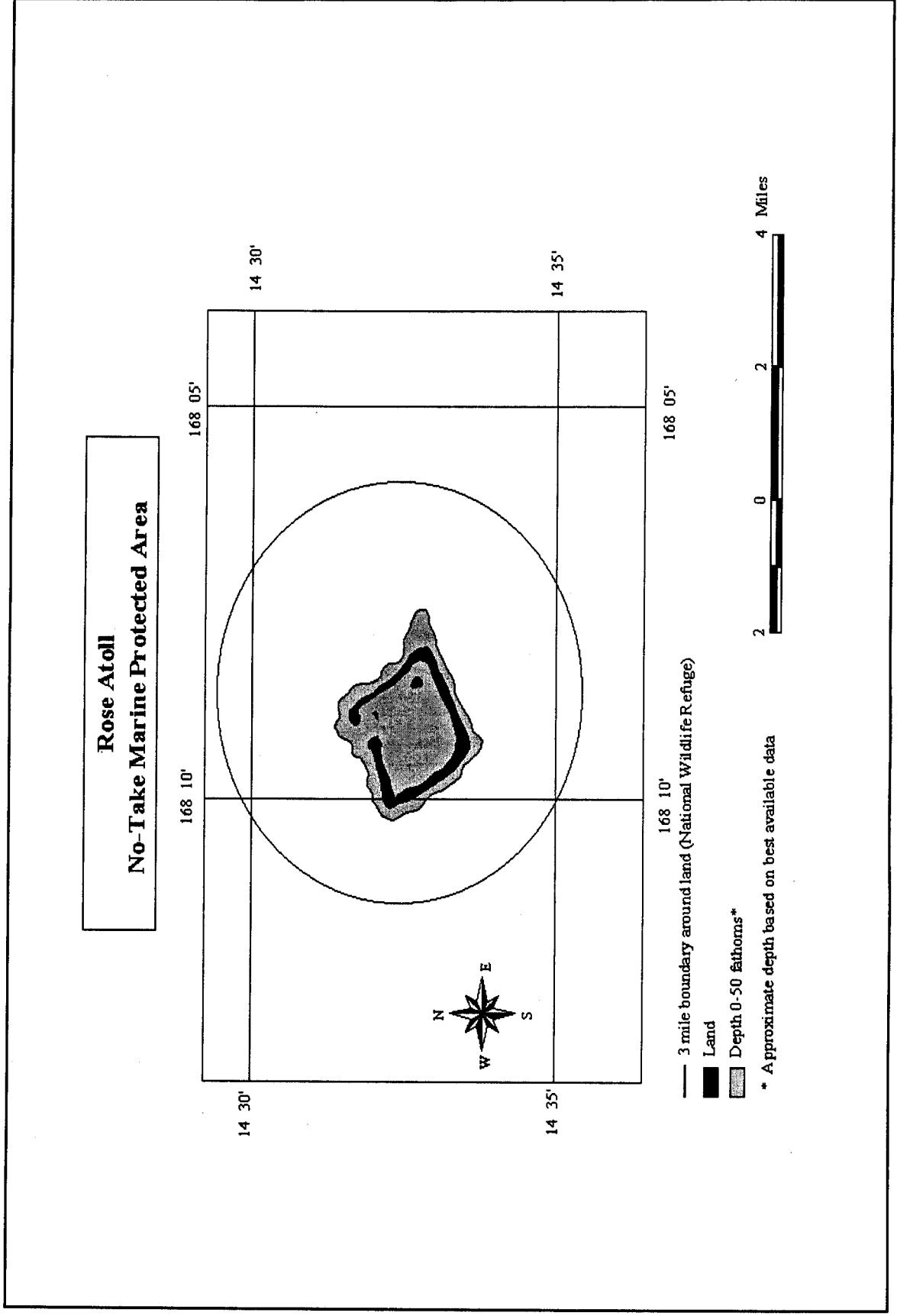
