EXECUTIVE SUMMARY

ES.1 INTRODUCTION

This section summarizes the Environmental Impact Statement (EIS) for the Pelagic Fisheries of the Western Pacific Region in the following manner:

- The rationale for its preparation is first presented;
- Areas of controversy are then identified;
- Oceanographic processes affecting pelagic ecosystems and habitat are reviewed;
- The pelagic ecosystem and the status of stocks of targeted, non-targeted, and protected species are summarized;
- Domestic and foreign fisheries in the region are described and compared;
- The alternatives analyzed in this EIS and their potential to mitigate negative impacts on environmental resources are presented;
- The conclusions of the analyses are summarized; and
- Unresolved issues are identified.

ES.2 PURPOSE AND NEED FOR THIS EIS

This document analyzes the impacts on the human environment resulting from the management of U.S. pelagic fisheries under the Fishery Management Plan for the Pelagic Fisheries of the Western Pacific Region (Pelagics FMP). Although Environmental Assessments (EAs) were prepared pursuant to the National Environmental Policy Act (NEPA) for the original Pelagics FMP and many of its subsequent amendments, until now a comprehensive Environmental Impact Statement (EIS) considering all the environmental impacts caused by fisheries managed under this plan had not been produced. It has become clear that some of these impacts may be significant. Therefore, the purpose of this EIS is to provide not only a comprehensive overview of pelagic fisheries conducted under the FMP and their effects, but also to describe management actions that would mitigate these negative effects.

In addition, on August 4, 2000, the U.S. District Court, District of Hawai'i, issued an Order Further Amending Order Modifying Provisions of Order of Injunction (August Order) in Center for Marine Conservation (CMC) *et al.* v NMFS (Civ. No. 99-00152 DAE), requiring NMFS to take certain actions, including completion of an EIS by April 1, 2001. The schedule for preparation and filing of this EIS was carried out to comply with that order.

ES.3 AREAS OF CONTROVERSY

Areas of current controversy are addressed in this EIS by measures contained in various of the alternatives. The areas of controversy are broadly described below.

Interactions between longliners and protected species. CMC v NMFS has highlighted the issue of sea turtle mortality resulting from operations of the Hawai'i-based longline fishery. Resource managers and conservationists have also become concerned about seabird mortality that results when birds dive on the baited hooks being payed out from longline vessels during gear deployment.

Gear conflicts in American Samoa. The longline fishery in American Samoa employs relatively small *"alia"* catamarans. Local concern has focused on the possibility that if restrictions are placed on the Hawai'i-based longline fishery, some of these other larger longline vessels may move to American Samoa increasing the potential for gear conflicts and catch competition.

Data Availability. The quantity, quality and availability of fisheries and protected species interactions data are inadequate for many of the domestic fisheries subject to the Pelagics FMP. For the Hawai'i-based longline fishery this concern has focused on the adequacy of observer coverage. The lack of comparative data from foreign sources also hinders understanding of the effects of pelagic fisheries on protected species in the Western Pacific Region.

Appropriateness of Regulatory Measures. The injunction placed on the Hawai'i-based longline fishery as a result of the lawsuit filed by CMC heralded a new, and much more restrictive management of this fishery. Gear restrictions prohibiting shallow swordfish-style sets and time/area closures are both included in the Biological Opinion on the Authorization of Pelagic Fisheries under the Fishery Management Plan for the Pelagic Fisheries of the Western Pacific Region (Pelagics BO) for this fishery, are incorporated in NMFS' Preferred Alternative in this EIS and are likely to be implemented through subsequent regulations. Many Hawai'i-based fishers believe they are being unfairly singled out, considering the dominance of foreign-flag fleets in pelagic fisheries in the western and central Pacific Ocean. The Pelagics Biological Opinion extends the gear restrictions to general longline permittees across the entire Northern Hemisphere, potentially affecting three start-up ventures in Guam.

ES.4 OCEANOGRAPHY

Biological elements of the pelagic ecosystem are fundamentally dependent upon physical phenomena such as winds, tides and solar heating, and their effects on the pelagic habitat. Direct effects include other physical processes such as current patterns, upwelling, and the nature of the thermocline. Indirect effects include such things as nutrient enrichment in areas of upwelling or concentration of prey species in convergence zones.

Broad-scale oceanic circulatory patterns create both upwelling and convergence zones where productivity is enhanced. Circulation patterns in the Pacific Ocean are dominated by subtropical gyres rotating clockwise in the North Pacific and counterclockwise in the South Pacific. Spinning off from these flows are large and small eddies that create vertical fluxes, with regions of divergence (upwelling) where the thermocline shoals and deep nutrients are pumped into surface waters enhancing phytoplankton production, and also regions of convergence (downwelling) where the thermocline deepens. To the north of the Hawaiian and Marianas Archipelagoes, and also to the south of American Samoa, lie the subtropical frontal zones consisting of several convergent fronts located along latitudes 25°-40° N. and S. often referred to as the Transition Zones. To the south of the Hawaiian and Marianas Archipelagoes, and to the north of American Samoa, spanning latitudes 15° N.-15° S. lies the equatorial current system consisting of alternating east and west zonal flows with adjacent fronts. Such areas of high trophic transfer are important habitat for foraging, migration, and reproduction for many species, and these areas of enhanced productivity are targeted by fishers, typically the northern zones for swordfish, and the southern zones for tuna.

