8. ANTICIPATED IMPACTS OF THE ALTERNATIVES

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

8.1 Anticipated Impacts on Target and Non-target Stocks

Clearly all alternatives that result in the harvesting of marine species will immediately reduce that species' abundance in the NWHI. However the critical issue for managers is whether that reduction will have adverse population or ecosystem impacts.

Impacts of Alternative 1A on Target and Non-target Stocks:
Under Alternative 1A (FMP Status Quo), fishery impacts to target and non-target stocks are anticipated to remain unchanged. Fisheries would continue to be managed under their respective fishery management plans and would be expected to retain their current resiliency and natural condition. Fisheries would continue to be managed under limited entry and harvest quota systems as described in Chapter 5 and the NWHI ecosystem would be anticipated to remain in the "pristine" condition observed in 2002 during the multi-agency NOWRAMP study, which followed more than a decade of active fishery management by the WPRFMC.

The harvest of bottomfish is a direct impact on the target species. As described in Chapter 5, 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 NWHI bottomfish fishery.

The maximum sustainable yield (MSY) of bottomfish MUS from the NWHI as a whole has been estimated to be 586,000 pounds (Kobayashi 1996). 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 (2003) 77,000 pounds of bottomfish were harvested from the Mau Zone and 145,000 pounds of bottomfish were harvested from the Ho'omalu Zone. These landings represent 59 and 32 percent, respectively, of the Mau and Ho'omalu Zones' MSYs.

As described in Chapter 7, 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 dependent upon the skill of the vessel captain. Experienced vessel crew have the ability to catch the desired species with little bycatch (fish which are discarded for economic, regulatory or other reasons). It is, however, impossible to completely avoid bycatch and the incidental catch of non-target species. Direct impacts would be seen in catches of target and non-target species as well as bycatch, as described As discussed in Chapter 7, 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. Indirect impacts could include habitat damage 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 (see Chapter 7), neither significant habitat impacts, nor alterations of trophic dynamics are likely.

Under this alternative crustacean stocks would continue to be managed under the current FMP regulations, however a new model currently being developed by PIFSC would be used to determine exploitable populations. In addition it may be that under the new model, a harvest guideline of 13% of the exploitable population would correspond to a 10% risk of overfishing and a new harvest guideline may need to be considered. Thus the risk of localized overfishing under this alternative would be dependent on the estimates of exploitable populations and the reliability of those estimates.

Impacts of the continuation of the current management regime for precious corals on target and non-target stocks are anticipated to be minimal as only selective gear is allowed and harvests are strictly controlled by the use of bed quotas, minimum sizes and other measures (see Chapter 5).

The harvest of pelagic fish under the current Pelagics FMP would represent a direct impact on the target species. As described in Chapter 7 however, this is small fishery and its presence or absence is not expected to have an appreciable impact on its target or non-target stocks.

Because the special permit case-by-case approval process, as well gear restrictions and other measures recommended by the Council for the NWHI in the Coral Reef Ecosystems Fishery Management Plan were disapproved by NMFS, this alternative could potentially result in overfishing of coral reef associated species. However given experience to date this is unlikely in the near- term as there has been little interest in this remote fishing area.

Impacts of Alternative 1B on Target and Non-target Stocks:
Under Alternative 1B (Reserve Status Quo), short-run fishery impacts on target and non-target stocks are anticipated to remain largely unchanged. Bottomfish landings would be capped to those made in 2000 through a series of fathom-based area closures around most NWHI, as well as the imposition of non-transferable vessel quotas. In the short-run the vessel quotas are likely to result in some level of discarding, as species targeting is difficult and participants may be motivated to discard less valuable species in favor of higher valued fish. However the fact that 2000 landings (262,000 lbs) were well below MSY for this fishery means that it is unlikely that these discards will have an adverse impact on species populations or the NWHI ecosystem. The implementation of area closures may result in local depletions of some species as fishery participants will be forced to concentrate their effort in smaller available open areas. In the long-run, the non-transferable nature of the vessel quotas means that as fishery participants age and leave the fishery, there will be no new entrants to take their place and the fishery will close. This will remove all actual and potential federal fishery impacts on NWHI bottomfish target and non-