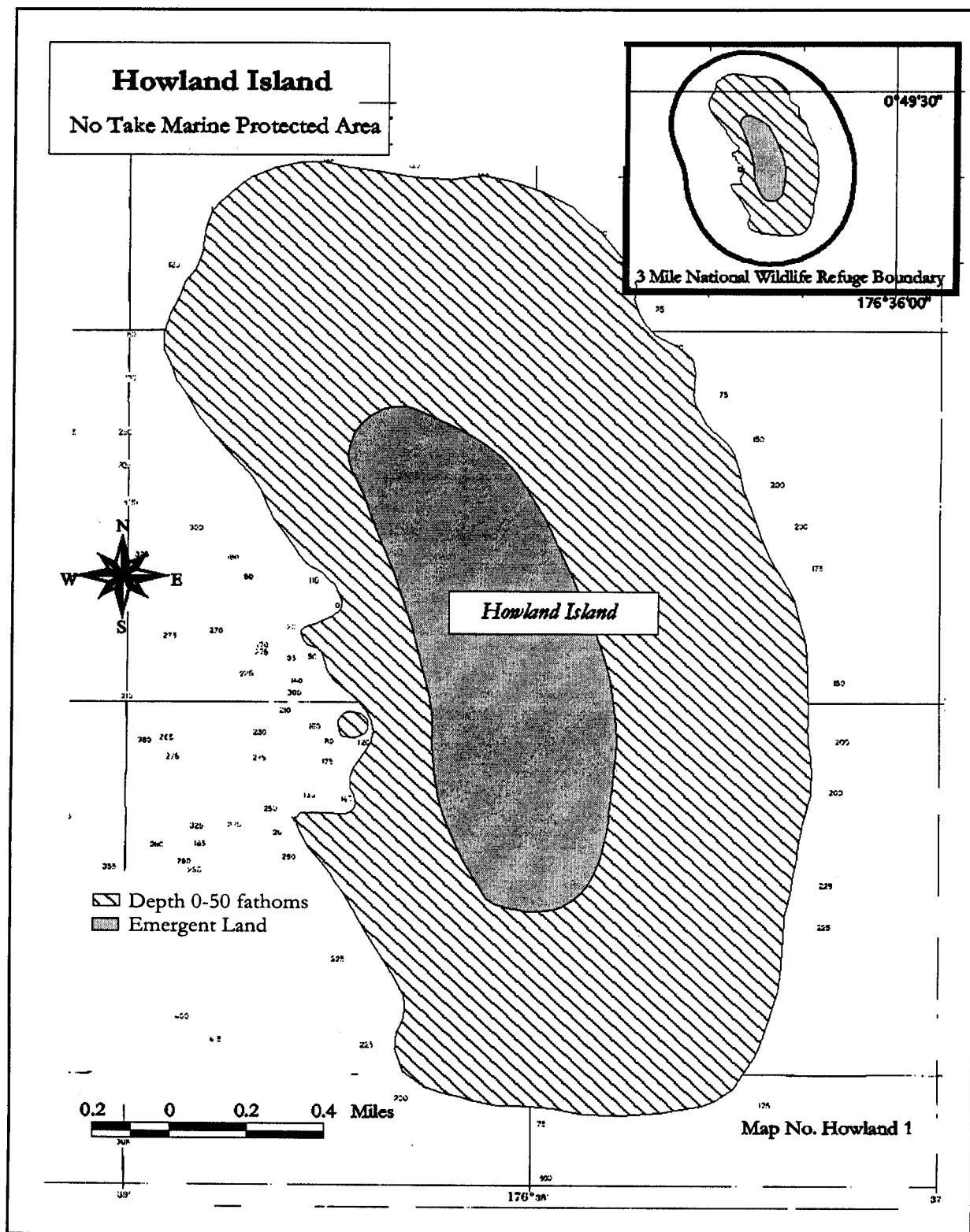


