CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

For each alternative, the potential direct and indirect impacts (those that occur later in time or farther removed in distance) on each of the affected components of the human environment are described below in Sections 4.1 through 4.4.

The potential cumulative impacts of the alternatives are discussed and compared in Section 4.5. Concurrent with development of this EIS, two other management initiatives affecting the Western Pacific Region in general and the NWHI in particular were emerging. These result from President Clinton's establishment by Executive Order of a Northwestern Hawaiian Islands Coral Reef Reserve and the Council's development of a Coral Reef Ecosystem Fishery Management Plan. These developments and a comparison of their potential effects with those resulting from implementation of the alternatives described in this EIS are contained in Section 4.5.1.

4.1 IMPACTS OF ALTERNATIVE 1

Two variations of Alternative 1 are analyzed: Alternative 1A is the no action alternative which continues the present management regime under the Bottomfish FMP. Alternative 1B adds to the no action alternative a suite of Council-approved measures that have not yet been implemented by NMFS. Alternative 1B is the Council's preferred alternative.

4.1.1 Target Species

4.1.1.1 Alternative 1A

The harvest of bottomfish is a direct impact on the target species. The nature of the impact varies regionally. In the island areas outside Hawai'i, the small number of participants often results in dramatic differences in landings and CPUE from year-to-year as a result of highliners entering or leaving the fishery and the effects of severe storms on vessels and infrastructure. Bottomfish landings in American Samoa continue to be relatively low in comparison to their historic peaks in the early 1980s, mainly because of the departure of fisherman from the bottomfish fishery to the more lucrative pelagic longline fisheries. Recent (1996-2001) calculations of catch per unit effort (CPUE) indicate that the bottomfish fishery in American Samoa is not overfished. A drop in the CPUE in 2002 is thought to be the result of three very experienced fishermen leaving the fishery (WPRFMC 2004).

In Guam, CPUE dropped significantly from 1994 to 1995, and has remained relative low since that time. However, while calculations indicate that this fishery may be in a "yellow light" condition, the bottomfish charter sector, which typically practices a great deal of "catch-and-release" fishing, may have skewed the overall CPUE to a level unrepresentative of commercial bottomfish fishing (WPRFMC 2004).

In the CNMI, bottomfish CPUEs showed an unexpected drop in 2000, but by 2002 had recovered

to exceed the 20-year mean value (WPRFMC 2004).

In Hawaii, a combination of fishing effort control through a limited entry system and control of harvest through biological reference points is used to maintain a sustainable fishery. The biological indicators in Hawaii are calculated on an archipelago-wide basis. The reference points are calculated in this manner based on research data which indicate that larval drift and genetic exchange supports a single stock approach. SPR values for the five major BMUS species are all above the 20 percent critical threshold level when viewed on an archipelago-wide basis. Of these species, *onaga* usually has the lowest value with the 2002 value at 26 percent. This low value is due to the consistently poor condition of the resources in the MHI. Eighty percent of the MHI bottomfish fishery occurs in state waters and now that the state management plan for the MHI bottomfish fishery (including gear restrictions, closed areas and non-commercial bag limits) has been implemented it is likely that the condition of *onaga* resources in that area will improve and the archipelago-wide SPR value will increase over time. The *onaga* SPR values for the last four years are all obove the 1998 low of 22 percent.

In the NWHI bottomfish stocks are relatively healthy. Calculations of SPR and percent immature fish in the catch indicate no localized depletion for any of the species managed in the NWHI (WPRFMC 2004).

The maximum sustainable yield (MSY) of BMUS from the NWHI as a whole was estimated by Kobayashi (1996) at 586,000 pounds. This is the greatest quantity of bottomfish that could be harvested annually on a sustainable basis by average NWHI bottomfish fishing vessels. Using average operational characteristics for these vessels, Pooley (1996) partitioned the MSY into 131,000 pounds for the Mau Zone and 455,000 pounds for the Ho'omalu Zone. In the most recent year for which data are available (2002) 108,000 pounds of bottomfish were harvested from the Mau Zone and 120,000 pounds of bottomfish were harvested from the Ho'omalu Zone. These landings represent 92 and 24 percent, respectively, of the Mau and Ho'omalu Zones' MSYs. Continuation of bottomfish fishing in the NWHI, as it has been practiced under the FMP (Alternative 1A), is therefore sustainable and conservative of the health of the target stocks.

4.1.1.2 Alternative 1B (Preferred Alternative)

The impacts resulting from implementation of Alternative 1B would be similar to those of Alternative 1A. With respect to the different island areas, there are no pending measures that would affect American Samoa. Including the CNMI in the management area of the Bottomfish FMP would have no direct or indirect effect on effort there, so landings of target species would not be affected. The proposed management measures for Guam would potentially reduce effort, landings and gear competition, to the extent that vessels over 50 feet in length fish within 50 miles of Guam. For Hawai'i, the potential management measures could have conflicting effects

on target species landings. Dropping the "use-it-or-lose-it" limited entry permit provisions could result in a reduction of effort, while allowing new Mau Zone permits through qualifying or through the CDP could increase landings of target species.

4.1.2 Bycatch

4.1.2.1 Alternative 1A

Commercial and recreational bottomfish fishing in the region is conducted with handlines that are set and hauled using electric, hydraulic or hand-powered reels. Vessels usually are 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 dependant upon the skill of the vessel captain. Experienced vessel crew have the ability to catch the desired species with little bycatch. It is, however, impossible to completely avoid bycatch and incidental catch of non-target species. Direct impacts are therefore catches of bycatch and non-target species, as described in Section 3.2. Indirect impacts could include habitat damage (discussed in Section 4.1.4) or changes in trophic dynamics such as alterations of relative predator-prey abundance. However, given the low level of NWHI bottomfish fishing effort, the large amount of bottomfish habitat in the NWHI, and the relatively small quantities of bycatch in the fishery, neither significant habitat damage, nor alterations of trophic dynamics are likely.

Current fisheries-dependent data collection programs provide only limited information on the amount and type of bycatch in the bottomfish fisheries (Section 3.9). The information collected on the mortality of bycatch species in the fisheries is insufficient to accurately assess the status of bycatch populations, however it is unlikely that the level of bycatch mortality in the bottomfish fishery significantly affects populations of these species.

4.1.2.2 Alternative 1B (Preferred Alternative)

The impacts resulting from implementation of Alternative 1B would be similar to those of Alternative 1A. With respect to the different island areas, there are no pending measures that would affect American Samoa. Including the CNMI in the management area of the Bottomfish FMP would have no direct or indirect effect on effort there, so bycatch types or amounts would not be affected. The proposed management measures for Guam would potentially reduce effort, and therefore bycatch amounts, to the extent that vessels over 50 feet in length fish within 50 miles of Guam. For Hawai'i, the potential management measures could have conflicting effects on bycatch amounts. Dropping the "use-it-or-lose-it" limited entry permit provisions could result in a reduction of effort and lower bycatch, while allowing new Mau Zone permits through qualifying or through the CDP could increase quantities of bycatch.

4.1.3 Protected Species

This section includes an analysis of the direct and indirect effects of Alternative 1 (1A and 1B) on protected species and critical habitat. The factors considered in this section include: 1) the status of the affected populations of species; 2) the level of removals attributed to the proposed activities of the preferred alternative; and, 3) the impact of that removal on those populations in addition to all other direct and indirect human effects.

The 2002 BiOp prepared by NMFS for the Bottomfish FMP can be found in Appendix H. During the Section 7 consultation process, NMFS reviewed the observer data and other records to assess the impacts of the bottomfish fishery on listed species. The same information was reviewed to assess the interaction rate and impacts to non-listed marine mammals.

The impacts of Alternatives 1A and 1B would be similar. The measures pending implementation for Hawai'i could result in an increase or a decrease in bottomfish fishing effort in the NWHI. It is not possible to predict the net change, if any, in effects on protected species.

4.1.3.1 Marine Mammals

Except for the Hawaii-based longline fishery, all fisheries in Hawaii, including the bottomfish fishery, are classified in Category III under section 118 of the Marine Mammal Protection Act of 1972 (62 FR 28657, May 27, 1997). Category III fisheries are those that have been determined to have a remote likelihood or no known incidental takings of marine mammals. The designation does not mean that there are no interactions; only that marine mammals would not normally be hooked, snagged, injured or killed during fishing operations. (See Appendix F for additional information on the MMPA.)

The most objective information available about interactions of the NWHI bottomfish fishery with protected species comes from observer programs implemented by the State of Hawai'i and NMFS. The State of Hawaii deployed observers on commercial bottomfish fishing vessels in 1981 and 1982. During that time, no interactions with Hawaiian monk seals or other marine mammals were recorded (Nitta 1999). Thus, the loss of catch or interactions with the gear were not considered to be a significant risk to Hawaiian monk seals or cetaceans (all fish loss was attributed to sharks on the observed trips). Also, the low level of commercial bottomfish fishing effort in the NWHI during that period contributed to the conclusion that interactions with protected marine mammals were minimal if any did occur.

From October 1990 through December 1993, NMFS conducted an observer program for the bottomfish fishery in the Protected Species Study Zone of the NWHI. Observer coverage began on a voluntary basis in October 1990, and became mandatory (i.e., vessels were required to carry

observers on board as ordered by the Southwest Regional Administrator) in November of that same year due to the proximity of bottomfish fishing operations to Hawaiian monk seal habitat. The objectives of the observer program were to document and characterize any interactions of the bottomfish fishery with protected species and to collect catch and effort data for the bottomfish fishery (Nitta 1993).

The NMFS observer program recorded interactions between marine mammals (Hawaiian monk seals and bottlenose dolphins) characterized by removal of fish and bait from fishing lines without hooking or entanglement in the fishing gear (Nitta 1993). Analysis of observer reports indicate a Hawaiian monk seal interaction rate of one event per 67.7 hours of fishing and a bottlenose dolphin interaction rate of one event per 37.7 hours of fishing (Nitta 1993). Some Hawaiian monk seals and bottlenose dolphins seemed to exhibit an apparent familiarity with certain vessels.

Observer coverage of the NWHI bottomfish fishery was reinstituted in the fourth quarter of 2003. Six of 30 vessels departed with observers (20 percent coverage) in the fourth quarter of 2003 and first quarter of 2004. No marine mammal interactions were recorded.

Because direct information is scarce, the possible effects of individual monk seals following bottomfish fishing vessels and consuming catch or discards on the monk seal population area difficult to determine. Individual seals could have better growth rates and reproductive success when they rely upon the easy prey of hooked fish. On the other hand, reliance on fishing vessels for food could hinder the growth and reproductive success of individual seals when vessels move out of an area and seals must learn to forage on their own, or if the prey they obtained from the vessels is inadequate for the monk seals dietary needs. In addition, use of the vessels as a food source increases the likelihood that an individual seal will become hooked or entangled in fishing gear (NMFS 2002).

4.1.3.1.1 Cetacean: Bottlenose Dolphin

Genetic studies suggest the Hawai'i population of bottlenose dolphins is discrete from the eastern Pacific bottlenose dolphin stock (Scott and Chivers 1990). However, the status of the bottlenose dolphin stock in Hawaiian waters relative to their optimum sustainable population (OSP) is unknown, as there are insufficient data to evaluate trends in abundance and carrying capacity of the region (Forney et al. 2000).

The NMFS observer data from 1990-1993 were analyzed to estimate rates of interactions between the bottomfish fishery and protected species. During a total of 1,546.1 hours of fishing on 26 trips, 41 bottlenose dolphin interaction events involving 327 individuals were recorded. The rate of interaction between the bottlenose dolphin and the bottomfish fishery was estimated

to be one interaction every 37.7 hours of fishing (Nitta 1993). Bottlenose dolphins typically stayed with the vessel as long as fish were being retrieved. The bottlenose dolphins stole the fish off lines at depths of five to 10 fathoms during retrieval. It was noted that *kāhala* were not targeted by the bottlenose dolphins, as were other fish species.

An easily accessible artificial source of prey, such as fish stolen from handlines, may impact the bottlenose dolphin by disrupting normal feeding behavior. It is known that at least one wild dolphin has developed some dependency upon hand feeding (NMFS 1994). Thus, habituation to an easy source of prey may impact bottlenose dolphins by affecting their ability to hunt and forage in the wild. Other potential impacts to bottlenose dolphins are vessel collision and hooking/entanglement in fishing gear, although no such interactions have been documented.

No direct injury or mortality to bottlenose dolphins has been documented in the bottomfish fishery. Given the information available, it is unlikely that the bottomfish fishery is significantly affecting the bottlenose dolphin population, i.e., diminishing the Hawai'i population of the species by reducing the reproduction, numbers, or distribution of the species.

4.1.3.1.2 Pinniped: Hawaiian Monk Seal

The Bottomfish FMP contains management measures intended to monitor and mitigate interactions between the fishery and Hawaiian monk seals (Section 2.3.4). The NMFS Regional Administrator has the authority to place federal observers on board bottomfish vessels to record interactions with Hawaiian monk seals or other protected species if this action is deemed necessary (50 CFR 660.65). In addition, before the NMFS Regional Administrator issues a Mau Zone or Ho'omalu Zone limited access permit to fish for bottomfish, the primary operator and relief operator named on the application form must have completed a protected species workshop conducted by NMFS (50 CFR 660.61). Since 1989, when the NWHI bottomfish limited access permit fishery was established, NMFS has certified more than 40 vessel captains who have completed the requisite one-time protected species workshop program. The HMSRT (1999) has suggested that higher levels of direct interactions between Hawaiian monk seals and the NWHI bottomfish fishery can best be mitigated by continuing to educate fishermen through briefing materials and workshops. Recently, NWHI bottomfish fishermen as a group have agreed to voluntarily attend annual protected species and regulatory workshops conducted by NMFS. The workshops, for all permit holders and vessel operators, would review Hawaiian monk seal life history, the status of interaction mitigation efforts, and relevant regulatory measures.

The current management regime includes measures that are intended to conserve bottomfish stocks or improve the economic performance of the fishery but which also mitigate interactions between the fishery and Hawaiian monk seals. Prohibitions on the use of explosives and chemicals reduce the potential for incidental harm to Hawaiian monk seals and help protect

Hawaiian monk seal habitat. By reducing fishing effort, the limited access programs for the Mau Zone and Hoʻomalu Zone decrease the potential for direct impacts from Hawaiian monk seals approaching bottomfish fishing vessels and feeding on discarded fish or becoming hooked or entangled in fishing gear. The restriction on fishing effort also lowers the chance of vessel groundings or other accidents that could result in Hawaiian monk seal mortality or pollution of habitat.

The State of Hawaii Division of Aquatic Resources does not systematically collect information regarding protected species interactions. NMFS-PIRO Protected Species Program made available to the fishery participants reporting cards that could be used to anonymously report protected species interactions. To date, no cards have been returned to NMFS. In 2000, NMFS sent each bottomfish fishery permit holder marine mammal interaction reporting forms, but no reports of marine mammal injury or mortality have been received by NMFS. Therefore, the only information available to NMFS on Hawaiian monk seal interactions with the bottomfish fishery is the observer data from the two programs noted above, fisher self reports and investigations of hooks embedded in Hawaiian monk seals.

The NMFS observer data collected from 1990-1993 documented interactions of Hawaiian monk seals with bottomfish fishery operations. An interaction typically consists of Hawaiian monk seals approaching vessels and stealing fish either from hooks or from a competing predator (dolphins). Hawaiian monk seals were not reported hooked or entangled, but were observed active in the "theft" of fish from handlines. Typically, they surfaced to consume the fish. Fish that were too large for consumption were abandoned. While some interactions involved a single fish, other interactions lasted as long as the retrieval of fish continued, with Hawaiian monk seals continually stealing fish.

The following paragraphs discuss ways in which the bottomfish fishery has interacted with or may potentially impact the Hawaiian monk seal.

Behavioral Modification: Observer data revealed that some Hawaiian monk seals may follow a vessel from station to station for several days. Some seals seem to have no fear of the vessels, approaching and remaining close to the vessels for long periods. These Hawaiian monk seals could steal an average of 20 fish per day. Some seals, more wary of vessels, typically did not approach closely nor did they steal fish directly from handlines, but they did sometimes consume discarded fish. Hawaiian monk seals also targeted shark-distracting lines baited with live bait.[1]

[1]Shark distracting lines are usually baited with *kāhala* or discard fish that are often associated with ciguatoxin or ciguatoxin-like conditions (Nitta 1993). However, it is unknown at this time whether Hawaiian monk seals are affected by this or other biotoxins.