Near Hawai'i, there are two prominent frontal zones associated with two isotherms (17° C and 20° C), located at latitudes 32°-34° N. (the Subtropical Front or STF) and latitudes 28°-30° N. (the South Subtropical Front or SSTF). Both the STF and SSTF represent important habitats for swordfish, tunas, seabirds and sea turtles. Hawai'i-based longline vessels targeting swordfish set their lines where the fish are believed to be moving south through the fronts following squid, the primary prey of swordfish. Squid is also the primary prey item for albatross, hence the albatross and longline vessels targeting swordfish are often present at the same time in the same area of enhanced biological productivity.

The physical structure of the Pacific ocean is, however, far from static. Large-scale climatological events such as *El Niño* and *La Niña* and longer-term fluctuations, termed regime shifts, operating on decadal time scales affect oceanic circulation patterns, upwelling of nutrients and ultimately the productivity of the ecosystem. Such fluctuations may have profound effects on fisheries. For example, during an *El Niño* period the purse seine fishery for skipjack tuna shifts over 1,000 km from the western to the central equatorial Pacific. Recent regime shifts in the North Pacific have occurred in 1976 and 1989, with both physical and biological (including fishery) impacts. Recent years have also seen a strong *El Niño/La Niña* cycle.

In the pelagic environment, physicochemical conditions such as water temperature, salinity and oxygen content often determine whether or not a water mass is suitable for pelagic fish, and most species are associated with specific thermic regions. Some pelagic fish such as skipjack and yellowfin tuna, and blue marlin prefer warm surface layers, where the water is well mixed by surface winds and is relatively uniform in temperature and salinity. Other fish such as albacore, bigeye tuna, striped marlin and swordfish, prefer cooler, more temperate waters, often meaning they are preferentially found at higher latitudes or greater depths. Preferred water temperature often varies with the size and maturity of pelagic fish,

and adults usually have a wider temperature tolerance than sub-adults. Thus, during spawning, adults of many pelagic species usually move to warmer waters, the preferred habitat of their larval and juvenile stages. Tuna are commonly most concentrated near islands and seamounts that create divergences and convergences which concentrate forage species, also near upwelling zones along ocean current boundaries, and along gradients in temperature, oxygen and salinity. Swordfish and numerous other pelagic species tend to concentrate along food-rich temperature fronts between cold, upwelled water and warmer oceanic water masses.

These fronts represent sharp boundaries in a variety of physical parameters including temperature, salinity and chlorophyll, a measure of the standing crop of phytoplankton, the single-celled algae at the base of the pelagic food web. The dense cooler phytoplankton-rich water sinks below the warmer water creating a convergence of phytoplankton. Buoyant organisms, such as jellyfish (a significant sea turtle prey) as well as vertically swimming zooplankton, can maintain their vertical position in the weak down-welling, and aggregate in the front to graze on the down-welled phytoplankton. The increased level of biological productivity in these zones attracts higher trophic-level predators such as swordfish, tunas, seabirds, and sea turtles.

These frontal zones have also been found to be likely migratory pathways across the Pacific for loggerhead turtles. Loggerhead turtles are opportunistic omnivores that feed on floating prey such as the pelagic cnidarian *Vellela vellela* ("by the wind sailor"), and the pelagic gastropod *Janthia sp.*, both of which are likely to be concentrated by the weak downwelling associated with frontal zones.

ES.5 ECOSYSTEM AND STOCKS

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

Pelagic Management Unit Species

The Pelagics FMP focuses its management efforts on a suite of "management unit species" (PMUS). These species have been assigned to species assemblages based upon the ecological relationships among species and their preferred habitat. The species complex designations

for the PMUS are marketable species, non-marketable species, and sharks [Table 3.3-1]. The marketable species complex has been subdivided into tropical and temperate assemblages. The temperate species complex includes those PMUS that are found in greater abundance in higher latitudes as adults including swordfish, bigeye, bluefin and albacore tuna, striped marlin and pomfret. The tropical species complex includes all other tunas and billfish as well as *mahimahi*, wahoo, and *opah*. Included in these assemblages are the species targeted by pelagic fisheries in the region, but the fisheries affect many other, non-targeted species as well as a variety of protected species.

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

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

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

None of the PMUS stocks in the Pacific are known to be overfished, although concern has been expressed for several species, and data are unavailable for others. Trends in overall catch and size composition of animals comprising the Hawai'i landings indicate that the swordfish population that supports the fishery within the Council's jurisdiction appears to be capable of sustaining current levels of effort.

Blue marlin stocks are of concern to recreational trollers and charter fleets. Various recent analyses characterize the blue marlin population as stable and close to that required to support average maximum sustainable yield (AMSY). Little is known about the status of stocks of striped marlin, black marlin, short-billed spearfish or sailfish.