Figure 2.7: Howland Island Marine Protected Area.



Baker Island
No Take Marine Protected Area

3 Mile National Wildlife Refuge Boundary
0°10'59" 176°39'01"

Baker Island
Not For Navigational Use

Legend
Depth 0-50 fathoms
Emergent Land

Scale
0.5 Miles

Map No. Baker 1

Figure 2.9: Jarvis Island Marine Protected Area.

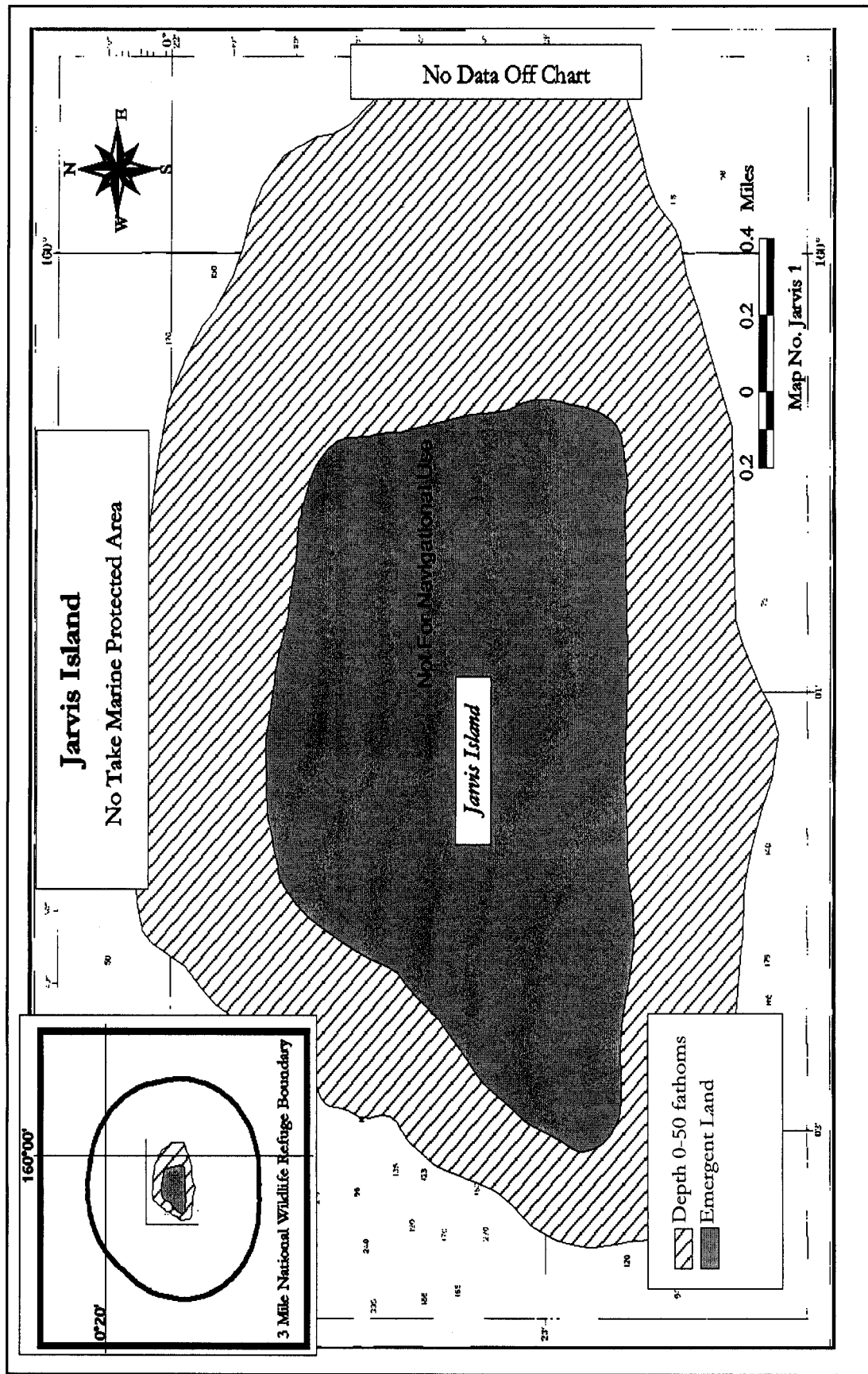


Figure 2.10: Kingman Reef Marine Protected Area.