The effects of these interactions (Hawaiian monk seals stealing fish) on Hawaiian monk seal populations are unclear but represent a modification of Hawaiian monk seal feeding behavior. Individual Hawaiian monk seals may habituate to the presence of fishing operations. The report, "Summary Report: Bottomfish Observer Trips in the Northwestern Hawaiian Islands October 1990 to December 1993" states that "(g)iven the artificial availability of these bottomfish species to seals and dolphins as a result of the fishing gear and technique, the proximity of populations of seals and dolphins to the fishing grounds, and the practice of discarding unwanted fish, it is likely that predation of catch by seals and dolphins will continue in the NWHI (Nitta 1993)."

Traveling with the vessel may displace effort on the part of Hawaiian monk seals to locate more permanent foraging locations. Hawaiian monk seals tracked by Abernathy and Siniff (1998) showed site fidelity to foraging locations. Finding suitable foraging locations may be a product of exploration, and may suggest that time spent following vessels that visit the same location intermittently may displace natural foraging habitat exploration and identification.

Observations of Hawaiian monk seals, and data from foraging behavior studies indicate that younger Hawaiian monk seals tend to forage nearer to shore, and adults, especially males, will forage at farther locations and deeper depths (Abernathy and Siniff 1998). This may suggest that juveniles are more susceptible than adults to fishery interactions in shallow water. However, more information is needed in order to determine which component of the Hawaiian monk seal population interacts with the fishery.

Because direct information is scarce, the possible effects of individual Hawaiian monk seals following bottomfish fishing vessels and consuming catch or discards on the Hawaiian monk seal population are difficult to determine. Individual seals could have better growth rates and reproductive success when they rely upon the easy prey of hooked fish. On the other hand, reliance on fishing vessels for food could hinder the growth and reproductive success of individual seals when vessels move out of an area and seals must learn to forage on their own, or if the prey they obtain from the vessels is inadequate for the Hawaiian monk seal's dietary needs. In addition, use of the vessels as a food source increases the likelihood that an individual seal will become hooked or entangled in fishing gear.

To mitigate these interactions, at least those resulting from discarded fish, the members of the NWHI bottomfish fishery have agreed to a voluntary retention program. Fishermen shall cease fishing and retain all gear on deck whenever a Hawaiian monk seal is sighted in an area within a 10 yard radius of where fishing operations are ongoing. If the Hawaiian monk seal remains in this designated area for more than two hours, the Master of the vessel shall relocate to other fishing grounds where there are no Hawaiian monk seals. All injured and/or dead bycatch will be retained on board the vessel. Discard of offal shall occur after fishing operations have ceased and only if there are no Hawaiian monk seals in the area.

Hookings and Entanglement: Accidental hookings of Hawaiian monk seals or other marine mammals in the bottomfish fishery have been reported or observed only rarely (Nitta 1999). As discussed above, no Hawaiian monk seals were observed hooked or entangled in fishing gear during the NMFS observer program for the bottomfish fishery. In the most recent BiOp (Appendix H), NMFS reviewed other sources of data on Hawaiian monk seal hookings, including reports from the public and researchers in the field. This information is reviewed below (Table 4-1). In assessing potential impacts of the federal bottomfish fishery on the Hawaiian monk seal, NMFS must apply a "worst case scenario" approach and attribute all hooks of unknown origin that are recovered or unrecovered to the federal bottomfish fishery even through they may have originated in other fisheries.

The positive attribution of observed hooks embedded in Hawaiian monk seals to a particular fishery is difficult. For example, similar types of fishing gear are used in the offshore bottomfish fishery and the MHI *ulua* fishery. The MHI *ulua* fishery, managed by the State of Hawai'i, is primarily shore-based and comprised mainly of recreational anglers. The circle hooks used in this fishery resemble those used in the offshore bottomfish fishery (both State of Hawai'i and Federal components), although the size of the *ulua* circle hooks employed in the recreational fishery tends to be larger. Some of the hooks embedded in Hawaiian monk seals have been positively identified by NMFS as those used during shoreline fishing for *ulua* based on gear type, size of hook and location of the Hawaiian monk seal when discovered, while other hooks have been identified as those used in the offshore bottomfish fishery. However, the origin of many of the hooks found embedded in Hawaiian monk seals is uncertain.

TABLE 4-1: Hookings of Monk Seals Since 1982 That May Be Attributable to the Bottomfish Fishery

DATE AND LOCATION	DESCRIPTION	OUTCOME	REPORT CONFIRMATION STATUS
1982 - FFS	Adult female was observed with bottomfish hook in mouth.	Resighted without hook at FFS.	Photograph of hooked seal reviewed by NMFS.to identify type of hook.
1990 - MHI - Kauai	Juvenile observed with hook.	NMFS response included capture and hook removal. Monk seal was released alive. Hook identified as type used in the *ulua* shore-based fishery.	NMFS researchers identified hook as *ulua* or bottomfish hook. No identifying gear attached to hook.
1991 - Kure Atoll	Subadult female observed with hook in corner of mouth.	Seal subsequently seen without hook.	Hook never recovered or identified.
1994 - NWHI, Ho'omalu Zone	Monk seal hooked in lower jaw while stealing fish from line.	Line cut leaving 12-18 inch tailing line.	NMFS received a call from the fisherman.

DATE AND LOCATION	DESCRIPTION	OUTCOME	REPORT CONFIRMATION STATUS
1996 - FFS	Adult male observed with hook in mouth.	Hook removed by researchers. Monk seal released alive. Hook identified as type used in the *ulua* shore-based fishery and bottomfish fishery.	Independent researchers identified hook as *ulua* or bottomfish hook. No identifying gear attached to hook.
2000 - Molokai	Juvenile male observed with 2 hooks and line embedded in chest (ventral) area.	NMFS response included capture and physical exam of seal. No hooks or line present, but slight injury documented by veterinarian.	Fishery unknown.
2001 - Kaho'olawe	Adult male with hook in abdomen or flipper.	Sightings ceased. Seal disappeared or hook lost.	Fishery unknown.

Source: NMFS unpub. data, 2002

The BiOp (NMFS 2002) identified the following instances of hookings that may be attributable to direct interactions with the bottomfish fishery: 1) In 1982, an adult female Hawaiian monk seal was observed at FFS with a hook in its mouth. A photograph was taken of the seal showing a portion of the hook shank extending from the corner of the seal's mouth. The hook was identified by NMFS as a bottomfish hook. However, independent review of the same photograph, suggests identification of the hook type to be inconclusive based solely on the visible portion of the hook shank. The seal was later resighted without the hook; 2) In 1990, NMFS researchers removed a hook of the type used in both the *ulua* shore-based fishery and bottomfish fishery from a Hawaiian monk seal on Kaua'i. No line or gear was attached to the hook that would aid in further identification; and 3) In 1996, NMFS researchers removed a hook from an adult male seal at FFS. The hook was identified as a type used in both the *ulua* shore-based fishery and bottomfish fishery. No line or gear was attached to the hook that would aid in further identification.

Additionally, the following three reports of Hawaiian monk seal hookings could not be confirmed but were included by NMFS in the tally of hookings that may be attributable to the federal component of the bottomfish fishery: 1) In 1991, a Hawaiian monk seal was observed at Kure Atoll with a hook in its mouth. The seal was later resighted without the hook and thus the hook or gear was never recovered; 2) In 2000, an observation was made of a Hawaiian monk seal on Moloka'i with two hooks embedded in its chest. A veterinarian dispatched by NMFS to inspect the seal found no hooks, but reported a non-serious injury where the hooks appeared to have been embedded. As discussed in Section 3.5.1.2, circle hooks, by design, are less prone to snagging on rocky or hard substrate bottoms and are very difficult to snag flat or smooth surface; and 3) In 2001, an adult male Hawaiian monk seal was observed with a hook and line at Kaho'olawe. The hook was never recovered. Efforts by NMFS to locate the seal were unsuccessful.

Of the above seven incidents listed in Table 4-1, only one is conclusively attributable to the

NWHI bottomfish fishery, and that was self-reported by the fisherman. In January, 1995 a fisherman from a commercial bottomfish fishing vessel reported to NMFS biologists that his vessel had hooked a Hawaiian monk seal at "No-Name Bank" in December, 1994. The adult-sized seal was pulled to the boat and the leader was cut, leaving about 12 - 18 inches trailing. According to the fisherman, the seal had taken the catch (probably *uku*), and the hook was lodged in the lower jaw.

In the March 8, 2002 BiOp, NMFS found that the bottomfish fishery as managed under the FMP may incidentally hook Hawaiian monk seals. However, based on available information regarding fishing participation and landing caps, and current NWHI Reserve closed areas (all areas of critical habitat around areas where Hawaiian monk seals have been observed with hooks potentially attributable to the bottomfish fishery in the past), NMFS expects that the rate of incidental hooking will be very low, notably less than one Hawaiian monk seal per year. Consequently, the estimated rate of serious injury leading to mortality will be substantially lower. Based on the foregoing, it is reasonable to expect that few Hawaiian monk seals will be hooked and/or die as a result of interactions with the bottomfish fishery. This rate of take is unlikely to reduce the numbers, reproduction, or distribution of the Hawaiian monk seal population. The rate of serious injury leading to mortality of Hawaiian monk seals may be further reduced if fishermen remove hooks and/or disentangle Hawaiian monk seals from bottomfish gear subsequent to the gear interaction.

Intentional Injury to Hawaiian monk Seals: In 1990, there were allegations that some fishermen were intentionally killing or injuring Hawaiian monk seals in order to stop them from stealing fish and bait from hooks (Wagner 1990; NMFS 1991). At that time a number of dead Hawaiian monk seals were observed by NMFS researchers with head injuries of unknown origin. However, there was no evidence that the injuries were inflicted by bottomfish fishermen. The only documented case of an illegal killing of a Hawaiian monk seal occurred when a resident of Kaua'i killed an adult female in 1989 (NMFS 1998). Since 1990, no additional Hawaiian monk seals have been sighted with injuries suspected of being intentionally inflicted by humans (G. Antonelis pers. comm. 2000). Indeed, there appears to be little incentive for bottomfish fishermen to intentionally harm Hawaiian monk seals during fishing operations, as studies such as that of Kobayashi and Kawamoto (1995) indicate that the incidence rate of bottomfish damaged by Hawaiian monk seals is low (0.45 per 1000 fish).

Discards and Biotoxin Poisoning: Hawaiian monk seals may feed on discards, including fish species associated with ciguatoxin, because fishery participants feed the Hawaiian monk seals and/or dump discards in the presence of Hawaiian monk seals. NMFS observers reported that fishery participants illegally fed discards to Hawaiian monk seals during hand line retrieval in order to distract the Hawaiian monk seals from stealing valuable catch. The prevalence of feeding discards as a means of distracting seals is unknown, but is not believed to be practiced

routinely throughout the fishery (Katekaru pers. comm. 2001). Feeding of discards to Hawaiian monk seals is prohibited under both the ESA and the MMPA.

Discard availability may affect Hawaiian monk seals in several ways. As discussed above, the availability of discards to Hawaiian monk seals may modify normal Hawaiian monk seal foraging behavior. Concerns have been raised that bottomfish discarded by fishermen and consumed by Hawaiian monk seals may contain high levels of ciguatoxin or other biotoxins (Nitta 1999). In particular, *kāhala* are often discarded during bottomfish fishing operations because large specimens have a reputation for carrying ciguatoxin and, consequently, are not accepted for sale in the Honolulu fish auction. However, two studies in the NWHI found that *kāhala* tested positive for ciguatoxin much less frequently than shallow water species, such as wrasses, that are known to be common Hawaiian monk seal prey items (Ito et al. 1983; Goodman-Lowe 1998).

NMFS believes that it is unlikely that Hawaiian monk seals are or would be poisoned by consuming lost (fish that inadvertently come off gear while fishing) or discarded fish that are ciguatoxic. Hawaiian monk seals are known to commonly consume other species (e.g., moray eels) that contain high levels of ciguatoxin (Hokama 1980), and no Hawaiian monk seal sickness or death has been attributed to ciguatoxin poisoning (Work 1999; NMFS 2000; Gilmartin et al. 1980; Nitta 1993). The investigation of the mass die-off at Laysan Island in 1978 included necropsy and analysis of 18 Hawaiian monk seals. Of the 18 Hawaiian monk seals tested, only two tested positive for ciguatoxin and maitotoxin; reaction to these toxins was not proven to be the cause of death (Work 1999). Moreover, there is no information on the sensitivity of Hawaiian monk seals to ciguatera poisoning. However, fish that are frequently highly ciguatoxic, such as moray eels and wrasses, are known to comprise a portion of the diet of the Hawaiian monk seal with no apparent adverse effects.

Reduction of Prey Available to Hawaiian monk Seals: Available data on Hawaiian monk seal prey indicate that there is little overlap of the bottomfish management unit and bycatch species and the known prey items of Hawaiian monk seals. Tables 3-4 and 3-5 indicate that there is no evidence that Hawaiian monk seals depend on the species targeted or caught incidentally in the fishery, although some overlap between bycatch families and Hawaiian monk seal prey families are evidenced by reports of Hawaiian monk seals stealing catch and discarded fish from bottomfish fishing vessels. However, this overlap may be indicative of opportunistic feeding on bottomfish target/bycatch/incidental catch species and not evidence that these species are a component of the normal Hawaiian monk seal diet. Available information indicates that Hawaiian monk seals are not foraging on identifiable teleost prey in deep water in lieu of shallow water teleosts.

There is little or no information on the indirect effects of the bottomfish fishery on the Hawaiian

monk seal through competition for prey or alteration of prey assemblages by removal of key predator fishes. It is thought that such effects would be minimal. The deep-slope bottomfish fishery in Hawaii concentrates on species of eteline snappers, carangids and a single species of grouper concentrated at depths of 30-150 fm. This depth range is outside NMFS' designated critical habitat for the Hawaiian monk seal, which extends out from shore to 20 fathoms in ten areas of the NWHI. In addition, research on the diet of Hawaiian monk seals indicates that the species commonly caught in the bottomfish fishery represent a small fraction of the total number of Hawaiian monk seal prey items (Section 3.3.1.3.1). Given the available information, it seems unlikely that the bottomfish fishery is competing directly or indirectly with Hawaiian monk seals for the same fish species.

Summary of Environmental Consequences to the Hawaiian Monk Seal: Contributing factors to the species' status over the past four decades include male aggression and mobbing behavior, shark predation, disease, climatological regime shifts affecting environmental carrying capacity, human interactions (disturbance) including research, sea wall entrapment, contaminants, fisheries, entanglement in marine debris and vessel groundings (Section 3.3.1.3.3). At each Hawaiian monk seal breeding subpopulation, differing combinations of these factors likely have contributed to local trends in abundance, with the relative importance of individual factors changing over time.

It appears that the overall population of Hawaiian monk seals has remained stable over the last 9 years. The species' population trend is determined by the highly-variable dynamics of the six main reproductive subpopulations. Demographic trends over the past decade have been driven primarily by the dynamics of the FFS subpopulation, where an increasingly inverted age structure indicates that recruitment of adult females and pup production may soon decrease. At FFS, the count of animals older than pups is now less than half the count in 1989. Poor survival of pups has resulted in a relative paucity of young seals, so that this population of Hawaiian monk seals is expected to experience further population declines as adults die and there are few juveniles to replace them. Because this subpopulation has the largest number of animals, declines in this subpopulation would cause the species' total abundance to decline (unless other subpopulations experience increases that are large enough to offset decreases at FFS).

Over the last decade, the causes of the poor survival for these age classes at FFS have been related to poor condition from starvation, shark predation, male aggression, habitat loss, and entanglement in marine debris. A decrease in prey availability may be the result of decadal scale fluctuations in productivity or other changes in local carrying capacity for seals at FFS or a combination of factors (Craig and Ragen 1999; Polovina et al. 1994; Polovina and Haight 1999). At this point it is speculative to indicate whether or not fishing effort in these areas has been intense enough to change the forage base.

Therefore, NMFS anticipates that changes in feeding behavior in response to fishing vessel activity may have negative consequences for individual seals, but these behavioral changes do not appear to affect the survival of seal populations. Since 2003, when the observer coverage for the NWHI bottomfish fishery was reinitiated, there has not been any observed interactions between the NWHI bottomfish fishery and Hawaiian monk seals (PIRO 2005).