Because of their primary importance in many of the pelagic fisheries, more is known about tuna stocks. Most indicators suggest a reduction of bigeye tuna biomass in the past several years although biomass in the eastern Pacific seems to have stabilized. Although some analyses suggest that current levels of harvest may exceed MSY the stock is well above minimum sustainable stock threshold (MSST) and is therefore not overfished. The current population size is probably approximately at a level that can support AMSY. Recently, increased concern has arisen about the status of the stock in the face of large catches of juvenile tuna being taken from around floating objects in the equatorial regions of the Pacific.

Albacore stocks appear to be in good condition and are experiencing moderate levels of exploitation. Neither the northern nor southern stocks are regarded as overfished and current catches are likely to be sustainable.

Yellowfin tuna catch rates in the major industrial fleets (purse seine and longline) show "flat" trends and, in general, the Pacific yellowfin stock appears to be in good condition and current catch levels are considered sustainable.

Bluefin tuna are slower to become sexually mature than other species of tuna and they reproduce in a more limited portion of the Pacific than other tuna species. This makes them more vulnerable to overfishing.

All recent analyses indicate that harvest ratios for skipjack tuna are appropriate for maintaining current catch levels and that overall the stocks are very healthy. Although local depletions and variability may occur in response to local environmental conditions and fishing practices, the overall stock is healthy and can support existing levels of fishing .

Non-target Species

Pelagic fisheries catch a number of non-target species, both PMUS and non-PMUS. This is particularly true for the longline fishery. NMFS observers recorded more than 60 different species caught by the Hawai'i-based longline fleet between 1994 and 1997. Of significance are the 85,523 sharks caught by the fleet in 1997, of which the majority (approximately 95 percent) were blue sharks. Up until about five years ago, most sharks caught by pelagic longline gear were released alive. However, as a result of the growing demand for shark fins in Asian markets the practice of shark finning increased during the late 1990s. This practice is now prohibited as defined in the Shark Finning Prohibition Act. About one percent of the sharks, mainly mako and thresher, are retained for later sale.

Sea Turtles

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

All five sea turtle species of concern forage in the waters surrounding the Hawaiian Archipelago. Leatherbacks and loggerheads, however, are the species of principal concern with regard to incidental take in the Hawai'i-based pelagic longline and other commercial fisheries of the Pacific. These fisheries are conducted mainly by Japan, Taiwan, Spain, Korea, and, to a lesser extent, the United States. It is estimated that on average about 570 million longline hooks are set by all fleets in the Pacific each year. The Hawai'i-based longline fishery sets on average 14.3 million hooks per year. Between 1991 and 1998, there were no interactions with hawksbill turtles recorded by fisheries observers monitoring the Hawai'i-based pelagic longline fleet, and green sea turtles have been infrequently encountered.

The dramatic decline over the last decade in the number of leatherbacks nesting annually leads to the conclusion that the leatherback turtle is now on the verge of extinction in the Pacific Ocean. Primary threats to the species are the incidental killing of turtles by coastal and high seas fishing and to a lesser extent the killing of nesting females and collection of eggs at the nesting beaches. There are no nesting populations of the leatherback turtle in areas under U.S. jurisdiction in the Pacific; however, there are important foraging areas off the west coast of the continental United States and on the high seas near the Hawaiian islands.

The diet of the leatherback turtle generally consists of cnidarians (i.e., medusae and siphonophores) in the pelagic environment. Leatherbacks have the most extensive range of any living reptile and have been reported circumglobally from latitudes 71° N. to 42° S. in the Pacific and in all other major oceans. In a single year a leatherback may swim more than 10,000 km. They lead a completely pelagic existence, foraging widely in temperate waters except during the nesting season, when gravid females return to beaches to lay eggs. Typically leatherbacks are found in convergence zones and upwelling areas in the open ocean, along continental margins, and in archipelagic waters. Hawai'i fishers in offshore waters commonly see leatherback turtles, generally beyond the 100 fm curve but within sight of land. Two areas where sightings often take place are off the north coast of O'ahu

and the west coast of the Island of Hawai'i. The pelagic zone surrounding the Hawaiian Islands is apparently regularly used as foraging habitat and migratory pathways for this species. Further to the north of the Hawaiian islands, a high seas aggregation of leatherback turtles is known to occur at 35° N. latitude, between 175° W. and 180° longitudes (NMFS, 1991).

The loggerhead turtle is listed as a threatened species throughout its range, primarily due to incidental mortality associated with commercial fishing operations and the alteration and destruction of its habitat. It is a cosmopolitan species found in temperate and subtropical waters and inhabiting continental shelves, bays, estuaries and lagoons. Major nesting grounds are generally located in warm temperate and subtropical regions, generally north of 25° N. or south of 25° S. latitude in the Pacific Ocean. For their first several years of life, loggerheads forage in open ocean pelagic habitats. Both juvenile and subadult loggerheads feed on pelagic crustaceans, mollusks, fish, and algae. As they age, loggerheads begin to move into shallower waters, where, as adults, they forage over a variety of benthic hard- and soft-bottom habitats (reviewed in Dodd, 1988). Satellite telemetry studies show that loggerhead turtles tend to follow 17° and 20° C sea surface isotherms north of the Hawaiian islands.