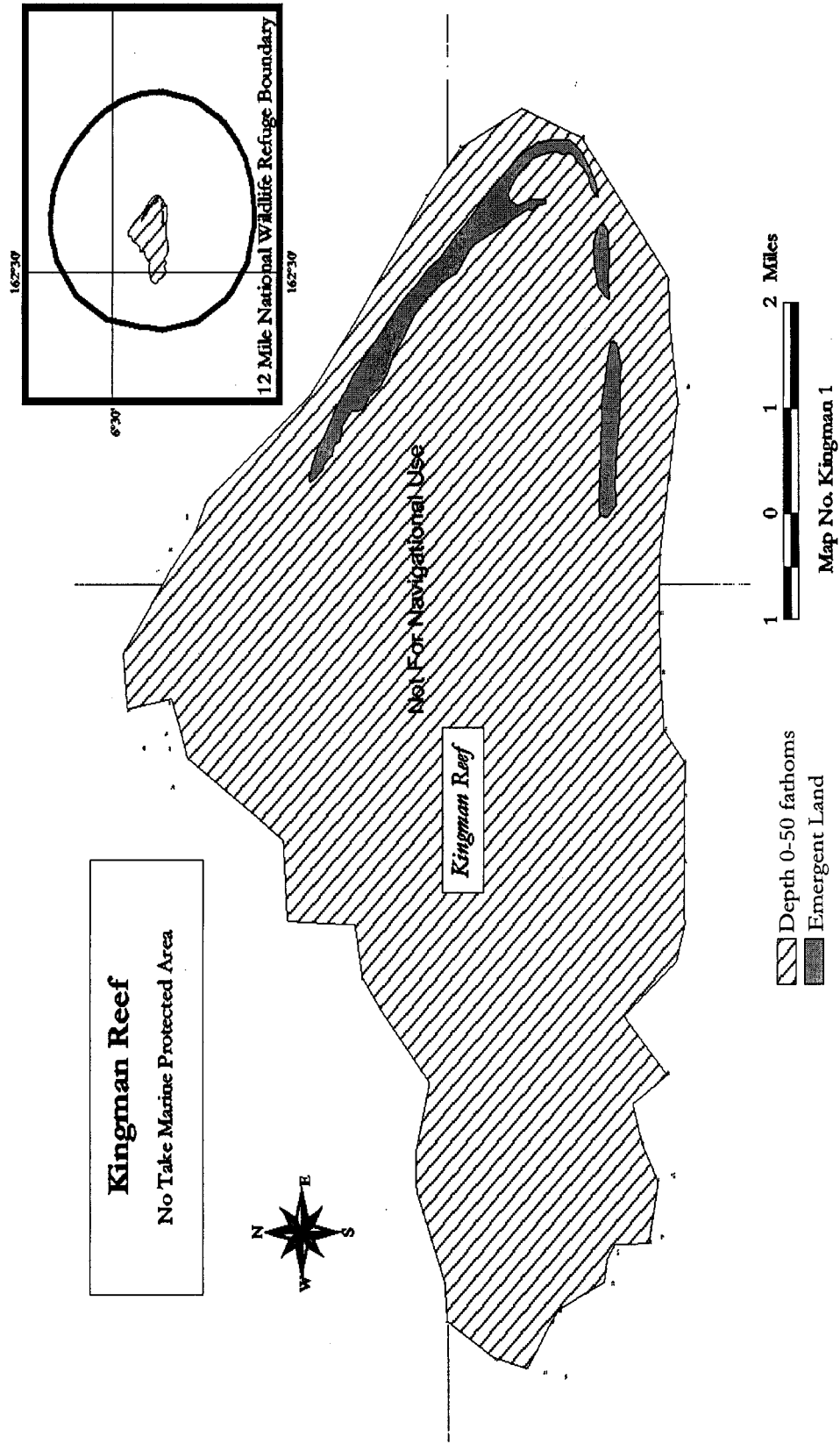


Figure 2.11: Palmyra Atoll Marine Protected Area.