Given the expected low rates of hooking and the lack of evidence of competition for fishery resources from the bottomfish fishery, the bottomfish fishery is unlikely to have direct or indirect effects that would diminish the value of foraging areas within Hawaiian monk seal critical habitat. Nor is the bottomfish fishery likely to reduce appreciably the likelihood of both the survival and recovery of the Hawaiian monk seal in the wild by reducing the reproduction, numbers, or distribution of the species. Population survival may be more affected by changes in forage base that are associated with phenomena like decadal shifts in productivity.

4.1.3.2 Sea Turtles

If the bottomfish fishery affects sea turtles, the green turtle is most likely the species to be affected because it occurs within the action area with more frequency than any other species. The recovery plan for the green turtle (NMFS and FWS 1998) lists the primary threats for Hawai'i as disease, nest predation, directed take, fisheries incidental take, and boat collisions. The latter two may be relevant to the bottomfish fishery; however, NMFS and State of Hawai'i observer data for the bottomfish fishery (1990-1993 and 2003-2004) contain no reports of these types of direct interactions between any species of sea turtle and the bottomfish fishery (Nitta 1999; PIRO 2004).

Indirect effects may persist from the bottomfish fishery. However, there is no evidence that effects from vessel lighting on females or hatchlings has or is occurring as a result of fishery operations. It is possible, however, that hatchlings may be adversely affected by fishing activities in the NWHI (NMFS 1991). It is well documented that shore-based artificial lighting may affect sea turtles by discouraging females from nesting and disorienting hatchlings away from the sea. Therefore, one could construct a scenario wherein vessels operating deck lights at night may attract and concentrate hatchling turtles off shore or disorient females during nesting activities. The effects could expose the hatchling turtles to predators such as sharks, snappers and barracuda and disrupt or prevent females from successful egg deposition.

About 5.6 percent of the bottomfish fishing effort takes place in the vicinity of FFS where most of the green turtle egg deposition and hatching takes place. In recent years, only six bottomfish vessels have fished in the entire Ho'omalu zone. Given this dispersed and low level of fishing activity, continued bottomfish fishing in the NWHI is expected to have no measurable effect on sea turtle adults or hatchlings in the NWHI.

4.1.3.3 Seabirds

The NMFS observer program for the NWHI bottomfish fishery conducted from October 1990 to December 1993 reported a moderate level of interactions between seabirds and the bottomfish fishery (Nitta 1999). Interactions were characterized by attempted bait theft. Although there is a possibility of accidental hooking, circle hooks used in the bottomfish fishery do not lend easily to snagging. No seabird injuries or mortalities were reported while fishermen were fishing for bottomfish. One interaction involving a Laysan albatross occurred while a bottomfish fishing vessel was trolling for pelagic species. The bird became hooked but was subsequently released alive.

The more recent observer data (fourth quarter of 2003 and first quarter of 2004) show three interactions with seabirds. Two unidentified boobies were hooked and released during trolling operations, and one black-footed albatross was entangled and released during bottomfish fishing operations.

This low level of direct interactions between seabirds and the bottomfish fishery would continue under this alternative. While continued bottomfish fishing may affect a very limited number of individual seabirds, it is expected to have no effect on seabird distribution, survival or population structure. The potential for indirect interaction due to competition for prey is negligible, as seabirds do not prey upon bottomfish or bycatch from this fishery.

4.1.4 Essential Fish Habitat, Biodiversity and Ecosystems

Under NMFS guidelines, impacts of an action on EFH and HAPC must consider the EFH and HAPC of all managed species in the region. Therefore, the present assessment must consider impacts of bottomfish fishing to not only bottomfish EFH and HAPC, but also to pelagics, precious corals, crustaceans and coral reef ecosystem EFH and HAPC. Table 4-2 summarizes EFH and HAPC for the five approved Western Pacific FMPs.

TABLE 4-2: Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPC) for all Western Pacific FMPs

FMP	EFH (Juveniles and Adults)	EFH (Eggs and Larvae)	HAPC
Pelagics	Water column down to 1,000 m	Water column down to 200 m	Water column above seamounts and banks down to 1,000 m

FMP	EFH (Juveniles and Adults)	EFH (Eggs and Larvae)	HAPC
Bottomfish and Seamount Groundfish	Bottomfish: Water column and bottom habitat down to 400 m Seamount Groundfish: (adults only) water column and bottom from 80 to 600 m, bounded by 29°-35°N and 171°E-179°W	Bottomfish: Water column down to 400 m Seamount Groundfish: (including juveniles) epipelagic zone (0-200m) bounded by 29°-35°N and 171°E-179°W	Bottomfish: All escarpments and slopes between 40-280 m, and three known areas of juvenile *ʻōpakapaka* habitat Seamount Groundfish: not identified
Precious Corals	Keāhole Point, Makapuʻu, Kaʻena Point, Westpac, Brooks Bank, 180 Fathom Bank deep water precious corals (gold and red) beds and Miloliʻi, Auʻau Channel and S. Kauaʻi black coral beds	Not applicable	Makapuʻu,Westpac, and Brooks Bank deep water precious corals beds and the Auʻau Channel black coral bed
Crustaceans	Bottom habitat from shoreline to a depth of 100 m	Water column down to 150 m	All banks within the NWHI with summits less than 30 m
Coral Reef Ecosystem	Water column and benthic substrate to a depth of 100 m	Water column and benthic substrate to a depth of 100 m	All MPAs identified in approved portions of FMP, all PRIAs, many specific areas of coral reef habitat

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

As the above table shows, Western Pacific areas designated as EFH or HAPC fall into two categories: either the water column above the ocean bottom, or the ocean bottom itself. Water column EFH and HAPC have been designated for pelagic, bottomfish, crustacean and coral reef ecosystem MUS. Bottomfish fishing activities directly impact the water column only by the release of chum (*palu*). A bottomfish fishing handline rig typically consists of a terminal weight that hangs below a series of branch lines with baited hooks. Above the branch lines is a small bag containing a handful of chum, usually a mixture of chopped up fish parts and a filler such as oats. When the line is dropped, it's allowed to sink to the bottom, and then is pulled up several fathoms. The line is then jerked sharply to open the bag and release the chum over the baited hooks. The chum moves with the current while slowly sinking. The area affected is extremely localized and the effect is very transient. The constituents of the chum represent a small food subsidy to nearby demersal fish and benthic fauna. Water column EFH or HAPC is not significantly negatively impacted.

Indirect impacts to water column EFH or HAPC could occur through pollutant discharges from bottomfish fishing vessels. The day-to-day operations of a fishing vessel can produce a number of waste products, including oil, sewage and garbage, that can affect marine habitat (WPRFMC

1998a). The small number of vessels permitted to participate in the NWHI bottomfish fishery[2] and the low level of participation in bottomfish fishing in most other island areas minimizes this potential impact. Most bottomfish fishing around the MHI takes place in state waters inside three miles from shore.

Areas of ocean bottom have been designated EFH and HAPC for precious corals, crustaceans, bottomfish and coral reef ecosystem MUS. Regulations adopted in the Bottomfish FMP both directly and indirectly reduce the likelihood of damage to habitat caused by fishing gear and operations. The FMP prohibits the use of destructive gears such as explosives, poisons, trawl nets and bottom-set ground lines in the fishery.

Deep water precious corals beds designated as EFH or HAPC are well below the depths fished or anchored in by the bottomfish fishery. Neither direct nor indirect impacts from bottomfish fishing activities would be expected. Shallower black coral beds designated EFH or HAPC, however, occur within the depth range fished for bottomfish. Individual colonies of black coral could be damaged or destroyed by anchors or weights on the terminal end of the fishing line. Habitat damage, however, would be expected to be insignificant because of the hard substratum favored by these corals. Submersible-supported studies conducted in 2001 at bottomfishing banks in the NWHI have reported minimal evidence of fishing impacts to habitat (C. Kelly pers. comm. 2001).

Areas of EFH for crustacean and coral reef MUS are relatively shallow compared with typical depths where bottomfish fishing takes place. However, crustacean and coral reef ecosystem EFH extends to 100 m, depths at which bottomfish fishing vessels may anchor and occasionally fish. When fishing in deeper waters fishermen may anchor their vessels in order to maintain a position over productive fishing areas. Anchoring is generally conducted at depths from 80 to 120 m (40-60 fathoms). At these depths anchor damage to EFH/HAPC is minimal, as much of the habitat consists of a mosaic of sandy low-relief areas and rocky high relief areas. It is also important to note that the anchor typically used to maintain a vessel's position over a rocky area is constructed of 3/4 in. steel reinforcing rod ("rebar") fashioned in the shape of a four-sided J-hook. Because the rebar is bendable, this design helps prevent the anchor from becoming inextricably lodged on the bottom and has the added benefit of reducing damage to habitat during recovery.

HAPC for crustacean MUS is quite shallow. Bottomfish fishing vessels would neither anchor nor fish at such shallow depths, and no direct impacts on these habitats would be expected. The

[2] Under the current limited access program for the NWHI bottomfish fishery, participation in the fishery is limited to 17 federally-permitted vessels, although this level of participation has not been reached since 1991. In 2002, only 9 vessels participated in the fishery.

accidental grounding of a fishing boat, however, can adversely affect shallow EFH and HAPC. The impact of a vessel striking the bottom can physically destroy habitat in the immediate area. The possible subsequent break-up of the vessel and release of fuel and oil can result in pollution of habitat and mortality of marine life. A grounding can also lead to the introduction of alien species, such as rodents or insects, which can have an adverse impact on terrestrial native fauna and flora in the area. Fishing vessel groundings are relatively rare events. For example, in the 1200 mile-long NWHI, only two fishing boats have run aground during the past 15 years – one was a swordfish longline vessel and the other a lobster boat. In both cases there was localized habitat damage under the hull, but no reported effects on surrounding areas.

HAPC for coral reef ecosystem MUS comprise a variety of areas designated as MPAs in the FMP, including EEZ coral reefs in unpopulated areas - the PRIAs, the NWHI[3], and Rose Atoll in American Samoa. The outer boundary for these MPAs is the 50 fm isobath. A zone-based management approach is applied to MPA design and designation, distinguishing no-take and low-use areas. Fishing is prohibited in no-take MPAs, including that by existing FMP fisheries. No-take MPAs are delineated by the 10-fm isobath. These areas are FFS, Laysan Island, the northern half of Midway Atoll, Jarvis Island, Howland Island, Baker Island, Kingman Reef and Rose Atoll. All other areas within the 50-fm isobath would by default become low-use MPAs, where fishing is tightly controlled by a special permit requirement and other conditions. Although not an MPA in the sense of having these restrictions, Guam's Southern Banks are designated a no-anchoring zone.

Bottomfish EFH and HAPC are similar to those designated for crustaceans, but extend deeper. At depths where bottomfish vessels may anchor, potential impacts are as described above for crustacean EFH. To fish at greater depths (below about 120 m), bottomfish fishermen typically anchor upwind of the desired location in shallower water and drift downwind letting out anchor line scope until the desired depth is reached. Thus, impacts to benthic habitat at these greater depths are restricted to small fishing weights (typically 2-4 kg) hitting the bottom as lines are being deployed. Damage to either hard or soft bottom habitats would be minimal.

Continuation of the current bottomfish fishing management regime in the Western Pacific Region will not adversely affect EFH or HAPC for any managed species, as it is not likely to lead to substantial physical, chemical or biological alterations to the habitat, or result in loss of, or injury to, these species or their prey.

[3] Sections of the CRE FMP pertaining to the NWHI were not approved due to potential inconsistencies with the EOs establishing the NWHI Coral Reef Ecosystem Reserve.

4.1.5 Commercial, Recreational and Charter Fishing Sectors

Assuming harvest and participation trends comparable to recent (1998-2002) years, 228,000 to 332,000 lb of bottomfish with an ex-vessel value of $759,000 to $1,102,000 would continue to be harvested by 9-13 Mau Zone and Ho'omalu Zone permit holders under this alternative. While these revenues are expected to have a positive direct economic impact on fishery participants, the profitability of the average bottomfish fishing operation in the NWHI has been marginal (see Table 3-26). In 1988, a limited access program was established for the Ho'omalu Zone in the NWHI, the primary motivation for which was avoidance of economic overfishing. However, in recent years the average vessel fishing in the Ho'omalu Zone has failed to cover its total annual costs through bottomfish fishing (Section 3.5.1.5.2). The average vessel has earned a positive return on operations, and presumably vessel owners derive sufficient income from other economic activities to cover fixed costs.

In the Mau Zone, the poor economic performance of many vessels has resulted in a considerable turnover pattern of entry and exit. In 1999, a limited access program was established for the Mau Zone to support long-term productivity of bottomfish resources in the zone and to improve the economic stability of the fishery.

No data on the profitability of commercial bottomfish fishing operations in the MHI are available, nor is there information on the non-market value of subsistence or recreational bottomfish fishing around the MHI. However, it is likely that without the supplement to basic incomes obtained from subsistence or part-time commercial fishing, many fishermen in Hawai'i would face economic hardship in the state's expensive economic climate.

There is also a lack of data on the economic performance of vessels harvesting bottomfish in American Samoa, Guam and CNMI. It is probable, however, that fishing for bottomfish and other types of offshore fishing provide an important subsistence or income supplement to many families in these island areas.

4.1.6 Regional Economy

This alternative would have a direct positive effect on Hawai'i's economy. Assuming revenue trends comparable to recent years, the NWHI bottomfish would continue to generate annual revenues of about $1M (WPRFMC 2004). Individuals and firms that directly or indirectly support and are supported by the fishery would be able to maintain current levels of output, income and employment. Estimates are that the NWHI bottomfish fishery contributes $1,382,747 of output (production) and $482,218 of household income to the state economy, and creates the equivalent of 25 full-time jobs (Section 3.6.1.2), although this fishery has shrunk since then.

The contribution of Hawai'i's bottomfish fishery to the state economy is small (Section 3.6.1.2). However, given the vulnerability of the economies of Hawai'i and other U.S. Pacific Islands to sharp and sudden economic downturns, as evidenced by negative changes in the economic condition of most of these island areas during the past several years, the importance of economic diversification is apparent (Section 3.6.1.1). Commercial fishing appears to be one of the few economic sectors outside the mainstay of tourism in which substantial economic growth is possible.

4.1.7 Fishing Community

Continued bottomfish fishing in the EEZ surrounding the NWHI would promote social and economic stability among fishery participants and help preserve elements of local fishing culture Section 3.7 describes the sociocultural importance of bottomfish fishing in Hawai'i. The bottomfish fishery provides direct and indirect social and cultural benefits for fishermen and their families, seafood consumers and the broader community. Direct benefits would accrue to the communities of Kaua'i and O'ahu, as vessels participating in the NWHI fishery are homeported in these communities.

4.1.8 Native Hawaiian Community

This alternative would have a positive economic impact on Native Hawaiians who are owners, captains or deck hands of bottomfish fishing vessels operating in the NWHI. No recent data on the ethnicity of participants in the NWHI bottomfish fishery are available, but the level of participation by Native Hawaiians in this fishery was reported to be low (Iversen et al. 1990). However, Alternative 1B would attempt to increase the participation of Native Hawaiians in the fishery through a community development program. The Magnuson-Stevens Act provides for the establishment of a Western Pacific community development program for any fishery under the authority of the Council (Sec. 305(i)(2)(A)). This provision was added to the Act to address concerns that communities consisting of descendants of indigenous peoples in the Council's area have not been appropriately sharing in the benefits from the area's fisheries. The Council and the Secretary, respectively, have discretion to develop and to approve programs for eligible communities for the purpose of enhancing access to the fisheries under the authority of the Council.

In the case of the NWHI bottomfish fishery, the Council determined that a community development program should be incorporated in the Mau Zone limited access system to increase the economic benefits received by eligible communities from the fishery. Twenty percent of the target number of permits issued under the Mau Zone limited access system are reserved for the exclusive use by eligible communities. The Council reserved 20 percent of the permits because this figure reflects the proportion of Native Hawaiians in Hawai'i's population. However, the

number of permits reserved for the program may be periodically reviewed and changed. Permits issued under the community development program are not subject to the "use-it-or-lose it" requirement.

An allocation under a community development program is not based on customary or traditional fishing practices in eligible communities or on treaty rights related to fisheries. Rather, the legislative history of this provision suggests that allocations are mainly to be based on a concern that eligible communities have not been appropriately sharing in the benefits from the area's fisheries. An allocation under a community development program does not establish for a participating community a perpetual entitlement to access and withdrawal rights. Each allocation is temporary and revokable.