The olive ridley turtle is listed as threatened in the Pacific, except for the Mexican nesting population, which is listed as endangered, primarily because of over-harvesting of females and eggs. The olive ridley is one of the smallest living sea turtles (carapace length usually between 60 and 70 cm) and is regarded as the most abundant sea turtle in the world. Since the directed take of sea turtles was stopped in the early 1990s, the nesting populations in Mexico appear to be recovering, with females nesting in record numbers in recent years. In 1996, the primary nesting beach at La Escobilla in Oaxaca sustained over 800,000 nests. There is some discussion in Mexico that the species should be considered recovered. The olive ridley turtle is omnivorous and identified prey include a variety of benthic and pelagic items such as shrimp, jellyfish, crabs, snails, and fish, as well as algae and sea grass (Marquez, 1990).

Green turtles in Hawai'i are genetically distinct and geographically isolated which is uncharacteristic of other regional sea turtle populations. Both the nesting population and foraging populations of green turtles in Hawai'i appear to have increased over the last 17 years.

The hawksbill turtle is listed as endangered throughout its range. In the Pacific, this species is rapidly approaching extinction primarily due to the harvesting of the species for its meat, eggs and shell, as well as the destruction of nesting habitat by human occupation and disruption. There are no reports of interactions between this species and the Hawai'i-based longline fishery, although the potential for interaction exists. Hawksbills have a relatively unique diet of sponges.

Seabirds

Pelagic fisheries in the region also interact with seabirds, with the Hawai'i-based longline fishery resulting in the annual mortality of thousands of protected black-footed and Laysan albatross that nest on the Northwestern Hawaiian Islands (NWHI). Seabirds follow longline vessels and dive on the baited hooks, become hooked and subsequently drown. It is estimated that between 1994 and 1999, an average of 1,330 Laysan albatross and 1,743 black-footed albatross were killed in the Hawai'i-based longline fishery each year. The average annual incidental catches of black-footed and Laysan albatross in the Hawai'i longline fishery (based upon NMFS statistical analysis) represent about 0.45 and 0.06 percent of the total estimated populations of these species, respectively. Data collected by NMFS observers show that when Hawai'i-based longline vessels target swordfish the incidental catch of seabirds (0.758 bird catch/set) is far higher than when vessels target tuna (0.013 bird catch/set). One reason for this difference in catch rates is that vessels targeting swordfish are more likely to operate within the foraging range of the seabirds. The region of greatest interactions between seabirds and the Hawai'i-based longline fleet is a latitudinal band from 25° N. to 40° N., from the dateline to about 150° W. longitude.

A third species of albatross, the short-tailed albatross, also forages in the area and has been determined to be affected by these fisheries. It has been shown to be extremely vulnerable to mortality in demersal longline fisheries in other parts of the world. The short-tailed albatross is listed as endangered in all parts of its range under the ESA. Although no short-tailed albatross has been reported taken in the Hawai'i-based longline fishery, seven short-tailed albatross have been killed in longline fishery interactions in Alaska (NMFS, 1998b), raising concerns that similar mortality could occur in the Hawai'i-based fishery, notwithstanding the significant differences between the fisheries. Consultation under Section 7 of the ESA was initiated by NMFS in 1999, after a short-tailed albatross was seen flying over a research vessel engaged in swordfish longlining operations in 1997. The consultation was initiated to determine the effects of the Hawai'i-based longline fleet on the short-tailed albatross. This consultation was concluded on November 29, 2000, with the issuance of a Biological Opinion (BO) by the Fish and Wildlife Service (FWS, 2000). The BO concluded that the level of take in the Hawai'i-based longline fishery is not likely to jeopardize the species, but did specify a number of 'reasonable and prudent measures' to be implemented by the fleet to minimize and monitor takes and to ensure survivability of injured birds. These measures have been incorporated into the alternatives in place of the optional deterrent measures described in the DEIS. The BO is described more fully in Chapter 2.

Marine Mammals

Pelagic fisheries in the region also occasionally interact with cetaceans, some of which are endangered. Cetaceans listed as endangered under the ESA and that have been observed in the Western Pacific Region include the humpback whale, sperm whale, blue whale, fin

whale and sei whale. In addition, one endangered pinniped, the Hawaiian monk seal, occurs in the region.

ES.6 DOMESTIC FISHERIES MANAGED UNDER THE PELAGICS FMP

The Western Pacific Regional Fishery Management Council (Council) develops management measures for fisheries in the Exclusive Economic Zones (EEZ) surrounding the state of Hawai'i, the territories of American Samoa and Guam, the Commonwealth of the Northern Mariana Islands (CNMI), and several islands and atolls that are U.S. possessions under direct federal jurisdiction (referred to collectively as the Pacific remote island areas, or PRIAs)[1]. The dominant domestic fishery managed under the Pelagics FMP is the Hawai'i-based longline fishery; the pole-and-line fishery was historically dominant in Hawai'i but has declined in recent years. U.S. purse seiners, usually based outside the region (but delivering catches to canneries in American Samoa), sometimes fish in the EEZs around the PRIAs and American Samoa. The purse seine fishery is not discussed in detail here because it has not raised any major management issues that can be addressed by the Council. In the western and central Pacific Ocean, U.S. purse seiners fish in a number of foreign EEZs, on the high seas, and to a limited extent within the U.S. EEZs around the PRIAs and American Samoa. Their operations are regulated under the *Treaty on Fisheries Between the Governments of Certain Pacific Island States and the Government of the United States of America* (SPTT).