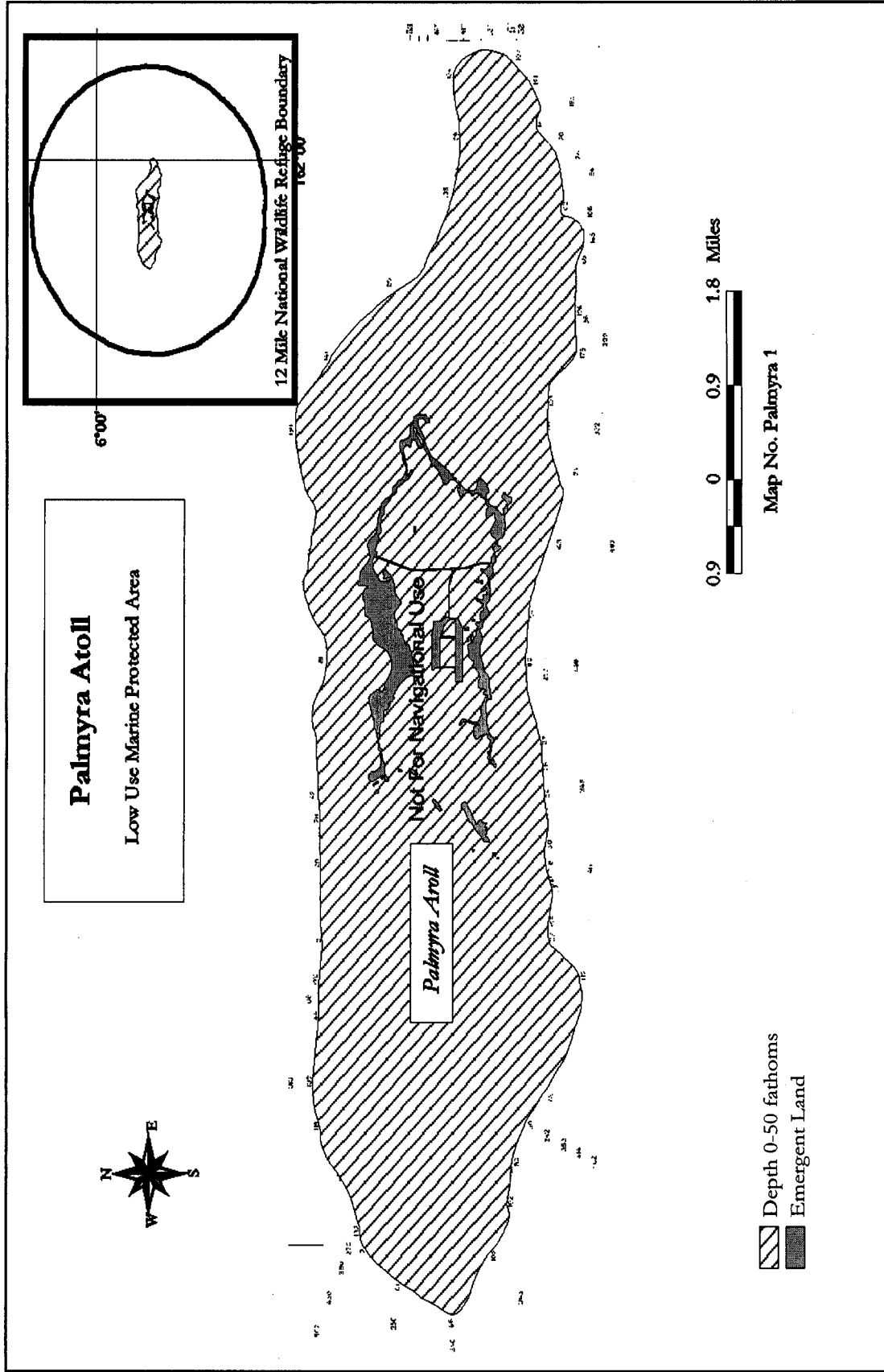


Figure 2.12: Wake Island Marine Protected Area.