target stocks. It is unlikely to have an impact on their (currently positive) population trajectory or the (currently pristine) NWHI ecosystem. Similarly it is unlikely to have an impact on the MHI populations or ecosystem as evidence of mixing between the NWHI and MHI is limited. However, if significant transfer from the NWHI to the MHI does occur, the robust NWHI stocks should already be contributing to the MHI stocks. The degree to which this would increase under Alternative 1B is unknown but believed to be low, especially in light of recent findings indicating that larval transfer is more likely to flow from the MHI to the NWHI (see Chapter 7). Any positive impacts would be anticipated to be potentially offset by increases in MHI bottomfishing effort as a result of the highly efficient NWHI vessels relocating to the MHI, as well as existing MHI vessels increasing landings to fill the market void left by the closure of the NWHI fishery.

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

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

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

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

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

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

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

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

Impacts of Alternative 3 on Target and Non-target Stocks:
Alternative 3 (Precautionary Modification 1) would create two additional no-take MPAs in federal waters around the NWHI in which all fishing would be prohibited. These would be in addition to the measures discussed in Alternative 2.

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

Impacts of Alternative 4 on Target and Non-target Stocks:
Alternative 4 (Precautionary Modification 2) would create two additional no-take MPAs in federal waters around the NWHI in which all fishing would be prohibited. The northern of these

two additional no-take MPAs would be significantly larger than under Alternative 3. These would be in addition to the measures discussed in Alternative 2.

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

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

Under Alternative 5, harvests of bottomfish would be capped to those made in 2000 through a series of fathom-based area closures around most NWHI, as well as the imposition of non-transferable vessel quotas and a requirement that landings be in species specific ratios. In the short-run the vessel quotas and landing ratio requirements are likely to result in some level of discarding, as species targeting is difficult and limits will be met for some species before others. In this situation, fishery participants are likely to discard those fish for which they are over their quota, while continuing to fish for species for which they are under their quota. However the fact that 2000 landings were well below MSY for this fishery means that it is unlikely that these discards will have an adverse impact on species populations or the NWHI ecosystem. The implementation of area closures may result in local depletions of some species as fishery participants will be forced to concentrate their effort in smaller available open areas.

In the long-run, the non-transferable nature of the vessel quotas means as fishery participants age and leave the fishery, there will be no new entrants to take their place and the fishery will close. This will remove all potential federal fishery impacts on NWHI bottomfish target and non-target stocks. It is unlikely to have an impact on their (currently positive) population trajectory or the (currently pristine) NWHI ecosystem. Similarly it is unlikely to have an impact on the MHI populations or ecosystem as evidence of mixing between the NWHI and MHI is limited. However, if significant transfer from the NWHI to the MHI does occur, the robust NWHI stocks should already be contributing to the MHI stocks. The degree to which this would increase under Alternative 5 is unknown but believed to be low, especially in light of recent findings indicating that larval transfer is more likely to flow from the MHI to the NWHI (see Chapter 7).
Any positive impacts would be anticipated to be potentially offset by increases in MHI bottomfishing effort as a result of NWHI vessels relocating to the MHI, as well as MHI vessels increasing landings to fill the market void left by the closure of the NWHI fishery. Both NWHI and MHI bottomfish fishery participants may replace some effort with pelagic trolling as many

vessels already participate in both fisheries. Given the long travel time and relatively low value of trolling catches, it is unlikely that participants will continue or increase NWHI pelagic trolling effort.