The other main domestic fishery types in the Council region are troll and handline. Fishery participants using these gear types may be recreational fishers, charter boats or commercial operations. The recreational sector overlaps somewhat with the commercial due to so-called "expense" fishers, who sell some proportion of their catch to cover operating costs. Table ES-1 summarizes 1998 landings by fishery type and area. Section 3.10 describes these fisheries in greater detail. As can be seen from the table, the Hawai'i-based longline fishery is by far the largest, with troll fisheries a distant second. Within the Council region, Hawai'i accounts for the most landings, even when the longline fishery is left out of the equation. It is worth noting that the total domestic catch for these fisheries, which broadly reflects fishing effort, is quite small (less than one percent) in comparison to the 1,719,000 mt western Pacific total.

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

Table ES-1: Domestic pelagic fishery landings in the Council region, 1998 (in metric tons). Source: WPRFMC, 1998.

Fishery	Area				
	American Samoa	Guam	Hawai'i	CNMI	Total
Longline	401	0	12,961	0	13,362
Troll	11	371	992*	87	1,462
Pole-and-line	0	0	316	0	316
Handline	0	0	482*	0	482
Other	0	0	598	0	598
Total	**412**	**371**	**15,349**	**87**	**16,220**

*MHI only

The Council's Pelagics FMP was implemented in 1987, replacing a Preliminary Fishery Management Plan (PMP) promulgated by the Secretary of Commerce and implemented in 1980. Effective pelagic fishery management was difficult at that time because the United States did not recognize coastal state jurisdiction over tuna species. Management authority extended only to non-tuna "highly migratory species," primarily billfish that were for the most part incidentally caught in the distant-water longline fisheries. Despite this lack of jurisdiction, foreign fishing largely ceased in the Council region EEZs with implementation of the PMP. U.S. tuna policy changed in 1992 with an amendment to the 1976 Fishery Conservation and Management Act recognizing jurisdiction over tuna; later that year Amendment 6 to the Pelagics FMP brought tuna under FMP management. (For a more comprehensive description of Pelagics FMP management measures and a chronological listing and description of amendments see Appendix L.)

Most management measures implemented since creation of the Pelagics FMP are in response to the rapid growth in the number of fishing vessels registered for use under a Hawai'i longline limited access permit (hereinafter referred to as Hawai'i-based longline vessels), which began soon after FMP implementation in 1987. This growth resulted primarily from an influx of vessels leaving mainland U.S. fisheries, and in particular, from the arrival of a fleet of converted shrimp trawlers from the Gulf of Mexico. Between 1987 and 1991, when an emergency rule established an entry moratorium (later converted to a limited entry program by Amendment 7), the number of active vessels in the Hawai'i-based longline fishery increased more than four-fold. In addition, the incoming vessels were larger and had more fishing capacity than older Hawai'i-based vessels. Until that time, the Hawai'i-based longline fleet primarily targeted tropical tunas for local consumption and export to the Japanese *sashimi* market. The new entrants to the Hawai'i-based longline fishery principally targeted swordfish in waters to the north of the EEZ around Hawai'i; this segment grew rapidly with landings peaking in 1993 at more than 5,900 mt, or about two-fifths of the approximately 14,000 mt total North Pacific swordfish landings in that year (Cousins *et al.*, 2000). Most swordfish landings are exported from Hawai'i, with the largest share going to the U.S. East Coast.

ES.7 FOREIGN FISHERIES IN THE CENTRAL AND WESTERN PACIFIC

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

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

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

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

Longline fisheries usually target tuna or swordfish. Tuna longlining is characterized by day fishing at moderate depths (100-250 m) to target albacore and yellowfin, or deeper depths (250-400 m) to effectively target bigeye tuna (Hanamoto, 1976; Boggs, 1992). The Japanese longline fleet had mainly targeted albacore for canning until the early 1970s. These longliners deployed "conventional" longline gear of 4 to 6 hooks between floats (HBF) fishing a depth of approximately 90-150 meters. In the early 1970s longliners changed to 'deep' sets by placing more hooks between longline floats. The deeper longline gear was more effective in catching bigeye tuna and the fleet shifted activities in waters near the equator where the thermocline is shallower.

In addition to the sector of the Hawai'i-based longline fishery which targets swordfish, there are several foreign fleets (e.g., longline, gillnet and harpoon) that target swordfish in the

Pacific. While most of the foreign longline effort targets tuna species, the shallower swordfish longlining has a higher incidence of encountering a protected or endangered species. Foreign longline fisheries specifically targeting swordfish occur in Japan, Chile and Australia. Fishing methods by the Japanese swordfish fleets are similar to the Hawai'i fleet: night fishing with three or four branchlines between each float which results in a shallow gear configuration.

ES.8 ALTERNATIVES

The National Environmental Policy Act requires that an EIS should propose a reasonable range of alternative actions in line with management objectives, to be explored and rigorously evaluated. Alternatives must include the "no action" alternative that projects the continuation of current management actions without change. The environmental consequences of each alternative are then evaluated and a preferred alternative is identified. Current issues related to management of fisheries under the Pelagics FMP predominantly focus on the Hawai'i-based longline fishery, and consequently the alternatives focus predominantly on strategies to minimize the impacts of this fishery on environmental resources.