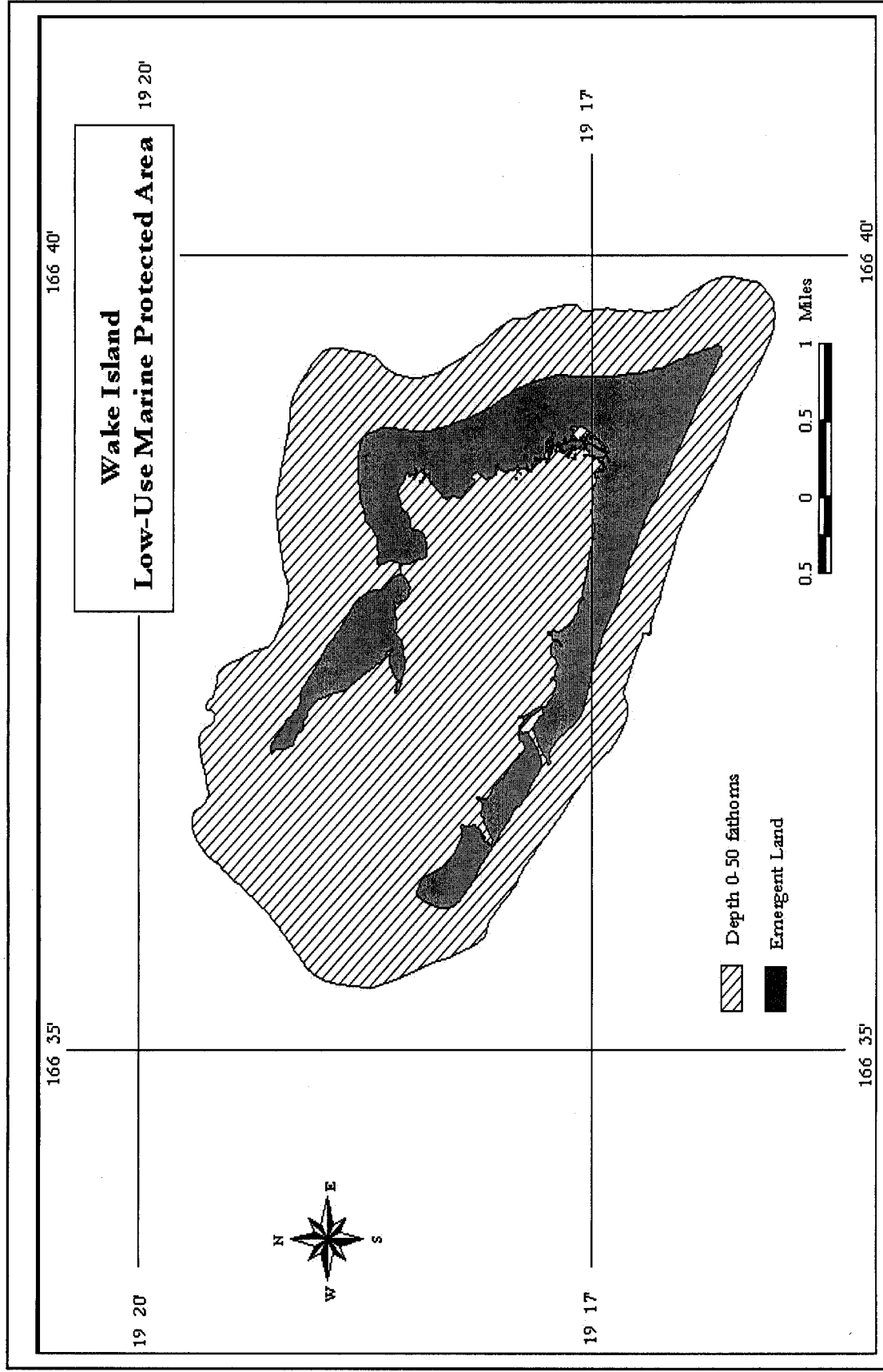


Figure 2.13 : Johnston Atoll Marine Protected Area.