It is also important to note that this provision does not provide a statutory basis for a conferral of rights to make decisions which effect management of a particular fishery resource or effect the allocation of access and withdrawal rights to other stakeholders. This point was emphasized by the National Resource Council Committee to Review Community Development Quotas (NRC 1999) with specific regard to the Magnuson-Stevens Act community development program in Alaska, where it is referred to as a community development quota (CDQ) program. The report of the Committee states, "Sharing in economic benefits is not the same as ... sharing in management responsibilities" (p.81). And further notes, "If 'management' is understood as management of the resource ..., then the Alaska CDQ program is not co-management (sharing of management with a higher governmental authority) and not yet community management (full devolution of resource management authority). The CDQ program assigns rights to economic benefits via a quota share of the TAC (total allowable catch) but there is no assignment of resource management authority " (p.89).

4.1.9 Administration and Enforcement

Alternative 1A would perpetuate the status quo for existing administrative and enforcement procedures without adding or reducing costs or responsibilities to management agencies (Section 3.9). Alternative 1B would add administrative costs and enforcement responsibilities. In Hawai'i, dropping the "use-it-or-lose-it" provisions of the limited access permits would remove the necessity for the PIRO to track landings for the purpose of permit renewal. However, landings would still be monitored for stock assessment purposes. Some additional administrative costs would be incurred if additional Mau Zone permits were issued or if the CDP were implemented.

If the CNMI is added to the Bottomfish FMP management area, no additional costs would be incurred in collecting and processing all of the data necessary for preparation of the bottomfish annual report, as this information is already included in the reports.

If the area closure/vessel size limit measures for Guam are implemented, a requirement for enforcement of these provisions would arise.

4.2 IMPACTS OF ALTERNATIVE 2

Alternative 2 is immediate cessation of bottomfish fishing in the NWHI.

4.2.1 Target Species

The cessation of bottomfishing fishing activities in the NWHI would remove anthropogenic sources of mortality from the target stocks. The direct effect of a total closure of the bottomfish fishery in the NWHI would be the gradual return of the NWHI bottomfish spawning biomass to equilibrium with sources of natural mortality. An indirect effect could be to enhance recruitment to the MHI portion of the target species populations. Localized depletions have been documented for several of these species in both federal and state waters around the MHI. However, the effect of an increase in recruitment to the MHI remains uncertain and may be offset to some extent if fishing effort is redistributed from the NWHI to the MHI by displaced vessels. Impacts in other areas of Council jurisdiction would be the same as for Alternative 1, as only the NWHI fishery would be affected by this alternative.

4.2.2 Bycatch

Bycatch in the NWHI bottomfish fishery is low because of the selective gear and fishing practices used. The amount of mortality of bycatch species in the NWHI bottomfish fishery is unknown, but if bycatch is low, bycatch mortality (in absolute numbers) must also be low. Although bottomfish fishing causes some mortality to bycatch species, the amount is likely to be far less than natural mortality. The cessation of bottomfish fishing in these zones would eliminate anthropogenic sources of mortality on these species, and allow a return to equilibrium with natural sources of mortality. However, the positive impact of this alternative likely would not be detectible against the background of natural population fluctuations.

4.2.3 Protected Species

4.2.3.1 Cetaceans, Sea Turtles and Seabirds

This alternative would eliminate the potential for impacts from behavioral disturbance, entanglement in fishing gear and other interactions between cetaceans, sea turtles and seabirds and the NWHI bottomfish fishery. Given the infrequency of these interactions, it is likely that the closure of the NWHI bottomfish fishery would have no measurable effects on the distribution or abundance of these species.

4.2.3.2 Hawaiian Monk Seal

The cessation of commercial bottomfish fishing in the NWHI would eliminate any potential direct or indirect negative impacts of bottomfish fishing operations on Hawaiian monk seal populations. These potential impacts include a low-level risk of accidental hooking, entanglement in bottomfishing fishing gear, behavioral disturbance and competition for food resources.

4.2.4 Essential Fish Habitat, Biodiversity and Ecosystems

The immediate closure of the NWHI bottomfish fishery would eliminate mechanisms by which bottomfish fishing activities potentially affect the marine environment such as pollution and physical habitat disturbance. Given the low density of bottomfish fishing operations in the NWHI, the infrequency of fishing vessel groundings and the large natural perturbations in coral reef habitat, the added protection to the coral reef ecosystem, EFH and HAPC in the NWHI resulting from termination of the bottomfish fishery is likely to be minimal. Submersible-supported studies conducted in 2001 at bottomfishing banks in the NWHI have reported minimal evidence of fishing impacts to habitat (C. Kelly pers. comm. 2001). However, by eliminating any possible negative impact from bottomfish fishing operations in the NWHI, this alternative would help maintain the value associated with preservation of the coral reef ecosystem in the NWHI (Section 3.4.4). Potential impacts of bottomfish fishing activities to EFH or HAPC for any managed species outside the NWHI are not likely to lead to substantial physical, chemical, or biological alternations to the habitat, or result in loss of, or injury to, these species or their prey for the reasons described for Alternative 1.

4.2.5 Commercial, Recreational and Charter Fishing Sectors

Immediate closure of the NWHI bottomfish fishery would impose an economic hardship on fishery participants. This alternative would immediately prohibit bottomfish fishing in the EEZ surrounding the NWHI. It is estimated that up to 45 fishermen would be displaced by this action based on the current number of vessels (17) eligible to fish in the area under the limited access programs for the Mau and Ho'omalu Zones and assuming that each Mau Zone vessel and Ho'omalu Zone vessel has a crew of two and three, respectively, and one-fourth of the vessels are not owner-operated. Based on recent landings data, about 300,000 lb of bottomfish with an ex-vessel value of about $1M would no longer be harvested from the NWHI fishery (WPRFMC 2004).

The termination of the NWHI bottomfish fishery would force displaced fishermen to relocate their fishing activities to bottomfish grounds that are still open, shift to different fisheries or tie up their vessels. It is likely that displaced fishermen would have difficulty relocating their

operations to bottomfish fishing grounds around the MHI. Respondents in a 1993 survey of participants in the NWHI fishery generally indicated that it is not worth their time to fish around the MHI because it takes too long to catch a full load of fish (Hamilton 1994). Closure of the NWHI fishery is likely to have less of an impact on Mau Zone permit holders than Ho'omalu Zone permit holders, as most of the former tend to own smaller boats and currently utilize MHI bottomfish fishing grounds and/or participate in other fisheries (e.g., handlining or trolling for pelagic species). In contrast, Ho'omalu Zone vessels require larger catches to be profitable and have few, if any, viable alternative fisheries. For the owners of these vessels, closure of the fishery would represent a sunk cost of $150,000 to $250,000 per vessel.

Transfer of effort from the NWHI to the MHI could also indirectly create economic hardship in the form of reduced profitability for fishermen already engaged in the MHI fishery. Bottomfish fishing grounds in the MHI are fully utilized with few, if any, unexploited areas. Recently implemented state regulations that close certain bottomfish fishing grounds have further increased competition for fishing locations around the MHI. If NWHI fishermen were to shift their effort to the MHI, catch per unit effort and individual harvest for both displaced and resident fishermen would likely decline due to the intensified fishing pressure on bottomfish resources. Lower individual catches would mean a decrease in the incomes of part-time and full-time commercial fishermen and a reduction in the non-market value of the fishing experience to a number of recreational fishermen and charter fishing patrons. Total harvest in the MHI fishery would probably remain at current levels regardless of increased participation from displaced NWHI fishermen because nearly all MHI fishing grounds are fully utilized.

Those displaced fishermen who elect to target other species are likely to recover some portion of the revenue previously generated from bottomfish fishing in the NWHI, particularly if they pursue more widely distributed species like tuna. Many Mau Zone vessels are already outfitted to participate in fisheries on other stocks, but some boat owners may not be capable of shifting into other fisheries without significant additional capital outlays. Conversion to charter fishing may be a feasible option for some vessel owners. However, the charter fishing fleets in most of Hawai'i's ports are already over-capitalized (Hamilton 1998).

Given that opportunities for displaced fishermen to recover their lost harvest and income would be limited and the fishery is already characterized by limited profitability (Section 3.5.1.5.2), it is likely that some displaced fishermen would be forced to sell out or retire. It is uncertain how active the Hawai'i or nationwide market is for the types of vessels, gear and other investment capital used in the NWHI bottomfish fishery. However, it is possible that the Hawai'i market for these assets could quickly be flooded. Closure of the NWHI bottomfish fishery would likely depress the immediate resale market for bottomfish fishing equipment and vessels as well as diminish the long-term investment value of the vessels owned by displaced fishermen who opt to continue fishing. This could create an economic hardship for those fishermen who are relying on

money earned from selling their fishing assets to supplement their retirement funds.

It is possible that closure of the NWHI fishing grounds could help rebuild stocks in the MHI and sustain or increase harvests, thereby mitigating the revenue reductions from fishing restrictions. However, the ability of closed areas to increase yields has not been demonstrated for bottomfish fisheries in Hawai'i. It should also be noted that, even if a closed area has the potential to have a positive effect on fish populations and fishery productivity, it may take several years after the closure of the NWHI fishery occurs for this effect to be realized because of the high age of first reproduction for most bottomfish species. Given this time lag, it is unlikely that the potential economic benefits of an area closure would accrue to the current generation of bottomfish fishermen. Moreover, if fishing effort is allowed to increase in the MHI, any economic gains from a closed area will be dissipated over the long-run.

4.2.6 Regional Economy

The immediate cessation of bottomfish fishing in the EEZ surrounding the NWHI would result in a decrease in output, household income and jobs in Hawai'i. However, an input-output analysis indicates that the contribution of the NWHI bottomfish fishery to overall economic activity in Hawai'i is small (Section 3.6.1.2). Recent estimates are that the fishery contributes $1,382,747 of output (production) and $482,218 of household income to the state economy and creates the equivalent of 25 full-time jobs, although the fishery has shrunk since then. The impact of the loss of the fishery would consist of a reduction in state output, income and employment by 0.00003 percent or less. Even this low figure may over-estimate the regional impacts as it does not consider the potentially off-setting impacts of the re-employment of the labor and capital that would be left idle as a result of closure of the NWHI fishery. For example, unemployed workers might find other jobs in Hawai'i that may or may not be fishing-related and fishing vessels could be used in other fisheries.

With the exception of American Samoa, it is difficult to argue that commercial fishing plays a pivotal role in the economies of any of the U.S. Pacific Islands (Section 3.7). In all of these island areas, moreover, other fisheries – particularly pelagic fisheries – are more important than bottomfish fishing. In no area does bottomfish fishing occupy a core part of the fishing industry. However, in the 1990s downturns in economic activity in Hawai'i and the other U.S. Pacific Islands brought on by outside forces underscore the importance of economic diversification in these small and isolated island areas. Commercial fishing broadens the base of Hawai'i's economy and is one of the few economic sectors in the state that has experienced significant growth. The termination of the NWHI bottomfish fishery would hamper further expansion of Hawai'i's commercial fishing industry and impede current efforts to diversify the state economy.

4.2.7 Fishing Community

Immediate cessation of fishing for bottomfish in the EEZ surrounding the NWHI would directly affect the fishing communities of Kaua'i and O'ahu. As discussed in Section 3.7, the NWHI bottomfish fishing fleet and most of the other industrial-scale fishing fleets in Hawai'i are based in Honolulu. In addition, this urban area is the center of the state's fish marketing/distribution network. When examined from a community frame of reference, however, the economic contribution of the harvesting and processing of fishery resources to the total economy of Honolulu is diluted by the relative scale of other economic activities in the metropolitan area, such as tourism. In other words, Honolulu is the center of a major portion of commercial fishing-related activities in the state but is not a community "substantially dependent upon or substantially engaged in" fisheries in comparison to its dependence upon and engagement in other economic sectors.

Although closure of the NWHI bottomfish fishery would have no significant socioeconomic effects in the context of the economy of Honolulu or any other community, it would have a direct and significant negative impact on individual fishing enterprises. Fishery participants would suffer from a loss of earning potential, investment value and lifestyle. As indicated in Section 4.2.6, closure of the NWHI bottomfish fishery would result in the loss of the equivalent of 25 full-time jobs in Hawai'i. However, the finding that relatively few persons would be negatively impacted economically and the regional economy would be insignificantly affected does not lessen the economic hardship that reduced earnings or loss of a job would create for some fishermen and their families. This economic hardship would occur at a time when opportunities for shore-based jobs within fishing related fields (e.g., at marinas or dry dock facilities) as well as in other segments of Hawai'i's labor market where fishermen and their family members are likely to seek employment.

Hawai'i has suffered more than a decade of economic stagnation, and workers in both the public and private sectors have lost jobs (Section 3.6.1.1). A study of workers that were laid off following the shut down of the sugar industry on the island of Hawai'i found that more than a year after the loss of their jobs 35 percent of the interviewees were still unemployed and seeking work (DeBaryshe et al. undated). Moreover, anecdotal evidence suggests that many of those who had found employment were in temporary or seasonal jobs. Although three-quarters of the plantation workers who were laid off made use of state-sponsored job training services, use of these services did not increase the chance of finding a new job. Demographic characteristics such as age, former plantation job grade and education were also largely unrelated to the likelihood of re-employment. It is likely that individuals who lose their jobs as a result of closure of the NWHI bottomfish fishery would encounter similar difficulties in finding suitable alternative jobs.

Deckhands would arguably be the most severely impacted by termination of the NWHI

bottomfish fishery – they will probably be the first to lose their jobs and they may have the greatest difficulty in finding alternatives. Pooley and Kawamoto (1990) indicate that the net revenue of a bottomfish fishing vessel operating in the NWHI is most sensitive to the crew share percentage and to changes in total fixed costs. If termination of the NWHI bottomfish fishery results in a reduction in net revenues, captain/owners may partly try to make do by decreasing the pay of deckhands or laying them off. Appropriate employment opportunities outside of fishing may be limited for affected individuals, and for many the income losses may be long-term.

Those who become unemployed would face the social and psychological costs of job loss. Individuals who lose their jobs typically experience heightened feelings of anxiety, depression, emotional distress and hopelessness about the future, increases in somatic symptoms and physical illness, lowered self-esteem and self-confidence and increased hostility and dissatisfaction with interpersonal relationships (DeBaryshe et al. undated). In addition, both spouses and children of such individuals are at risk of similar negative effects. The aforementioned study of workers displaced from the sugar industry found many families reported difficulty in paying bills and in affording transportation, health care and even food and clothing (DeBaryshe et al. undated). The results of this financial strain were high levels of psychological distress among some family members as well as an increase in physical health problems. It is probable that a similar level of stress would be experienced by individuals who lose their jobs as a result of an immediate closure of the NWHI bottomfish fishery.

Immediate closure of the bottomfish fishing grounds in the NWHI would also have a negative economic impact on local businesses that directly or indirectly support and are supported by the fishery. Included are individuals or firms that process, distribute and sell fishery products and enterprises that provide goods and services to the fish harvesting sector in Hawai'i such as chandlers, gear manufacturers, boatyards, tackle shops, bait shops and insurance brokers. While the percentage of business derived from the NWHI bottomfish fishery may be relatively small for some of these firms, any permanent loss of income during this extended period of stagnation in Hawai'i's economy could affect their economic viability.

It is likely that many families that depend on fishing and the seafood industry in Hawai'i are already economically, socially and psychologically stressed because of declining catch rates, increasing competition and unstable markets. In Hawai'i, there have been a number of highly publicized clashes between the owners of large and small fishing boats and between fishermen who are newcomers and those who are established residents (Section 3.7.1.1). Contributing to this stress is the imposition of ever more restrictive state and federal regulations. Undoubtedly, many fishermen in Hawai'i have the sense that government regulations are "boxing them in" and reducing their ability to maintain their characteristic highly flexible fishing strategy (Pooley 1993a; Hamilton et al. 1996; Polovina and Haight 1999). This flexibility is important to the economic success of many smaller and medium-sized fishing vessels because of natural

variations in the availability of various types of fish. Closure of the NWHI bottomfish fishing grounds would further confine fishermen and could jeopardize the long-term economic viability of their fishing operations.

In addition to potential economic losses associated with the cessation of bottomfish fishing in the NWHI, there would be the loss of lifestyle to contend with, assuming that displaced fishermen cannot find an equally satisfactory alternative way of life. A 1993 survey of owner-operators and hired captains who participate in the NWHI bottomfish fishery found that enjoyment of the lifestyle or work itself is an important motivation for fishing among fishery participants (Section 3.7.1.1). This survey also found that half of the respondents who fish in the Ho'omalu Zone are motivated by a long-term family tradition. Some fishermen would be able to continue their fishing lifestyle by switching to other fisheries, but the aspects of the maritime culture associated specifically with fishing in the NWHI (place names, stories associated with the NWHI, fishing strategies, etc.) would be lost. Fishermen who have invested many years learning to fish in the area would lose the opportunity to connect with that landscape and apply their locale-specific fishing skills and knowledge.