The alternatives identified and constructed for this EIS may thus be considered amalgamations of mitigation measures having various degrees of efficacy in alleviating undesirable consequences of the fisheries. This is true even for Alternative 1, which represents the fisheries prior to the court ordered injunction under CMC v NMFS. The various components of Alternative 1 represent mitigation measures devised in the resolution of past issues, and include permit, logbook, observer, and gear marking requirements, a satellite vessel monitoring system (VMS), a cap on effort by limiting the number of permits available to the fishery and limits on the size of participating vessels, and closure of areas around the main Hawaiian Islands and the Northwestern Hawaiian Islands to minimize gear conflicts and catch competition with other fisheries and interactions with the Hawaiian monk seal, respectively. Alternative 1 serves as the base case for the Hawai'i-based longline fishery, and the effectiveness of each of the other alternatives for the Hawai'i-based longline fishery is measured against this base case.

Even prior to the current lawsuit and filing of the injunction, however, the Pelagics FMP management regime was not static. A number of management measures affecting this and other pelagic fisheries were being developed and implemented by NMFS, the Council and other agencies. This suite of measures forms the basis of Alternative 2 and represents the evolutionary direction that would have been followed in the absence of other pressures. Some of these measures continued to evolve during the period between filing of the Draft EIS and this Final EIS, and therefore Alternative 2 has been updated to reflect these changes. The changes include (1) replacement of the former optional seabird deterrent measures with obligatory reasonable and prudent measures in the Terms and Conditions of Fish and Wildlife Service's Biological Opinion of the longline fleet's impact on the short-tailed albatross; and (2) recognition of the effect of recently passed federal legislation amending

the Magnuson-Stevens Act to prohibit shark finning. The base case measures included in Alternative 1 and the additional measures in Alternative 2 are also made a part of Alternatives 4-7 and 10. The latter five alternatives have in addition various combinations of gear restrictions and time/area closures to improve mitigation potential by varying degrees. Alternative 10, NMFS' Preferred Alternative, adds to the basic mitigation measures described above gear restrictions, a time/area closure, minimum levels of observer coverage, and a permit-vessel decoupling restriction as presently understood to be a part of the Pelagics BO.

Three other alternatives are analyzed. Alternative 3 represents the current status quo under the terms of the court ordered injunction and Alternative 8 reflects a complete closure of the Hawai'i-based longline fishery. Alternative 9 is a unique alternative, designed to address several issues developing about other pelagic fisheries in the region, including potential gear conflicts around American Samoa, data collection and reporting in the PRIAs, and catch competition between fisheries throughout the region. Alternative 9 could be implemented in combination with any of the other alternatives.

In addition to the ten alternatives, a fishing experiment, Option A, is described that would rigorously explore several gear and operational variables with the intention of developing exportable technologies for shallow set swordfishing that would minimize interactions with sea turtles. Option A could be implemented in combination with Alternatives 1-2, 4-7, 9 and 10.

The ten alternatives plus option A are summarized as follows:

Alternative 1: Pelagics FMP (No Action - the pre-injunction baseline).

Alternative 2: Council-proposed adjustments to the Pelagics FMP (or similar NMFS measures).

Alternative 3: Pelagics FMP management regime as modified by Court-ordered actions resulting from CMC v NMFS (current status quo).

Alternative 4: Closure of areas north of 29° N. latitude to Hawai'i-based longline fishing from July through January of every year; and implementation of the pending actions from Alternative 2.

Alternative 5: Requirement for Hawai'i-based vessels to use line-shooters and/or weighted branch lines when setting longline gear, and implementation of the pending actions from Alternative 2.

Alternative 6: Closure of areas north of 29° N. latitude to longline fishing by Hawai'i-based vessels at all times, and closure of all areas to longline

fishing by Hawai'i-based vessels during the months of April through July; and implementation of the pending actions from Alternative 2.

Alternative 7: Requirement for Hawai'i-based vessels to use line shooters and/or weighted branch lines when setting longline gear, and closure of all areas to longline fishing by Hawai'i-based vessels during April and May of every year; and implementation of the pending actions from Alternative 2.

Alternative 8: Prohibition of longline fishing by domestic vessels in the western Pacific EEZ and prohibition of the landing of longline-caught pelagic fish by domestic vessels at U.S. ports in the Western Pacific Region.

Alternative 9: Analysis of the limited effort alternatives for American Samoa's longline fishery, preparation and implementation of a comprehensive research plan to evaluate the potential for catch interactions among Pelagics FMP-managed fisheries in the EEZs around all U.S. Pacific island areas, and imposition of permit and reporting requirements for pelagic fisheries in the PRIAs.

Alternative 10: (Preferred Alternative) Prohibition of swordfish-style (shallow set) gear north of the equator, an April-May closure of an area extending from the equator to 15° N., bounded by longitudes 145° W. and 180°, and limitation of opportunities to seasonally decouple a permit and a vessel; and implementation of the pending actions from Alternative 2.