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

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

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

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

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

Impacts of Alternative 7 on Target and Non-target Stocks:
Alternative 7 (Council Recommendation) would continue management of NWHI fisheries under the MSFCMA and establish moratoriums for fishing for NWHI lobster, precious corals and coral reef associated species until one or more science-based fishery ecosystem management plans for

the NWHI are developed by the Council in consultation with the NMSP, and implemented by NOAA Fisheries under the MSFCMA. In the interim: bottomfishing would be managed under a limited entry system that would allow up to 17 vessels maximum to fish the entire 1,200 mile NWHI chain without "use-or-lose" annual minimum landing requirements for permit renewal; pelagic fishing would be allowed by use of trolling or handline hook-and-line gear, with longline, trawls, purse seines, set nets and other fishing gears prohibited throughout the proposed sanctuary; all fishing vessels would also be subject to federal permitting and logbook requirements; no-take marine protected areas would be implemented within federal waters from 0-10 fathoms around each emergent island or atoll and from 0-50 fathoms around French Frigate Shoals, Laysan Island and the northern half of Midway Atoll; preferential Native Hawaiian participation would occur through the issuance of two of the ten Mau Zone limited access bottomfishing permits under the MSFCMA Western Pacific Community Development Program; preferential Native Hawaiian subsistence use could occur as Community Development Programs are developed for other NWHI fisheries; non-preferential access would be available to Native Hawaiians through participation in NWHI pelagic troll and handline fisheries and; all permits and fisheries would be required to be consistent with all applicable laws. It is likely that some or all of these interim measures would also be incorporated into any NWHI fishery ecosystem management plans. Monitoring by NOAA Fisheries would continue and marine research by NOAA Fisheries, the National Ocean Service, the U.S. Fish and Wildlife Service, the University of Hawaii and other research partners would be coordinated under the Hawaii Archipelagic Living Marine Resource Research Plan currently under development by the NOAA Fisheries' Pacific Islands Fisheries Science Center and other NWHI research and management agencies. This research would continue to be independently peer-reviewed and to provide the scientific basis for adaptive management of NWHI fisheries.

Although NWHI marine resources are currently characterized as pristine, Alternative 7's no-take marine protected areas are anticipated to provide precautionary protection to coral reef resources from potential impacts due to fishing activities. Similarly, moratoriums on fishing for lobster, precious corals and coral reef species pending implementation of fishery ecosystem management plans would provide precautionary protection for these stocks, and ultimately result in their management under plans that consider the full range of ecological impacts of these fisheries.

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

Alternative 7's requirement that pelagic fishing be limited to troll and handline gears is not anticipated to have any impact on NWHI pelagic stocks as this is a small fishery which is believed to already be limited to these gear types. However, this requirement would ensure that

non-selective gears such as trawls, purse or set nets could not be used in the proposed sanctuary. The requirement that operators of fishing vessels used for pelagic fishing be subject to federal permitting and reporting requirements (and observers if requested by NOAA Fisheries) would allow scientists and managers to obtain a complete record of all effort and harvests and thus lead to improved research and management decisions regarding these stocks.

8.2 Anticipated Impacts on Marine Habitat

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

Impacts of Alternative 1A on Marine Habitat:
Under Alternative 1A (FMP Status Quo), fishery impacts to target and non-target stocks are anticipated to remain unchanged. Fisheries would continue to be managed under their respective fishery management plans and marine habitat would be expected to retain its current resiliency and natural condition. Fisheries would continue to be managed under limited entry and harvest quota systems as described in Chapter 5 and the NWHI ecosystem would be anticipated to remain in the "pristine" condition observed in 2002 following more than a decade of active fishery management by the WPRFMC.

As described in Chapter 7, each fishery management plan contains definitions of Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPC). At their extremes these areas encompass the entire EEZ water column as well as the sea floor out to a depth of 400 meters and represent the majority of marine habitat potentially affected in the NWHI.

Continuation of the current bottomfish fishing regulations in the NWHI will not likely adversely affect marine habitat as they are not likely to lead to substantial physical, chemical or biological alterations to the habitat, or result in the loss of, or injury to, these species or their prey. Studies with submersible research vessels conducted at bottomfishing banks in the NWHI have found minimal evidence of fishing impacts to habitat (see Chapter 7).

Regulations adopted in the Botttomfish FMP both directly and indirectly reduce the likelihood of impacts 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.

Bottomfish fishing activities direct impact the water column only by the release of chum. 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 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 fish and benthic fauna.

Bottomfish fishermen will at times 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 marine habitat 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 inch steel reinforcing rods ("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 impacts to habitat during recovery.