Based on recent harvest data, the bottomfish catch in the NWHI fishery represents about forty percent of the total commercial bottomfish harvest in Hawai'i (WPRFMC 2004). Closure of the NWHI bottomfish fishery would have a direct negative impact on seafood consumers by significantly reducing the amount of fresh bottomfish available for sale. There may be substitution possibilities in the form of other sources and species. However, catch rates in the MHI bottomfish fishery have shown a general downward trend, and it is doubtful that yields in this fishery can be increased. The quantity of imported bottomfish has increased in recent years, but the quality of these imports is considered by some consumers to be lower than that of locally-caught fish.

Immediate closure of bottomfish fishing grounds in the NWHI would also likely have a negative impact on those who value the continued existence of Hawai'i's maritime tradition and culture. As discussed in Sections 3.5.1.1 and 3.7.1.1, Hawai'i's commercial fishing industry dates back nearly 200 years, and fishermen have engaged in commercial handline fishing for bottomfish in the MHI and NWHI since the early part of the last century. The bottomfish fishery is a historically important component of an industry that is deeply intertwined with Hawai'i's social and cultural resources (Section 3.7.1.3). By reducing the diversity and economic viability of the commercial fishing life way in Hawai'i, closure of the NWHI bottomfish fishery would diminish the influence of Hawai'i's maritime culture.

One possible way in which the negative economic and social effects of this alternative on participants in the NWHI bottomfish fishery could be mitigated is the implementation of a permit or vessel "buy-back" program. Some holders of a Mau Zone or Ho'omalu Zone permit might be

willing to sell their permit or vessel to the federal government or a third party for the sole purpose of retiring the permit or vessel. Subject to the availability of funds for this purpose, the government might be willing to buy these permits or vessels to enable and encourage fishermen who wish to pursue alternatives to fishing for bottomfish in the NWHI. Any such "buy-out" would require, at a minimum, a cooperative seller, a willing buyer and available funds.

A second possible way in which the negative economic and social effects of this alternative could be mitigated is through a fisheries disaster relief program. Federal payments to fishing communities and industry groups have been made increasingly frequently under Section 312(a) of the Magnuson-Stevens Act, the MSA provisions that deal with Fisheries Disaster Relief. In late 1998, for example, Congress appropriated five million dollars to NOAA to provide emergency disaster assistance to persons or entities in the New England multispecies groundfish fishery who were most affected by seasonal area closures. One-time cash payments were received by both crew members and permit holders (vessel owners). Close involvement of fishery participants is advisable to ensure that any such mitigation measures are appropriate.

Owners of Hawaii-based longline vessels received financial assistance from a federal direct economic assistance program (DEAP) because of the unanticipated and serious business impairment and disruption participants experienced as a result of the series of restrictive management actions that began in late 1999 (66 FR 58440, November 21, 2001).[4] Owners of tuna vessels received $16,000, while owners of swordfish vessels received $32,000.

This alternative could have environmental justice implications under Executive Order 12898, as it may result in disproportionately high and adverse human health or environmental effects on minority or low income populations. As discussed in Section 3.7.1.1, a survey by Hamilton and Huffman (1997) of small-boat owners who engage in Hawai'i's commercial and recreational fisheries, including the troll, pelagic handline and bottomfish fisheries, found that a high proportion of the survey respondents were members of minority groups. An informal survey of bottomfish fishing vessel owners and crews revealed that nine of 16 vessels are owned and/or captained by Caucasians, two by Portugese-Americans, three by Hawaiians, one by a Japanese-American and one by an Asian-American (specific ethnicity unknown). Less is known about the ethnicities of the crews, and these tend to change much more rapidly than vessel owners or

[4] The Consolidated Appropriations Act of 2001 made $3.0 million available to NOAA Fisheries to provide economic assistance to fishermen and fishing communities affected by federal closures and fishing restrictions in the Hawaii longline fishery. Vessel owners that fished under a Hawaii longline limited access permit and harvested pelagic species in the Hawaii longline fishery between January 1, 1999, and November 29, 1999 were eligible to participate in the program. This eligibility period directed financial assistance to owners of vessels engaged in harvesting activity under a Hawaii longline limited access permit in the months immediately preceding the implementation of restrictive management actions.

captains. At the time of the informal survey, three vessels were crewed by Hawaiians, five by Caucasians, and two by a mixture of ethnicities. Regardless of ethnicity, fishermen, especially crew, are likely to be classified as low income.

Furthermore, as noted in Section 3.7.1.2.2, the Hawai'i seafood market includes a particular cultural interest in *'ōpakapaka*, *onaga* and other species of bottomfish. Members of certain minority groups in the state consider these species to be showy and auspicious fish for festive occasions. A decrease in the availability of high quality bottomfish during culturally important events would cause a loss in well-being among these consumers, although an assessment of this loss is not possible with available data.

4.2.8 Native Hawaiian Community

From a Native Hawaiian perspective, there are two aspects of this alternative that need to be examined. The first pertains to outstanding aboriginal claims of Native Hawaiians. Immediate cessation of bottomfish fishing would enhance the ability of the NWHI bottomfish stocks to replenish themselves until such time as an equitable settlement is agreed upon and roles and responsibilities of Native Hawaiians with respect to the resource base are clarified.

The second issue pertains to the interests of Native Hawaiians who are owners, captains or deckhands of fishing vessels presently harvesting bottomfish in the NWHI. This alternative would deprive them of the means of a livelihood. In view of the historic and cultural importance of fishing over the last 2000 years for Native Hawaiians, this deprivation of the right to make a living fishing at *ko 'a* that they have been accustomed to frequent is an especially onerous penalty. The negative effects are exacerbated by the fact that annexation of Hawai'i by the U.S. opened the "icebox" (fishery resources) of the Native Hawaiians to any U.S. citizen (Kosaki 1954). Over the decades this competition for resources has made it much more difficult for Native Hawaiians to succeed in customary occupations like fishing.

4.2.9 Administration and Enforcement

This alternative would reduce administrative costs by removing the need to maintain the current separate fisheries data collection system for the NWHI bottomfish fishery. In addition, the administrative costs of managing the limited access permit programs for the Mau and Ho'omalu Zones would be eliminated.

4.3 IMPACTS OF ALTERNATIVE 3

Alternative 3 is a phase-out of bottomfish fishing in the NWHI. With respect to impacts to biological components of the affected environment (Sections 3.1-3.5), the short-term impacts of a gradual phase-out program are the same as the impacts described for Alternative 1. That is, localized depletions of target species may occur in the MHI, and relatively small numbers of bycatch species would continue to be caught where bottomfish fishing occurs. Minor risks to protected species and habitats would remain while fishing continued. The long-term impacts are the same as for Alternative 2. Fishing pressure on stocks of target and bycatch species in the NWHI would be removed, but could increase in the MHI if fishing efforts are redirected there. Risks from the bottomfish fishery to protected species and habitats in the NWHI ultimately would be eliminated.

4.3.1 Commercial, Recreational and Charter Fishing Sectors

This alternative would permit harvest of bottomfish in the NWHI to continue during the life tenancy period of qualifying fishermen, thereby supporting fishing operations over the course of the current generation. The phase-out period would allow qualifying fishermen to adjust their fishing activities to areas outside the NWHI or continue fishing in the NWHI until retirement. Current investments in fishing vessels and gear could be amortized.

Over the short term, about 300,000 lb of bottomfish with an ex-vessel value of about $1M would continue to be harvested by about 9-11 Mau Zone and Ho'omalu Zone permit holders. However, harvest and participation in the NWHI fishery would gradually decline as fishermen depart from the fishery. Younger permit holders that remain in the fishery would likely experience a positive economic impact, as catch rates could increase in response to the gradual effort reduction.

The qualifying criteria may exclude some permit holders who once depended heavily on the fishery but have shifted their focus in recent years. For these individuals the option to return to the fishery would be lost.

4.3.2 Regional Economy

This alternative would have a minimal effect on economic activities in Hawai'i. Impacts of this alternative on the regional economy in the short-term would be similar to those of Alternative 1, which allows continued bottomfish fishing in the NWHI. The long-term impacts of this alternative would be as described in Alternative 2. Because of the very small contribution of this fishery to the regional economy, however, the difference between the impacts of Alternatives 1 and 2 would be insignificant.

4.3.3 Fishing Community

In the short-term the impacts of this alternative on fishing communities (proposed) are most like those of Alternative 1, which allows continued bottomfish fishing in the NWHI. Over the long-term the effects of this alternative are similar to those described for Alternative 2. In addition to the impacts on communities and current fishery participants, future generations of fishermen in Hawai'i would be affected by having one less option to draw on to make fishing a financially secure occupation.

The gradual elimination of the NWHI bottomfish fishery and consequent decrease in the availability of high quality bottomfish during culturally important events would cause a loss in well-being among consumers. In addition, the resultant diminishment of the viability of the commercial fishing life way would have a negative effect on the well-being of members of the broader community in Hawai'i who value the contribution that the commercial fishing industry makes to the state's cultural, social and economic diversity.

4.3.4 Native Hawaiian Community

This alternative would provide Native Hawaiians currently participating in the NWHI bottomfish fishery an opportunity to adjust their bottomfish fishing activities to areas outside the NWHI or continue bottomfish fishing in the NWHI until their retirement. However, no other Native Hawaiians would be able to obtain a permit for the NWHI bottomfish fishery. The long-term impact in terms of allowing time for clarification of outstanding claims of Native Hawaiians is similar to that of Alternative 2.

4.3.5 Administration and Enforcement

A large portion of the enforcement of this alternative could presumably be met through existing levels of air and surface patrolling used to monitor compliance with current regulations. As participation in the fishery declines the impacts of this alternative would be similar to those of Alternative 2.

4.4 IMPACTS OF ALTERNATIVE 4

Alternative 4 is adaptive management through zoning. Four zones are established: General Use, Special Use, Eco-tourism and Preservation. Alternative 4A differs from 4B in that the Preservation Zone in the former includes only waters around FFS and Laysan Island, whereas the Preservation Zone in the latter adds waters around Pearl and Hermes Reef, Lisianski Island, and Kure Atoll to the previously noted areas.

4.4.1 Target Species

4.4.1.1 Alternative 4A

This alternative would immediately prohibit bottomfish fishing in the waters around FFS, Laysan Island and Midway Atoll (Eco-tourism Zone). NMFS NWHI landings data (see Table 3-16) indicate that these areas have historically accounted for 19.2 percent of the total bottomfish harvest in the NWHI fishery. The closure of these areas represents a reduction in fishing mortality for the target species, a positive direct impact. Currently the bottomfish stocks in the NWHI are classified as healthy, however, and are not stressed from fishing activities. Research studies on larval distribution and advection patterns along with genetic data indicate that larval and genetic exchange is distributed throughout the entire archipelago. Indirectly, the reduction in fishing mortality in the closed areas could allow localized rebuilding of stocks and an increased contribution to the spawning biomass throughout the archipelago. However, the effect of an increase in recruitment to the MHI may be offset to some extent if fishing effort is redistributed from the NWHI to MHI by displaced vessels.

4.4.1.2 Alternative 4B

This alternative would immediately prohibit bottomfish fishing in the waters around FFS, Laysan Island, Pearl and Hermes Reef, Lisianski Island, Kure Atoll and Midway Atoll. NMFS NWHI landings data (see Table 3-16) indicate that these areas have historically accounted for about 32.5 percent of the total bottomfish harvest in the NWHI fishery. Compared with Alternative 4A, the reduction of target species mortality in the NWHI would nearly double if effort were not redistributed to other NWHI grounds. The net effect on archipelagic stocks, however, would depend on the net reduction of effort in both the MHI and NWHI fisheries.

4.4.2 Bycatch

4.4.2.1 Alternative 4A

Bycatch in the NWHI bottomfish fishery is low because of the selective gear and fishing

practices used. The amount of mortality of bycatch species in the NWHI bottomfish fishery is unknown, but if bycatch is low, bycatch mortality (in absolute numbers) must also be low. Although bottomfish fishing causes some mortality to bycatch species, the amount is likely to be far less than natural mortality. The cessation of bottomfish fishing in these zones would eliminate anthropogenic sources of mortality on these species, and allow a return to equilibrium with natural sources of mortality. However, the positive impact of this alternative likely would not be detectible against the background of natural population fluctuations. Indirect impacts are expected to be negligible.

4.4.2.2 Alternative 4B

The impacts of Alternative 4B are the same as described for Alternative 4A. Although additional Preservation Zones would be designated, the direct positive impact of this alternative likely would not be detectible against the background of natural population fluctuations, and indirect impacts are expected to be negligible.

4.4.3 Protected Species

4.4.3.1 Cetaceans, Sea Turtles and Seabirds

4.4.3.1.1 Alternative 4A

Laysan Island has the world's largest colony of black-footed albatrosses, and more than 90 percent of the Hawaiian population of the green turtle nests at FFS. Establishment of a Preservation Zone around FFS and Laysan Island would eliminate the potential for impacts to all protected species in those areas from the bottomfish fishery. Even outside the Preservation Zone, potential impacts to seabirds, sea turtles and cetaceans other than the bottlenose dolphin would not be expected. The low level of potential non-lethal impacts to the bottlenose dolphin from the bottomfish fishery would remain outside the Preservation Zone.

4.4.3.1.2 Alternative 4B

Impacts would be similar to those for Alternative 4A, but Preservation Zones would also include marine areas around Pearl and Hermes Reef, Lisianski Island and Kure Atoll. Establishment of a Preservation Zone around these areas would eliminate the potential for impacts to all protected species in those areas from the bottomfish fishery. Even outside the Preservation Zone, potential impacts to seabirds, sea turtles and cetaceans other than the bottlenose dolphin would not be expected. The low level of potential non-lethal impacts to the bottlenose dolphin from the bottomfish fishery would remain outside the Preservation Zone.

4.4.3.2 Hawaiian Monk Seal

4.4.3.2.1 Alternative 4A

Potential direct and indirect impacts of bottomfish fishing in the NWHI on Hawaiian monk seals include the low-level risk of accidental hooking, entanglement in bottomfish fishing gear, behavioral disturbance and competition for food resources. Under this alternative, the potential for direct and indirect negative impacts would be eliminated around FFS and Laysan Island, the two most important Hawaiian monk seal breeding areas.

4.4.3.2.2 Alternative 4B

This alternative would expand the positive impacts listed above to include all the major Hawaiian monk seal breeding and weaning areas in the NWHI.

4.4.4 Essential Fish Habitat, Biodiversity and Ecosystems

4.4.4.1 Alternative 4A

The added protection to the coral reef ecosystem, EFH and HAPC in the NWHI resulting from closure of areas around selected islands and atolls to bottomfish fishing is likely to be minimal and non-measurable given the low density of bottomfishing operations, the infrequency of fishing vessel groundings and the large natural perturbations in coral reef habitat. Submersible-supported studies conducted in 2001 at bottomfishing banks in the NWHI have reported minimal evidence of fishing impacts to habitat (C. Kelly pers. comm. 2001). However, to the extent that Alternative 4A results in an overall decrease in fishing effort in the NWHI bottomfish fishery, the possible impacts of fishing on coral reefs, EFH and HAPC would be reduced and the value associated with preservation of the coral reef ecosystem in the NWHI would be maintained (Section 3.4.4). In addition, the Preservation Zone of Alternative 4A would provide added protection to coral reefs around FFS and Laysan Island. FFS is the southern-most atoll in the NWHI and the largest coral reef area in Hawai'i. It has one of the highest diversities of hermatypic coral species in the Hawaiian Archipelago (Grigg 1983). Moreover, the expansive shallows enclosed by the barrier reef at FFS is a favorable habitat for certain Indo-West-Pacific fish species that are rare or absent from other areas of the Hawaiian chain (Hobson 1980). Laysan Island is of biological importance because it represents a reef ecosystem-type characteristic of the middle of the NWHI and because historically there has been little human activity on the island that would degrade the surrounding marine environment.