Option A: (could be added to any of Alternatives 1-2, 4-7 or 10) Limited fishing experiments under a Section 10 ESA permit in areas and times or with deployment of gear otherwise prohibited in the Hawai'i-based longline fishery. Depending on the design of the experiment, the sea turtle take reduction specified for any of Alternatives 1-2, 4-7 or 10 might be temporarily exceeded.

ES.9 EFFECTIVENESS OF THE ALTERNATIVES AS MITIGATION

The impacts on the human environment resulting from implementation of each of the alternatives and their respective effectiveness in mitigation of impacts to turtles and seabirds are summarized in Table ES-2.

Table ES-2: Effectiveness of the Alternatives as Mitigation.

Indicator	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7	Alt. 8	Alt. 10
No. of Vessels	119	118	77	115	94	86	85	0	92
No. of Crew	610	605	417	591	517	445	468	0	504
Total Fishery Gross Revenue ($M)	40.7	40.9	24.1	39.6	30.6	29.1	26.8	0.0	29.6
Loggerhead Mortalities	87	87	19	45	0	32	0	0	0
% Change	0	0	-78.5	-47.9	-100.0	-63.0	-100.0	-100.0	-100.0
Leatherback Mortalities	9	9	3	8	4	2	2	0	2
% Change	0	0	-63.7	-19.1	-61.2	-77.5	-77.9	-100.0	-83.6
Olive Ridley Mortalities	49	49	40	52	24	39	22	0	19
% Change	0	0	-17.5	+6.5	-51.1	-19.5	-55.1	-100.0	-60.6
Green Mortalities	5	5	3	5	2	3	1	0	1
% Change	0	0	-41.7	-6.1	-55.6	-36.3	-82.5	-100.0	-88.0
Black-footed Albatross Mortalities	1,283	152	250	128	13	128	11	0	15
% Change	0	-88.2	-80.5	-90.1	-99.0	-90.1	-99.1	-100.0	-98.9
Laysan Albatross Mortalities	952	140	156	94	5	94	5	0	6
% Change	0	-85.3	-83.7	-90.2	-99.4	-90.2	-99.5	-100.0	-99.4

Notes: Figures represent rounded values; percentages are calculated on raw numbers. Values for Alternatives 3, 5, 7 and 10 are means of switching and non-switching scenarios. Alternative 9 is not anticipated to have quantifiable effects on the longline fleet and is therefore not included in this comparison. Similarly, because Option A is not fully specified, the additional impacts that could result from its implementation are not estimated here.

ES.10 CONCLUSIONS

An examination of Table ES-2 reveals several conclusions. Alternative 1, as the baseline, has the highest mortalities of sea turtles and seabirds. Obviously, Alternative 8, which terminates the fishery, eliminates all takes of targeted, non-targeted and protected species. Alternative 2, by incorporating the reasonable and prudent seabird deterrent measures from the STAL BO, in comparison with Alternative 1, reduces seabird mortalities by nearly an order of magnitude. Even greater reductions of seabird mortalities are projected in alternatives 4-7 and 10 due to imposition of the seabird deterrent measures in concert with various gear restrictions and time/area closures.

Alternatives 5, 7 and 10 are predicted to completely eliminate mortalities of loggerhead turtles through elimination of the swordfish component of the fishery as it has been practiced. Alternative 3, the current injunction, also greatly reduces loggerhead mortalities. Alternatives 4 and 6 which have time/area closures, but do not eliminate shallow sets, are markedly less effective in avoiding loggerhead mortalities. Alternatives 3, 5-7 and 10 are

predicted to reduce leatherback mortalities by about 60-85 percent, with the preferred alternative (10) showing the greatest potential. Of the action alternatives, Alternative 4 is the least effective in avoiding leatherback mortalities. On a percentage basis, olive ridley mortalities are the least effectively mitigated by the alternatives in general, but the preferred alternative appears the most effective of those analyzed with about a 60 percent potential reduction. Alternative 10 also appears to offer the greatest reduction in green turtle mortalities.

Economic impacts to the fishery are least for Alternatives 2 and 4, and greatest for Alternative 8. In between these extremes, the reduction in gross revenues range from about 41 percent under the current injunction (Alternative 3) to about 25 percent for Alternative 5. The projected decrease in gross revenues for the preferred alternative is about 27 percent.

The impacts of the measures to reduce turtle interactions proposed under Alternatives 2-7 and 10 will be concentrated among swordfish vessels. These vessels, in turn, are closely associated with a single ethnic or sociocultural group - Vietnamese Americans. The negative economic and social effects of Alternatives 3, 5-7 and 10 on some Vietnamese American owners, captains and crew of swordfish vessels and Vietnamese Americans operating shoreside fishing support businesses would be immediate and substantial.

ES.11 ISSUES TO BE RESOLVED

The purpose of an EIS is to attempt to describe, as best we can, impacts of a range of alternatives to a proposed action so that decisionmakers are aware of the environmental consequences of the respective alternatives and can make an informed decision regarding the Preferred Alternative. The issues to be resolved may involve administrative approvals or evolution of management policy, but ultimately the scientific basis of the comparison of the alternatives is crucial to the validity of the decision.