Indirect impacts to the water column could occur through pollutant discharges from bottomfish fishing vessels. The day-to-day operations of a fishing vessel can produce a number of waster products, including oil, sewage and garbage that can affect marine habitat. The small number of vessel permitted to fish in the bottomfish fishery and laws against the discharge of garbage at sea (i.e. MARPOL) minimizes this potential impact.

Known NWHI precious coral beds are well below the depths where bottomfish vessels anchor or fish. Neither direct nor indirect impacts from bottomfish fishing 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.

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. Impacts to either hard or soft bottom habitats would be minimal.

The accidental grounding of a fishing boat can adversely affect shallow water habitat. The impact of a vessel striking the bottom can physically destroy habitat in the immediate area. The possible subsequent break-up of the vessels 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 with only two NWHI groundings in

the past 15 years. One of these was a longline vessels, the other a lobster boat. In both cases there was localized habitat damage under the hull but no reported effects on surrounding areas.

As described in Chapter 7, continuation of the current crustacean fishery management regime will not likely adversely affect marine habitat as NWHI lobster trapping is not believed to significantly affect the substrate. Impacts to the water column of lobster trapping are anticipated to be negligible and consist of at most a release of small amounts of bait into the surrounding area.

Impacts of the continuation of the current management regime for precious corals on marine habitat are anticipated to be minimal as only selective gear is allowed and harvests are strictly controlled by the use of bed quotas, minimum sizes and other measures (see Chapter 5).

Impacts of the continuation of the current management regime for the NWHI pelagic fishery on marine habitat are also anticipated to be minimal as this is hook and line fishery which operates through the suspension of baited hooks in the water column and has little to no contact with the substrate.

Because the gear restrictions and other measures recommended by the Council for the NWHI in the Coral Reef Ecosystems Fishery Management Plan were disapproved by NMFS, this alternative could potentially result in impacts to marine habitat from the use of destructive gears such as toxins or explosives. However given experience to date this is unlikely in the near- term as there has been little interest in this remote fishing area.

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

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

Alternative 1B would allow some NWHI pelagic trolling to occur within limited areas by individuals who could demonstrate use in the year 2000. Landings would be limited to each

individual's 2000 catch. In the short-term this will allow these individuals to continue fishing, in the long-term they will age and leave the fishery, there will be no new entrants to take their place and this fishery will close. Because this is such a small fishery hook-and-line fishery, impacts on marine habitat will be insignificant whether it is open or closed.

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

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

As with Alternative 1B, given that marine resources are currently characterized as pristine and permitted fishing activities are believed to have minimal impacts on marine habitat, this alternative provides precautionary protection to marine habitat from potential impacts due to fishing activities.

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

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

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

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

Impacts of Alternative 7 on Marine Habitat:
Alternative 7 (Council Recommendation) would continue management of NWHI fisheries under the MSFCMA and establish moratoriums for fishing for NWHI lobster, precious corals and coral reef associated species until one or more science-based fishery ecosystem management plans for the NWHI are developed by the Council in consultation with the NMSP, and implemented by NOAA Fisheries under the MSFCMA. In the interim: bottomfishing would be managed under a limited entry system that would allow up to 17 vessels maximum to fish the entire 1,200 mile NWHI chain without "use-or-lose" annual minimum landing requirements for permit renewal; pelagic fishing would be allowed by use of trolling or handline hook-and-line gear, with longline, trawls, purse seines, set nets and other fishing gears prohibited throughout the proposed sanctuary; all fishing vessels would also be subject to federal permitting and logbook requirements; no-take marine protected areas would be implemented within federal waters from 0-10 fathoms around each emergent island or atoll and from 0-50 fathoms around French Frigate Shoals, Laysan Island and the northern half of Midway Atoll; preferential Native Hawaiian participation would occur through the issuance of two of the ten Mau Zone limited access bottomfishing permits under the MSFCMA Western Pacific Community Development Program; preferential Native Hawaiian subsistence use could occur as Community Development Programs are developed for other NWHI fisheries; non-preferential access would be available to Native Hawaiians through participation in NWHI pelagic troll and handline fisheries and; all permits and fisheries would be required to be consistent with all applicable laws. It is likely that some or all of these interim measures would also be incorporated into any NWHI fishery ecosystem management plans. Monitoring by NOAA Fisheries would continue and marine research by NOAA Fisheries, the National Ocean Service, the U.S. Fish and Wildlife Service, the University of Hawaii and other research partners would be coordinated under the Hawaii Archipelagic Living Marine Resource Research Plan currently under development by the NOAA Fisheries' Pacific Islands Fisheries Science Center and other NWHI research and management agencies. This research would continue to be independently peer-reviewed and to provide the scientific basis for adaptive management of NWHI fisheries.