Research and subsistence/cultural activities in the Special Use Zone may result in habitat disturbance from anchoring as well as disturbance of the marine environment from noise and

pollution associated with vessel traffic. Tourist activities in the Eco-tourism Zone could also result in the alteration or destruction of reef habitat and disturbance of the marine environment. Restrictions on the level of human activities in the Special Use and Eco-tourism Zones would mitigate these effects.

4.4.4.1 Alternative 4B

This alternative would expand the positive impacts described for Alternative 4A to include marine areas around Pearl and Hermes Reef, Lisianski Island and Kure Atoll.

4.4.5 Commercial, Recreational and Charter Fishing Sectors

4.4.5.1 Alternative 4A

This alternative would immediately prohibit commercial bottomfish fishing within 20 nm of Laysan Island, FFS and within the boundaries of the Midway Atoll National Wildlife Refuge. Little bottomfish fishing activity has historically occurred around Midway Atoll, but Laysan Island and FFS are familiar and productive fishing grounds. However, closure of these areas would likely have less effect on the catches and revenues of participants in the NWHI fishery than closure of other areas of the NWHI. NMFS NWHI landings data (see Table 3-16) indicate that the additional areas that would be closed to bottomfish fishing under this alternative have historically accounted for 19.2 percent of the total bottomfish harvest in the NWHI fishery (Section 3.5.1.2.2; Table 3-15). Applied to recent landings data (WPRFMC 2004), this percentage represents about 58,000 lb of bottomfish with an ex-vessel value of about $190,000.

This alternative would affect fishermen as described in Alternative 2 except that displaced fishermen would have the additional option of relocating their fishing activities to bottomfish grounds in the NWHI that remain open. These open areas represent many of the most productive fishing grounds in the NWHI. However, the area closures may force some fishermen to travel farther, thereby making effort more costly. In addition, competition for remaining fishing locations would increase and catch rates could fall, translating into less harvesting revenue for any given effort level. Enterprises with high operating costs would be the first to feel the cost-revenue squeeze (Samples and Sproul 1988). Over the longer run, operations with high fixed costs would be disadvantaged by the reduced contribution margin of each fishing trip made. These negative economic effects are likely to cause some fishermen to exit the NWHI fishery. For those enterprises that weather the financial negative effects created by the initial reduction in net earnings, the long-term outlook would be brightened by a gradual increase in catch rates in response to the initial effort reduction. The final outcome for these enterprises may be a situation similar to the pre-regulatory situation, at least in terms of financial rewards.

It is possible that closed areas could serve as reservoirs to help augment stocks in surrounding fishing grounds and increase harvests, thereby mitigating the revenue reductions from fishing restrictions. However, the ability of closed areas to increase yields has not been demonstrated for bottomfish fisheries in Hawai'i. It should also be noted that, even if a closed area has the potential to have a positive effect on fish populations and fishery productivity, it may take several years after the closure of the NWHI fishery occurs for this effect to be realized because of the high age of first reproduction for most bottomfish species. Given this time lag, it is unlikely that the potential economic benefits of an area closure would accrue to the current generation of bottomfish fishermen. Moreover, if fishing effort is allowed to increase in the MHI, any economic gains from a closed area will be dissipated over the long-run.

4.4.5.2 Alternative 4B

This alternative would immediately prohibit commercial bottomfish fishing within 20 nm of FFS, Laysan Island, Pearl and Hermes Reef, Lisianski Island and Kure Atoll and within the boundaries of the Midway Atoll National Wildlife Refuge. NMFS NWHI landings data (see Table 3-16) indicate that these areas have historically accounted for about 32.5 percent of the total bottomfish harvest in the NWHI fishery (Section 3.5.1.2.2). Applied to recent landings data (WPRFMC 2003), this percentage represents about 97,500 lb of bottomfish with an ex-vessel value of $325,000. The effect on fishermen would be as described in Alternative 4A except that displaced fishermen would have fewer alternative fishing grounds and, consequently, the negative impacts would be heightened.

4.4.6 Regional Economy

4.4.6.1 Alternative 4A

This alternative would not affect overall economic activity in Hawai'i to any significant degree. Closure of the waters around FFS, Laysan Island and Midway Atoll could reduce annual revenues in the fishery by about $190,000, resulting in a potential drop in output and income of $240,736 and $83,954, respectively, and the possible loss of the equivalent of four full-time jobs. These losses would have a negligible effect on the state's economy. Furthermore, these figures may overstate the regional impacts as they do not consider potential off-setting impacts. For example, fishing vessels may recover some portion of their lost revenues by moving to other bottomfish fishing grounds or shifting to other fisheries.

4.4.6.2 Alternative 4B

The impacts of this alternative on Hawai'i's economy would be similar to those described for Alternative 4A except that the loss in fishery revenue would be larger and, therefore, the impact on the regional economy would be greater. Closure of the waters around FFS, Laysan Island, Pearl and Hermes Reef, Lisianski Island, Kure Atoll and Midway Atoll could reduce annual revenues in the fishery by as much as $325,000, resulting in a potential drop in output and income of $411,765 and $143,598, respectively, and the possible loss of the equivalent of about seven full-time jobs. These losses would have a negligible effect on the state economy. Furthermore, these figures may overstate the regional impacts as they do not consider potential off-setting impacts. For example, fishing vessels may recover some portion of their lost revenues by moving to other bottomfish fishing grounds or shifting to other fisheries.

4.4.7 Fishing Community

4.4.7.1 Alternative 4A

Closure of the waters around FFS, Laysan Island and Midway Atoll to bottomfish fishing is likely to cause some displacement of fishermen from the NWHI fishery, which, in turn, is likely to result in the loss of earning potential, investment value and lifestyle among the displaced fishery participants. Some of the participants would be from Kaua'i, but most would be from O'ahu. Some of the impacts on consumers and the broader community as described for Alternative 2 may occur, although they would be mitigated by permitting fishermen continued access to other productive fishing grounds in the NWHI.

4.4.7.2 Alternative 4B

The socioeconomic impacts of this alternative would be similar to those described for Alternative 4A except that a larger number of fishermen are likely to be displaced from the NWHI fishery.

4.4.8 Native Hawaiian Community

Alternatives 4A or 4B would have the same economic effects on Native Hawaiians currently participating in the NWHI bottomfish fishery as they would on other fishery participants (Section 4.4.6). Some of these negative effects could be mitigated by the community development program. This program is intended to increase participation by Native Hawaiians in the NWHI bottomfish fishery (Section 4.1.8).

Like the other alternatives considered, this alternative does not directly address Native Hawaiian concerns regarding claims to the NWHI and marine resources in the surrounding waters.

However, the zoning plan would provide Native Hawaiians preferential access to certain areas for subsistence, cultural and religious purposes. In recent years, Native Hawaiians in greater numbers have been regaining and practicing more traditional ancestral skills of voyaging, fishing, farming and resource management along with the more familiar customs of *hula*, chant, language and spirituality. Fishing is one facet in the maintenance of maritime attributes of traditional culture and reinforcing links to the sea. In addition, the development of a zoning plan provides an opportunity for greater inclusion of the native voice in the decision-making process. Participation in the planning and eventually in the management of the NWHI is essential to the exercise of traditional responsibility towards these ancestral territories.

4.4.9 Administration and Enforcement

4.4.9.1 Alternative 4A

The administrative costs associated with this alternative are expected to be significantly higher than the no action alternative, as the zoning approach differs substantially from the current federal fisheries management regime for the waters around the NWHI. Although this alternative may be practical and feasible from a technical and economic standpoint, potential jurisdictional concerns must also be considered. The ecosystem of the NWHI includes lands and waters managed by several local, state and federal agencies, and in some cases jurisdictional claims overlap (Appendix G). The formulation and application of a comprehensive zoning plan would require an unprecedented level of cooperation among agencies and levels of government as well as the development of new partnerships with non-government stakeholders. Separate jurisdictions and competing missions, together with disputes over ownership and control of land, submerged land masses and surrounding waters in the NWHI, could hinder or derail implementation of this alternative. It is likely that the process of developing the interagency, intergovernmental and public-private relationships required would be time-consuming and costly.

The collection of data on the results and efficacy of management actions is a necessary part of adaptive management. Costs would be incurred monitoring the impacts that zoning has on the health of the biological system and net economic welfare. Some of these costs may be reduced (or displaced) by involvement of the fishing industry and other parties such as university researchers and volunteers.

At-sea enforcement of zoning restrictions would likely require additional air and sea patrols. Additional patrols would cost as much as $100,000 per air patrol and $250,000 per surface patrol (WPRFMC 2000a). The costs of enforcing zoning restrictions could be moderated through use of a satellite-based, vessel monitoring system (VMS). A Honolulu-based VMS is currently operated by NMFS and USCG to monitor compliance in the pelagic longline and NWHI lobster fisheries.

Costs would be incurred in expanding the existing VMS to accommodate the additional vessel and area coverage associated with a zoning management strategy.

4.4.9.2 Alternative 4B

This alternative would affect administration and enforcement costs as described for Alternative 4A.

4.5 CUMULATIVE IMPACTS

This section describes the magnitude and significance of the environmental consequences of each alternative in the context of cumulative effects. The Council on Environmental Quality's regulations for implementing NEPA define cumulative effects as the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions (40 CFR ~ 1508.7).

4.5.1 Introduction

The management action that has likely had the most significant environmental consequences (positive and/or negative), when combined with the effects of measures found in the bottomfish and seamount groundfish fishery FMP, was the establishment of the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve extending 50 nm around the NWHI. President Clinton issued Executive Order 13178 on December 4, 2000, establishing the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve, pursuant to the National Marine Sanctuaries Amendments Act of 2000. The EO was revised and finalized by Executive Order 13196, issued January 18, 2001. In establishing the Reserve, the Executive Orders set forth a number of conservation measures, including the creation of Reserve Preservation Areas in which commercial fishing is prohibited unless otherwise specified.[5] Where commercial fishing is permitted, it is subject to catch limitations based on catch history. Recreational fishing is limited to prior participants. In Table 4-3, the Reserve Preservation Areas are summarized and compared with the boundaries of the marine zones proposed in Alternative 4 of this EIS. Generally, the Preservation Areas extend from the seaward boundary of State waters out to a mean depth of 100 fathoms. All of the Preservation Zones specified in Alternative 4 would have corresponding Preservation Areas under the Reserve management regime, but the Preservation Zones defined in Alternative 4 extend out 20nm, while the Reserve's Preservation Areas extend only to 100

[5]The EO includes provisions that allow commercial bottomfish fishing and commercial and recreational trolling for pelagic species within portions of the Reserve Preservation Areas around certain islands and banks.

fathoms. In addition to the Reserve's Preservation Areas that correspond with the Preservation Zones around Kure Atoll, Pearl and Hermes Reef, Lisianski Island, Laysan Island and FFS, the Reserve has Preservation Areas around a number of other islands and banks as listed in Table 4-3. The effect of the Preservation Areas on bottomfishing would be similar to that of the Preservation Zones of Alternative 4 for Kure Atoll, Pearl and Hermes Reef and FFS because most bottomfishing takes place in depths less than 100 fathoms. For Lisianski and Laysan however, the Reserve regime permits bottomfishing seaward of 25 and 50 fathoms, respectively. Thus, restrictions on bottomfishing around those islands are less than under Alternative 4. However, under the Reserve management regime, many more areas are closed to bottomfish fishing, as summarized in Table 4-3.

The State of Hawai'i is currently is the process of developing a management framework for areas in the NWHI under its jurisdiction. The State of Hawai'i, inter alia, is proposing to: regulate access to the NWHI through an access permit; prohibit all fishing except hook and line fishing; prohibit fishing in all state waters around FFS, Pearl and Hermes Reef, and Kure Atoll; prohibit fishing in state waters 0- 20 fathoms deep around Necker Island, Gardner Pinnacles, Maro Reef, Laysan Island, and Lisianski Island; and prohibit fishing in state waters 0-10 fathoms around Nihoa Island. Since the State has not finalized its plan for the NWHI, the proposed management areas are not included in Table 4-3.

TABLE 4-3: Comparison of the Alternative 4's Special Use and Preservation Zones with the NWHI Reserve Preservation Areas and Other Managed Areas in the NHWI.

ISLAND OR AREA	BOTTOMFISH EIS	NWHI RESERVE	OTHER
Kure	Special Use Zone shoreline to 10 fathoms (Alt 4A). Preservation Zone to 20nm from geographic center (Alt 4B).	Preservation Area extends from the seaward boundary of Hawaii State waters (3nm) out to a mean depth of 100 fathoms.	State of Hawai'i Wildlife Refuge shoreline to 3 nm.
Midway	Ecotourism Zone coincident with the Midway Atoll NWR.	Not included in Reserve.	Midway Atoll NWR between 28°5' and 28°25'; 177°10' and 177°30'.
Misc. banks in the vicinity of Kure, Midway and Pearl and Hermes (4).			HINWR to 10 fathoms.
Pearl and Hermes	Special Use Zone shoreline to 10 fathoms (Alt 4A). Preservation Zone to 20nm from geographic center (Alt 4B).	Preservation Area extends from the seaward boundary of Hawaii State waters (3nm) out to a mean depth of 100 fathoms.	HINWR to 10 fathoms.
Misc banks near (W of) Lisianski (2).			HINWR to 10 fathoms.
Lisianski	Special Use Zone shoreline to 10 fathoms (Alt 4A). Preservation Zone to 20nm from geographic center (Alt 4B).	Preservation Area extends from the seaward boundary of Hawaii State waters (3nm) out to a mean depth of 100 fathoms. Bottomfishing permitted seaward of 25 fathoms.	HINWR to 10 fathoms.
Pioneer Bank		Preservation Area to 12 nm from geographic center. Bottomfishing permitted.	HINWR to 10 fathoms.
Misc banks near (SW of) Laysan (4).			HINWR to 10 fathoms.
Laysan	Preservation Zone to 20nm from geographic center (Alts 4A and 4B).	Preservation Area extends from the seaward boundary of Hawaii State waters (3nm) out to a mean depth of 100 fathoms. Bottomfishing permitted seaward of 50 fathoms.	HINWR to 10 fathoms. Lobster fishing prohibited to 20 nm from geographic center (Crustaceans FMP).

ISLAND OR AREA	BOTTOMFISH EIS	NWHI RESERVE	OTHER
Maro Reef		Preservation Area extends from the seaward boundary of Hawaii State waters (3nm) out to a mean depth of 100 fathoms. Bottomfishing permitted seaward of 25 fathoms.	HINWR to 10 fathoms.
Raita Bank		Preservation Area to 12 nm from geographic center. Bottomfishing allowed for 5 years from order.	HINWR to 10 fathoms.
Gardner Pinnacles		Preservation Area extends from the seaward boundary of Hawaii State waters (3nm) out to a mean depth of 100 fathoms. Bottomfishing permitted seaward of 25 fathoms.	HINWR to 10 fathoms.
Unnamed bank between Gardner Pinnacles and St. Rogatien Bank		Preservation Area to 12 nm from geographic center. Bottomfishing allowed for 5 years from order.	HINWR to 10 fathoms.
St. Rogatien Bank		Preservation Area to 12 nm from geographic center, but not closer than 3 nm to the next bank east. Bottomfishing permitted.	HINWR to 10 fathoms.
Brooks Banks (2)		Preservation Area to 12 nm from geographic center of southeast Brooks Bank, but not closer than 3 nm to the next bank west (northwest Brooks Bank?).	HINWR to 10 fathoms.
French Frigate Shoals	Preservation Zone to 20nm from geographic center (Alts 4A and 4B).	Preservation Area extends from the seaward boundary of Hawaii State waters (3nm) out to a mean depth of 100 fathoms.	HINWR to 10 fathoms.
Unnamed bank east of French Frigate Shoals		Preservation Area to 12 nm from geographic center.	HINWR to 10 fathoms.

ISLAND OR AREA	BOTTOMFISH EIS	NWHI RESERVE	OTHER
Necker		Preservation Area extends from the seaward boundary of Hawaii State waters (3nm) out to a mean depth of 100 fathoms. Bottomfishing permitted seaward of 25 fathoms.	HINWR to 20 fathoms.
Misc. banks around Nihoa and Necker (8).			HINWR to 10 fathoms.
Nihoa		Preservation Area extends from the seaward boundary of Hawaii State waters (3nm) out to a mean depth of 100 fathoms. Bottomfishing permitted seaward of 25 fathoms.	HINWR to 10 fathoms.