The analysis presented in this EIS uses the best available population and economic models to project very specific consequences of selected sets of management measures assembled into a range of alternatives. The universe of alternatives, however, is infinite. Preliminary modeling for this EIS compared more than 300,000 possible combinations of management maesures. Impacts to turtle and seabird populations were projected, as were the consequences for the participants in the fisheries and related industries. The foundation of these projections is the body of knowledge about the nature of the actions to be regulated, the environmental resources at risk, and the effects of their interactions. While the proposed action can be described in some detail, considerable uncertainty exists in our understanding of critical aspects of the potentially affected resources. Numerous assumptions are required. The conclusions reached on the basis of this EIS must be drawn in the light of the uncertainties in the underlying knowledge of the resources at risk and the validity of the assumptions used to fill the gaps in our current state of knowledge. The present analysis required numerous assumptions about pelagic resources in the Western Pacific Region,

about how fisheries interact with those resources, and how modifications of management policies might modify the nature, frequency or severity of their interactions. Areas of significant uncertainty in our biological knowledge and in our understanding of the effects of proposed management measures are described below.

Stock assessment uncertainty: Estimates of population size and structure are based on limited data, almost all of which are derived from measuring catches of targeted species and looking for data that show how the population is responding to fishing pressure. Our knowledge of the population dynamics of targeted species is inferred, and of non-targeted species offen nonexistent.

Sea turtle biology. As is the case for fish stocks, our current understanding of sea turtle biology has significant gaps. Population size, age structure and movement patterns are not well understood, complicating our assessment of the impacts of changes to the management regime.

Seabird biology. Our current understanding of seabird biology also has significant gaps. Demographic information, breeding population estimates, population size and age structure are all matters of conjecture to one extent or another.

Sea turtle mortality after interactions with fisheries. The estimated mortality rates associated with the types of interactions (entangled, lightly hooked, deeply hooked, etc.) are based upon very limited information and numerous assumptions. The same mortality estimates are being applied to all species of sea turtles in the absence of species-specific post-hooking mortality data.

Foreign fleet bycatch data. Data on the bycatch of turtles and seabirds by foreign fleets fishing in the North Pacific outside the U.S. EEZ are unavailable.

Displacement of fishing effort and impacts to other areas. If Hawai'i-based longline fishing is curtailed or operations restricted, some vessels may redirect efforts to other areas and/or other fisheries with unpredictable results. Impacts to protected species may be greater in fisheries with less stringent management measures in place.

Potential catch interactions. Concerns continue to be expressed about potential catch interactions by sectors of Pelagics FMP-managed fisheries throughout the region. For example, the charter boat sector in Hawai'i is concerned about the possible impact of the Hawai'i-based longline fishery on marlin catch rates and some sports fishers favor catch-and-release over retention of marlin. Small-boat pelagic fishers in all island areas are concerned about potential long-distance effects of the purse seine fishery on catch rates of surface skipjack and yellowfin tuna, as well the large amount of discards associated with purse seine sets around untethered fish aggregation devices (FADs).

Observer Coverage: Because protected species interactions occur at very low rates, and self-reporting by fishers may be inaccurate (due to mis-identification of species or intentional under-reporting), a level of coverage sufficient for valid statistical inferences must be maintained. This level may be 100 percent is some situations.

Effectiveness of fisher education and training to reduce sea turtle takes. Several of the alternatives include implementation of fisher education and training programs. It is uncertain how effective these measures will be when observers are not present on vessels.

Data availability and quality. The technical data available to monitor and adjust the Pelagics FMP are incomplete and uncertain. The most serious deficiencies are catch and effort data for the recreational sector in most of the U.S. Pacific island areas. Poorly-documented issues, such as potential catch interactions between different gear types and scales of fishing, could be more thoroughly evaluated with improved fisheries statistics.

Targeting of small tuna at FADs. The shift towards purse seine fishing around untethered fish aggregating devices (FADs or *payao*) has affected the U.S. purse seine fleet's catch in two ways that have significantly increased fish discards. First, the average size of tuna caught tend to be smaller in floating object sets than in free-swimming school sets. A higher percentage of tuna that is caught in floating object sets is undersized for U.S. canning and, hence, is discarded. Second, because floating objects tend to aggregate a large number of pelagic species other than tuna, they produce more bycatch than free-swimming school sets. Small-scale fishers based on the island of Hawai'i and Hawai'i-based longline fishers have expressed concern about increasing handline catches of small yellowfin tuna at inshore *koa* (localized areas of tuna aggregation) and of small bigeye offshore at the Cross Seamount and anchored weather buoys, which function as FADs.

Jurisdictional issues: At the broadest level, local governments and cultural groups may question the validity of federal jurisdiction over EEZ waters. The CNMI government, for example, has claimed jurisdiction over waters out to 12 nm around its islands. In the past this led to a decision not to participate in the WPRFMC. Although still subject to litigation, an accommodation has been reached whereby they now participate in the Council process. Some Native Hawaiians question federal jurisdiction due to Hawai'i's history as a sovereign nation, in their view illegally annexed by the United States.

Resolution of these issues will procede in the arenas of scientific research, management policy development, international negotiation and legal interpretation.