It is also important to note that natural (non-anthropogenic) factors can dramatically influence cumulative impacts on the species and environment of the NWHI. The greatest overall influence on the NWHI ecosystem is that of cyclical climate events which affect productivity and distribution of species at all trophic levels. These events affect the nature of regional oceanographic conditions, and have been identified as the cause of 30-50 percent changes in productivity for numerous species in the NWHI (Polovina et al. 1994; Polovina et al. 1995). The response of individual species, species guilds (e.g., bottomfish), and the NWHI ecosystem as a whole is as of yet undeterminable.

4.5.2 Target and Bycatch Species

Productivity at all trophic levels in the NWHI appears to be the result of meso-scale oceanographic conditions which undergo cyclical changes. The structure of the ecosystem, patterns of recruitment, changes in species abundance and biodiversity, are driven by the combination of responses of all the organisms that make up the NWHI ecosystem. Further impacts accumulate from anthropogenic input from both local (vessel traffic and associated risks, marine debris, human habitation and disturbance, etc.) and non-local (high-seas marine debris) sources.

Bottomfish fishing in the NWHI began in the early 1900s and has continued at various levels until the present. Currently, bottomfish resources in the NWHI are classified as healthy, and well above overfishing thresholds. Exploitation rates have generally been higher in the MHI than in the NWHI, and localized depletions have been documented for several of these species in State of Hawai'i waters within the MHI. Genetic and larval advection research indicate a discernable

mixing of the NWHI and MHI populations within the archipelago, and therefore these species are managed as single stocks throughout the archipelago. However, localized depletions will affect overall recruitment within the archipelago. Under Alternatives 1A and 1B, continued bottomfish fishing in the NWHI is limited through effort control (i.e. limited entry). This level of effort could have a discernable cumulative effect on bottomfish stocks in the archipelago. The magnitude of the effect would be correlated with the amount of recruitment that occurs between the NWHI and the MHI. This additive effect however, may not be discernable against the combined effects described above. A closure of the NWHI fishery (Alternative 2) may likely have a long-term positive cumulative impact on the population status of bottomfish stocks in Hawai'i by the gradual addition of spawning biomass which could mitigate MHI depletions. This alternative would also further reduce the risks from local negative anthropogenic effects from fishing activities which would accrue in the absence of a fishery closure. The gradual phase-out of fishing activities in the region as proposed under Alternative 3 would effectively mimic in the short-term the cumulative impacts as presented in Alternative 1A and 1B. Over the long term, as the fishery is reduced through attrition of participants, the cumulative effects would be as described for Alternative 2. Under Alternatives 4A and 4B, reductions in fishing mortality would be less than under a total closure of the fishery, but the magnitude of the reduction could have a long-term positive impact on the population status of bottomfish stocks in the archipelago. Redirection of effort displaced from the NWHI to the MHI however, could negate the positive effects of effort reductions in the NWHI.

Further reductions in fishing effort through the creation of the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve have the potential for additional long-term positive effects on bottomfish stocks through gradual increases in spawning biomass. These positive effects of the Reserve, however, could be offset to some extent if the displacement of vessels from fishing grounds in the NWHI increases the fishing effort in other areas such as those fishing grounds in the MHI where bottomfish populations are locally depleted (i.e. Alt. 2 and 3). Although the effect of natural cyclical oceanographic changes on the population status of these species has yet to be determined, reductions in fishing effort through the zoning process could result in increased recruitment within the entire archipelago that may be discernible against the background of cyclical oceanographic processes. This alternative would also further reduce the risks from local negative anthropogenic effects from fishing activities which would accrue in the absence of reductions in fishing effort.

4.5.3 Protected Species

For all federally protected species other than the Hawaiian monk seal, the cumulative effects under the Alternative 1A and 1B are continued low-level risks of behavioral disturbance, collision, hooking, and entanglement in fishing gear. The effect of continued bottomfish fishing operations in the NWHI is likely to not alter the potential for impacts from other fishing activities

and anthropogenic influences within their geographic distribution.

Scientific studies to determine the carrying capacity and equilibrium population of Hawaiian monk seals in the Hawaiian Archipelago are not likely to be available in the foreseeable future and it is uncertain that bottomfish operations have any appreciable effect on the status of the NWHI Hawaiian monk seal population. A low level of interaction could foreseeably occur from bottomfish fishing operations, and the risk associated with these operations would remain under this alternative. However, given the infrequency and general nature of interactions of the NWHI bottomfish fishery with protected species, continued bottomfish fishing in the NWHI is unlikely to have measurable effects on the distribution or abundance of marine mammals, sea turtles or seabirds.

Although there is a low level of risk to individuals, it is not likely that a species will be affected. An immediate cessation of fishing as proposed under Alternative 2 would eliminate even this minimal risk to individuals. For protected species other than the Hawaiian monk seal, anthropogenic influences from outside the NWHI have a much greater cumulative effect than NWHI bottomfish fishing operations. However, Alternative 2 would remove any current and future impacts that bottomfish fishing may add to the suite of factors that impact these populations.

A gradual phase out of fishing activities in the region as proposed under Alternative 3 would effectively mimic in the short term the cumulative impacts as presented in Alternatives 1A and 1B. Over the long term, as the fishery is reduced through attrition of participants, the cumulative effects would be as described in Alternative 2.

Reductions in fishing mortality through the creation of zones closed to commercial fishing as proposed under Alternative 4 would be less than under a total closure of the fishery, but the magnitude of the reduction could have a positive impact resulting from reductions in fishing effort and vessel traffic. Again however, redirection of effort displaced from the NWHI to the MHI could negate the positive impacts. Further reductions in fishing effort through the creation of the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve would be an additional factor which may reduce the potential for vessel impacts and interactions near Hawaiian monk seal breeding areas. The other factors influencing the health of the Hawaiian monk seal population as listed in Chapter 3 are likely to have the greatest additive effect, however the magnitude of positive impact from zonal closures may not be measurable, due to the minimal impacts bottomfish fishing may have on the Hawaiian monk seal.

4.5.4 Essential Fish Habitat and Ecosystems

Because productivity at all trophic levels in the NWHI appears to be the result of meso-scale oceanographic conditions which undergo cyclical changes, the structure of the ecosystem, patterns of recruitment, changes in species abundance and biodiversity, are driven by the combination of responses of all the organisms which make up the NWHI ecosystem. Further impacts accumulate from anthropogenic input from both local (vessel traffic and associated risks, marine debris, human habitation and disturbance, etc.) and allochthonous[6] sources. Fishing activities can produce various negative effects on the environment including lost oil, sewage, garbage and debris, and the potential for habitat damage through anchoring and grounding. These effects would be additive when combined with the large perturbations in coral reef habitat in the NWHI that occur during winter storms. Submersible surveys indicate that the effect of bottomfish operations on coral reef substrate in the NWHI are undetectable. However, as with any fishery in the region, bottomfish fishing activities increase the risk of cumulative negative environmental impacts when added to the other anthropogenic impacts that may occur through grounding which can damage coral reef structure, release fuel and oil, and perhaps introduce terrestrial alien species into a sensitive habitat. Under Alternatives 1A and 1B, the risks associated with events of this type happening, and the associated negative cumulative effects, would continue. An immediate closure of the fishery as proposed under Alternative 2 would eliminate any possible negative impact from bottomfish fishing operations, such as potential damage from lost oil, sewage, garbage and debris, and habitat damage through fishing, anchoring and grounding. A gradual phase out of fishing activities in the region as proposed under Alternative 3 would effectively mimic in the short-term the cumulative impacts as presented in Alternatives 1A and 1B. Over the long term, as the fishery is reduced through attrition of participants, the cumulative effects of Alternative 3 would be as described for Alternative 2. Reductions in fishing activity through the creation of zones closed to commercial fishing as proposed under Alternative 4 would be less than under a total closure of the fishery, but the magnitude of the reduction could have a long-term positive impact on the NWHI ecosystem through the reduction of risks associated with bottomfish fishing operations. Again however, redirection of effort displaced from the NWHI to the MHI could negate the positive impacts. Reductions in effort through this zoning process, or through the creation of the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve, may have a positive impact, but the cumulative impact likely would not be discernible against the background of cyclical oceanographic processes. For example, considering the large perturbations in the shallow benthic habitat in the NWHI that result from the action of winter storms and associated storm surge and swell (Grigg 1983), the cumulative incremental impact of bottomfish fishing activities on this habitat is likely

[6]Allochthonous refers to something formed elsewhere than its present location. Its antonym, autochthonous, refers to something formed in its present location.

to be unmeasurable.

4.5.5 Human Community

It is likely that many families that depend on fishing and the seafood industry in Hawai'i are economically, socially and psychologically stressed because of declining catch rates, increasing competition and unstable markets. Also contributing to this stress is the imposition of ever more restrictive state and federal fishery management regulations. In the past several years a limited access program was established for the Mau Zone of the NWHI bottomfish fishery; the State of Hawai'i closed certain areas around the MHI to bottomfish fishing in an effort to rebuild local stocks; NMFS issued an emergency regulation that stopped commercial lobster fishing in the NWHI; and litigation concerning possible impacts of the Hawai'i-based longline fishery on sea turtles led a federal court to order NMFS to implement area closures, gear and effort restrictions, increased observer coverage and closure of the swordfish sector of that fishery. Most recently, and most significantly in terms of direct effects on participants in Hawai'i's bottomfish fishery, the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve was established by Executive Order 13178 (Appendix G).

Some of these management measures are specifically intended to promote sustainable fisheries and are expected to have positive economic impacts on fishery participants in the long-term. Nevertheless, it is likely that many fishermen in Hawai'i have the sense that government regulations are "boxing them in" and reducing their ability to maintain their characteristic highly flexible fishing strategy (Pooley 1993a; Hamilton et al. 1996; Polovina and Haight 1999). This flexibility is important to the economic success of many smaller and medium-sized fishing operations because of natural variations in the availability of various types of fish. Furthermore, the ability of fishermen to adapt to these regulatory changes by supplementing fishing incomes with shore-based employment is hampered by Hawai'i's depressed economy (Section 3.6.1).

At the same time that some members of the public are expressing concern about the negative economic and social impacts that incremental regulations are having on the fishing community, some citizens who may or may not directly interact with fishery resources are voicing concern about the possible impacts of modern, large-scale fisheries on the marine environment when added to the impacts of non-fishing sectors of society (e.g., impacts of shipping, ocean recreation and coastal development). There is increasing apprehension that these cumulative impacts may be radically altering marine biological communities and ecosystems and leading to a loss of biological diversity. According to environmental advocates, these impacts will ultimately degrade the quality of human life and compromise ethical obligations to preserve the environment. Further, there is growing skepticism among those with an interest in fisheries management that current management processes can establish effective controls to protect marine ecosystems and biological diversity (Ecosystem Principles Advisory Panel 1999). The Council

on Environmental Quality (1993) notes that biodiversity conservation must look beyond the species to the ecological units that sustain them. Such an ecosystem approach is necessary to ensure protection for a large number of species and their interrelationships and provide for the maintenance of natural processes.[7]

Concerns about the complicated regulatory environment and lack of an ecosystem-approach to marine resource management find common ground when the current institutional structure for management of the marine ecosystem in the NWHI is examined. The institutions involved in managing activities that affect this ecosystem include the U.S. Departments of Commerce and the Interior, the Hawai'i Department of Land and Natural Resources and other federal, state and local government agencies (Appendix G). This complicated institutional framework poses a significant challenge to ecosystem-based management, as jurisdictional boundaries do not match ecosystem boundaries.

4.5.5.1 Alternative 1A and 1B

This alternative would help fishermen in Hawai'i maintain a flexible fishing strategy in an increasingly restrictive regulatory environment, thereby increasing the chances of economic success for some fishing operations. Economically successful fishing enterprises, in turn, would have a positive, albeit comparatively small, effect on Hawai'i's economy. Individuals and firms that directly or indirectly support and are supported by fisheries would be able to maintain current levels of output, income and employment. Economically viable fishing enterprises also contribute to social stability among fishery participants and their families and help preserve elements of local fishing culture.

However, the establishment of the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve has not negated the positive effects on fishery participants resultant from the existing FMP (Altn.1). The Reserve closes large areas of the NWHI to commercial bottomfish fishing and limits the bottomfish harvest of holders of Mau Zone and Ho'omalu Zone permits to an annual individual quota equal to the average amount the individual permit holder harvested annually over the five years preceding December 4, 2000. This harvest quota effectively limits continued commercial bottomfish fishing within the Reserve to current permit holders. Over time, as current permit holders retire and withdraw from the fishery, commercial bottomfish fishing

[7] The Council on Environmental Quality (1997:20) states that the "ecosystem approach espoused by IEMTF [Interagency Ecosystem Management Task Force] and a wide range of government, industry, and private interest groups is a method for sustaining or restoring natural systems in the face of the cumulative effects of many human actions. In addition to using the best science, the ecosystem approach to management is based on a collaboratively developed vision of desired future conditions that integrates ecological, economic and social factors."

within the waters of the Reserve will be phased out.

While there is some uncertainty in exactly how the boundaries of the Reserve will be drawn, it appears that the Reserve will result in a substantial reduction in the use of some of the most productive fishing grounds in the NWHI bottomfish fishery, including Necker Island, Brooks Bank, Gardner Pinnacles and Lisianski Island. Initial analyses conducted by the Council (M. Mitsuyasu, pers. comm. 2000. WPRFMC) estimate that the area closures established by the Reserve will decrease the aggregate catch of bottomfish in the Mau Zone and Ho'omalu Zone by 67 percent and 57 percent, respectively. The total associated revenues that will be lost to fishery participants is estimated to be on the order of $600,000 annually. The State of Hawaii Department of Land and Natural Resources estimated "the area closures in the EO represents a range of impacts of over 12% and up to 30% of the catch, and a range of over 12% and up to 28% of the value (Coloma-Agaron, 2001)". The combined effects of closure of selected bottomfish fishing grounds in the NWHI and increasingly restrictive regulatory regimes for other fisheries would jeopardize the economic viability of some fishing operations and cause some participants in the NWHI bottomfish fishery to give up fishing as an occupation.

The restrictions that the Reserve places on bottomfish fishing would allay public concerns about the potential negative effects of fishing on the NWHI coral reef ecosystem. However, the added protection to this coral reef ecosystem resulting from these restrictions may be minimal. Moreover, it is too early to determine if the Reserve will result in a coordinated management regime for this coral reef ecosystem. To the extent that fragmentation of legislative and institutional conservation and management responsibilities continue to impair implementation of an ecosystem-based approach to the management of the coral reefs in the NWHI, the value associated with preservation of these reefs may be reduced (Section 3.4.4).

4.5.5.2 Alternative 2

The combined effects of closure of the NWHI bottomfish fishing grounds and other actions, including the establishment of the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve, would impose an economic hardship on fishermen in Hawai'i. Many fishing operations are already marginal, and hampering their ability to maintain their characteristic highly flexible fishing strategy would jeopardize the long-term economic viability of some fishing operations. As noted for Alternatives 1A and 1B, the situation would be aggravated by the depressed state economy which has made it more difficult for many fishermen to supplement fishing revenues with income from shore-based employment.
The added protection to the coral reef ecosystem in the NWHI resulting from termination of the bottomfish fishery is likely to be minimal.

4.5.5.3 Alternative 3

The combined effects on fishery participants of this alternative and other actions, including the establishment of the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve, would be similar to the effects described for Alternative 1A and 1B as long as the fishery operates. When the lifetimes of fishery participants expire, cumulative effects would be similar to Alt. 2

4.5.5.4 Alternative 4

The combined effects on fishery participants of this alternative and other actions, including the establishment of the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve, would be similar to the effects described for Alternatives 1A and 1B. The areas closed to bottomfish fishing by creation of the Reserve include those areas that would be closed under Alternative 4A or 4B.

The adoption of the zoning approach proposed under Alternative 4 would significantly alter the current institutional structure for management of the NWHI coral reef ecosystem. The established zones would include waters under the jurisdiction of various state and federal agencies that have conservation and management responsibilities (Appendix G). The development of a zoning plan would require the coordination of these legislative and institutional responsibilities across jurisdictional lines, as well as the appropriate involvement of all stakeholders in the planning process. Such coordination is consistent with an ecosystem-approach to marine resource management. The Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve also adopts a zoning approach and is intended to establish a coordinated management regime for this coral reef ecosystem.

4.6 SUMMARY AND COMPARISON OF THE ALTERNATIVES

Table 4-4 is a qualitative comparison of the effects of the alternatives evaluated in this EIS. The comparison begins by assuming that Alternative 1A, the no action status quo, is the baseline against which the other alternatives are compared. Alternative 1A, therefore, has neither positive nor negative impacts.

TABLE 4-4: Comparison of the Effects of the Alternatives

RESOURCE OR ISSUE	ALT. 1A	ALT 1B	ALT. 2	ALT. 3	ALT. 4A	ALT. 4B
Target Species	o	c1	c1p	dc1p	c1	c1
Bycatch	o	c1u	c1up	dc1up	c1u	c1u
Hawaiian Monk Seal	o	c2u	up	dup	up	up
Other Protected Species	o	c2u	up	dup	up	up
EFH/HAPC	o	c2u	up	dup	c2up	c2up
Fishing Sectors	o	c1	c1nn	c1dnn	c1n	c1n
Regional Economy	o	c1u	c1un	c1dun	c1un	c1un
Fishing Communities	o	c1	c1un	c1dun	c1un	c1un
Native Hawaiians	o	p	c1n	c1dn	p	p
Administration/ Enforcement	o	u	p	dp	nn	nn
NWHI Reserve	o	c2	pp	dpp	p	p
CRE FMP	o	c2	n	dn	p	p

Notes: o = status quo; p = positive impact; pp = highly positive impact; n = negative impact; nn = highly negative impact; d = delayed impact; c1 = impact contingent upon archipelago-wide effort changes; c2 = impact contingent upon NWHI effort changes; u = unmeasurably small

For target species, Alternatives 2, 3 and 4 would have a potential positive impact if there are archipelago-wide effort reductions. There is no guarantee this would occur, but under Alternatives 2 and 3, bottomfish fishing in the Ho'omalu Zone would sooner or later stop. Vessels that fish in that zone tend to be larger, longer-range, and more expensive to operate than vessels that fish in the Mau Zone or the MHI. It is unlikely that operators of these vessels would employ them in the MHI bottomfish fishery. If, on average, they are not covering fixed costs in the Ho'omalu Zone fishery, there is little likelihood of economic success in the MHI fishery. Under Alternatives 3 and 4, portions of the NWHI would remain open to bottomfish fishing, and

effort displaced by creation of the Preservation Zones likely would be relocated to open areas. Therefore, Alternatives 2 and 3 would likely have the greatest positive impact on target species. It should be noted, however, that BMUS stocks in the NWHI are in a healthy condition and are not presently overfished.

For bycatch species, Alternatives 2, 3 and 4 would have a potential positive impact if there are archipelago-wide effort reductions. Again, Alternatives 2 and 3, which would result in effort reduction in the NWHI and likely archipelago-wide, would likely have the greatest benefits to bycatch species. Due to the small quantities of bycatch in the fishery and the consequent limited amount of bycatch mortality however, the potential benefits of any of the alternatives would likely be unmeasurable.

For the Hawaiian monk seal, Alternatives 2, 3 and 4 would have a potential positive impact by eliminating fishing effort and reducing vessel traffic from, in the case of Alternatives 2 and 3, the entire NWHI, and in the case of Alternatives 4A and 4B, from around some or all, respectively, of the major breeding subpopulations. Again however, this positive impact is likely unmeasurable due to the minimal impact of the existing fishery on the Hawaiian monk seal.

A similar analysis applies to the other protected species, cetaceans, sea turtles and seabirds, with which the NWHI bottomfish fishery may interact. Alternatives 2, 3 and 4 would have a potential positive impact by eliminating fishing effort and reducing vessel traffic from all or highly productive portions of the NWHI. Once again however, this positive impact is likely unmeasurable because the minimal impact of the existing fishery on these species.

With respect to EFH, HAPC, and other ecosystems including coral reefs, and for all of the other protected resources, Alternatives 2, 3 and 4 would have a potential positive impact by eliminating fishing effort and reducing vessel traffic and operations from, in the case of Alternatives 2 and 3, the entire NWHI, and in the case of Alternatives 4A and 4B, from around some of the most productive reef systems in the NWHI. Once again however, this positive impact is likely unmeasurably small because of the minimal impact of the existing fishery (10 current permits) on these resources. The positive impact from Alternatives 4A and 4B is contingent upon a net reduction of effort in the NWHI. If effort is redirected to areas remaining open, the net benefit could be lost.

It can be seen from the above that for all of the biological resource categories, the analysis is similar. The potential positive impacts are directly related to the degree of restriction of fishing effort. However, only in the case of target species, might the impact actually be measurable.

The results of the analysis of the social and economic resources and issues contrast markedly with those of the biological resources. Impacts to fishermen would be most severely negative

under Alternatives 2 and 3, and somewhat less negative under Alternatives 4A and 4B. Impacts of these alternatives to the regional economy and to fishing communities (Kaua'i and O'ahu) would be negative, but unmeasurable.

Native Hawaiians would benefit from the community development program for Mau Zone limited access permits under Alternative 1B, and also from access to otherwise restricted areas for cultural and religious purposes under Alternatives 4A and 4B. To the extent they participate in the fishery, impacts to them under Alternatives 2 and 3 would be negative.

Costs associated with administration and enforcement would increase somewhat under Alternative 1B, but would decrease as bottomfish fishing vessels are eliminated from the NWHI under Alternatives 2 and 3. Under Alternatives 4A and 4B, however, costs would increase substantially.

With minor exceptions, the impacts of Alternatives 2, 3 and 4 on the social and economic resources and issues are negative to very negative. As noted above, this contrasts sharply with the positive impacts of these alternatives on biological resources and issues.

In positive impacts to fishery participants, their communities and the regional economy, supports the decision of selecting Alternative 1B as its preferred alternative. This selection is only possible because of the insignificant negative impacts to biological resources resulting from the current conduct of the bottomfish fishery in the NWHI, and because of the healthy status of BMUS stocks in the NWHI.

4.6.1 SUMMARY AND COMPARISON OF IMPACTS BY ALTERNATIVE

The impacts of each alternative on the environmental resources likely to be affected by the action are summarized for comparative purposes in Table 4-5. These alternatives and analyses of their impacts are discussed in greater detail in this chapter.

TABLE 4-5: Summary and Comparison of Impacts by Alternative

ENVIRONMENTAL RESOURCE CATEGORY	ALT. 1A: NO ACTION	ALT. 1B: (Preferred Alternative) EXISTING FMP PLUS RECENT COUNCIL RECOMMENDATIONS	ALT. 2: IMMEDIATE CESSATION OF BOTTOMFISH FISHING IN THE NWHI	ALT. 3: PHASE-OUT OF BOTTOMFISH FISHING IN THE NWHI	ALT. 4: ADAPTIVE MANAGEMENT THROUGH ZONING
Target Species	Threat of overfishing in NWHI minimized through fishing effort control, but localized depletion in MHI may occur.	Threat of overfishing in NWHI minimized through fishing effort control, but localized depletion in MHI may occur. Net effect of pending NWHI measures on effort is uncertain, but the risk of overfishing is minimized through the existing limited entry program. MUS in CNMI and PRIA would be afforded greater protection as they would be managed under FMP (i.e. gear restrictions). Positive impact on MUS within 50 nm of Guam as larger boats are prohibited from fishing.	NWHI populations would rebuild and recruitment to MHI may increase. However, the increase may be offset to some extent if fishing effort is redistributed from the NWHI to the MHI by displaced vessels.	Short-term impacts same as Alt.1. After the phase-out the impacts would be the same as Alt.2	Reduced fishing mortality would result in localized stock rebuilding if effort is reduced. Increased recruitment to MHI may occur. Alt. 4B would reduce fishing mortality in more areas (6) than Alt. 4A (2).

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Bycatch Species	Catch of bycatch species would continue, but at low levels due to selectivity of bottomfish fishing gear.	Catch of bycatch species would continue, but at low levels due to selectivity of bottomfish fishing gear. Net effect of pending NWHI measures on bycatch is uncertain, but the risk of increased bycatch is minimized through the existing limited entry program and gear restrictions contained in the FMP.	Fishing mortality on bycatch species would be reduced in the NWHI. MHI mortality could increase if fishing effort is redistributed from the NWHI to the MHI by displaced vessels.	Short-term impacts same as Alt.1. After the phase-out the impacts would be the same as Alt.2.	If effort is reduced, reduction of fishing mortality would have a positive impact, but may not be detectable against natural population fluctuations. Alt. 4B would reduce fishing mortality in more areas (6) than Alt. 4A (2).

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Hawaiian Monk Seal	Continued bottomfish fishing would expose seals to minimal risk of hooking, entanglement, behavioral disturbance and removal of prey. Potential effects of such risks were concluded by NMFS to not jeopardize the continued existence of the Hawaiian Monk Seal (2002 BiOp).	Continued bottomfish fishing would expose seals to minimal risk of hooking, entanglement, behavioral disturbance and removal of prey. Net effect of pending NWHI measures on monk seals is uncertain but the risk of increased interactions is minimized through the existing limited entry program.	Interactions between monk seals and NWHI bottomfish fishery would end.	Short-term impacts same as Alt.1. After the phase-out the impacts would be the same as Alt.2.	Interactions between monk seals and NWHI bottomfish fishery would be eliminated near breeding areas (the two most significant areas in Alt. 4A; the six most significant areas in Alt. 4B). Overall reduced risk of hooking, entanglement, behavioral disturbance and food competition.

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Sea Turtles	No impact on adults. Hatchlings may be attracted to vessel lights and experience increased mortality.	No impact on adults. Hatchlings may be attracted to vessel lights and experience increased mortality. Net effect of pending NWHI measures on turtles is uncertain but the risk of increased interactions is minimized through the existing limited entry program.	Interactions between sea turtles and NWHI bottomfish fishery would end.	Short-term impacts same as Alt.1. After the phase-out the impacts would be the same as Alt.2.	Risk of hatchling mortality eliminated near major nesting area at FFS (Alts. 4A and 4B). Overall risk of impact reduced slightly.
Seabirds	Continued bottomfish fishing would expose seabirds to minimal risk of hooking.	Continued bottomfish fishing would expose seabirds to minimal risk of hooking. Net effect of pending NWHI measures on seabirds is uncertain but the risk of increased interactions is minimized through the existing limited entry program.	Interactions between seabirds and NWHI bottomfish fishery would end.	Short-term impacts same as Alt.1. After the phase-out the impacts would be the same as Alt.2	To the extent that fishing effort decreases (likely greater for Alt. 4B than Alt. 4A), effects of fishing on seabirds in NWHI would be reduced.

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Cetaceans	Continued bottomfish fishing would expose cetaceans to minimal risk of hooking, collision and behavioral disturbance.	Continued bottomfish fishing would expose cetaceans to minimal risk of hooking, collision and behavioral disturbance. Net effect of pending NWHI measures on cetaceans is uncertain but the risk of increased interactions is minimized through the existing limited entry program.	Interactions between cetaceans and NWHI bottomfish fishery would end.	Short-term impacts same as Alt.1. After the phase-out the impacts would be the same as Alt.2.	To the extent that fishing effort decreases (likely greater for Alt. 4B than Alt. 4A), effects of fishing on cetaceans in NWHI would be reduced.

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Essential Fish Habitat, Biodiversity, Ecological Function	Exsiting FMP prohibits destructive fishing gears and the fishey does not adversely affect EFH for any MUS in the Region. Continued bottomfish fishing may expose coral reefs and other habitat to low-level risk of anchor damage, exposure to marine pollution and vessel groundings.	No expected increase in potential impact to EFH of any MUS. Continued bottomfish fishing would expose coral reefs and other habitat to low-level risk of anchor damage, exposure to marine pollution and vessel groundings. Net effect of pending measures on habitat is uncertain but the risk of increased habitat damage is minimized through the existing limited entry program and the gear restrictions contained in the FMP.	Effects of bottomfish fishing on coral reefs and other habitat in NWHI would end.	Short-term impacts same as Alt.1. After the phase-out the impacts would be the same as Alt.2.	Risk of fishing impacts reduced (in two areas for Alt. 4A and for six areas in Alt 4B), particularly to coral reefs within closed areas.

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Commercial, Recreational and Charter Fishing Sectors	Less than a dozen permit holders in the commercial NWHI bottomfish fishery would continue to annually harvest about 300,000 lb of bottomfish in the NWHI with an ex-vessel value of about $1M.	Less than a dozen permit holders in the commercial NWHI bottomfish fishery would continue to annually harvest about 300,000 lb of bottomfish in the NWHI with an ex-vessel value of about $1M. Net effect of pending NWHI measures on effort is uncertain and therefore effect on these sectors is also uncertain. Guam closed area expected to have minimal impact on fishing sectors.	Economic impacts would be negative, as revenues from the harvest of bottomfish in the NWHI would be eliminated. Some portion of lost revenues may be recovered by switching to other fisheries, but net income is likely to remain lower. If displaced fishing effort shifts to MHI, increased competition will have a negative economic effect on commercial, recreational and charter fishing sectors in MHI.	Harvest and participation in the NWHI fishery would gradually decline to zero as fishermen depart from the fishery. Younger fishermen that remain in the fishery may experience a gradual increase in catch rates in response to the gradual effort reduction.	Closed areas under Alt. 4A could reduce annual landings of bottomfish in the NWHI fishery by 69,000 lbs. and gross revenues by $221,000. Closed areas under Alt. 4B could reduce annual landings of bottomfish in the NWHI fishery by 117,000 lbs. and gross revenues by $374,000. Some portion of lost revenues may be recovered by switching to other fishing grounds or fisheries, but net income is likely to remain lower.

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Regional Economy	NWHI bottomfish fishery would continue to contribute as much as $1,382,747 of output (production) and $482,218 of household income to state economy and create the equivalent of as many as 25 full-time jobs.	NWHI bottomfish fishery would continue to contribute as much as $1,382,747 of output (production) and $482,218 of household income to state economy and create the equivalent of as many as 25 full-time jobs. Impact of Guam closed are expected to be negligible.	Impacts on Hawai'i's economy would be minimal, as the contribution of the NWHI bottomfish fishery to overall economic activity in Hawai'i is small.	Short-term impacts same as Alt.1. Long-term impacts same as Alt.2.	Impacts of Alts. 4A and 4B on Hawai'i's economy would be negligible.

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Fishing Community	Would promote social and economic stability within the fishing communities of Kaua'i and O'ahu and help preserve elements of local fishing culture.	Would promote social and economic stability within the fishing communities of Kaua'i and O'ahu and help preserve elements of local fishing culture. Would allow new permittees to enter the Mau Zone limited access fishery.	Impacts to the (proposed) fishing communities of Kaua'i and O'ahu would be negative, as it would cause a loss of earning potential, investment value and lifestyle among some fishery participants. If displaced fishing effort shifts to MHI, increased competition will have a negative social effect. Could have a disproportionately high and adverse effect on minority populations.	Minimal impacts in the short term, but negative long-term impacts because future generations of fishermen would have one less option to draw on to make fishing a more financially secure occupation. Could have a disproportionately high and adverse effect on minority populations.	Some impacts as described in Alt. 2 may occur, although they would be mitigated by permitting fishermen continued access to other productive fishing grounds in the NWHI. Impacts of Alt 4B could be greater than for Alt 4A if the former results in greater effort reduction.

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Native Hawaiian Community	Participation of Native Hawaiians in NWHI bottomfish fishery is currently low. Would provide no additional incentive for Native Hawaiians to enter the fishery.	Participation of Native Hawaiians in NWHI bottomfish fishery is currently low. Additional participation of Native Hawaiians in fishery would be encouraged through a Community Development Program.	Native Hawaiian participants in fishery would experience a reduction in income and lose access to customary fishing grounds.	Short-term impacts same as Alt.1 except community development program would be terminated. After the phase-out the impacts would be similar to those of Alt.2.	Economic hardship that area closures impose on Native Hawaiian participants in fishery (potentially greater for Alt. 4B than for Alt. 4A if the former results in greater effort reduction) may be mitigated by community development program. Zoning plan could provide Native Hawaiians preferential access to certain areas for subsistence, cultural and religious purposes.

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Administration and Enforcement	Current administrative and enforcement procedures and associated costs would not change.	Additional costs would be incurred to administer the CDP. Additional costs would be incurred by vessel registration and logbook processing in the Guam bottomfish fishery. Enforcement responsibilities of USCG and OLE would be increased by the Guam area closure.	Administrative costs would be reduced by removing the need to maintain separate fisheries data collection system and administering limited access programs.	Short-term impacts same as Alt.1. After the phase-out the impacts would be the same as Alt.2.	Development of required interagency, intergovernmental and public-private relationships is likely to be time-consuming and costly. Enforcement costs likely to increase, but costs may be moderated with VMS. Differences between Alts. 4A and 4B would be minimal.