Although NWHI marine resources are currently characterized as pristine, Alternative 7's no-take marine protected areas are anticipated to provide precautionary protection to coral reef habitat from potential impacts due to fishing activities. Similarly, moratoriums on fishing for lobster, precious corals and coral reef species pending implementation of fishery ecosystem management

plans would provide precautionary protection for marine habitat, and ultimately result in the management of these fisheries under plans that consider the full range of ecological impacts of these fisheries. However recent information on the NWHI lobster fishery indicates that it is unlikely to impact marine habitat as lobster traps are normally set in rubble fields and are not set on coral reefs (Dinardo, 2005, Moffit, 2005).

Changes to existing bottomfish management measures are unlikely to affect marine habitat as NWHI bottomfishing has been found to have virtually no discernable impact on benthic habitat (Kelley and Moffit, 2004).

Alternative 7's requirement that pelagic fishing be limited to troll and handline gears is not anticipated to have any impact on NWHI marine habitat as this is a small fishery which is believed to already be limited to these gear types which utilize hooks suspended in the water column that do not touch or impact benthic habitat.

8.3 Anticipated Impacts on Protected Species

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

Impacts of Alternative 1A on Protected Species:
Under Alternative 1A (FMP Status Quo), the impacts of NWHI fisheries on protected species are anticipated to remain unchanged. Fisheries would continue to be managed under their respective fishery management plans, observers would continue to be placed on bottomfish and lobster vessels if requested by NMFS, and physical interactions with protected species would remain at the virtually zero levels observed for these fisheries as described in Chapter 7.

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. 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.

As described in Chapter 5, the Bottomfish FMP contains management measures intended to monitor and mitigate interactions between the fishery and Hawaiian monk seals.

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. In addition, before the NMFS Regional Administrator issues a Mau Zone or Hoʻomalu 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. 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 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. 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 Ho'omalu 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 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 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.

There is one known monk seal interaction 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.

Observer coverage of the NWHI bottomfish fishery was reinstituted in the fourth quarter of 2003. Eighteen of 71 vessels (trips) departed with NMFS observers throughout the fourth quarter of 2003 and all of 2004. No marine mammal interactions were observed.

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 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 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). For these reasons, NWHI bottomfish fishermen are now voluntarily moving to a new fishing location if their vessel is approached by a monk seal.

The 1990-1993 observer data revealed that some Hawaiian monk seals followed fishing vessels from station to station for several days. Some seals seemed 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]

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.

---

[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.

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.

As discussed above, to reduce interactions resulting from discarded fish, the members of the NWHI bottomfish fishery have agreed to a voluntary retention program in which 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.

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. However monk seals have been found with embedded hooks.

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.

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 very low (0.45 per 1000 fish).

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, however 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 the 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. 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.

As described in Chapter 7, 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). 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 relatively 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, it is anticipated that changes in feeding behavior in response to fishing vessel activity may have had negative consequences for individual seals, but these behavioral changes do not appear to have affected the survival of seal populations. Population survival may be more

affected by changes in forage base that are associated with phenomena like decadal shifts in productivity.

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 appreciably affect individual monk seals or their populations.

If the bottomfish fishery affects sea turtles, the green turtle is most likely the species to be affected because it occurs within the NWHI with more frequency than any other species. The recovery plan for the green turtle (NMFS and FWS 1998) lists the primary threats for Hawaii 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 Hawaii 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 2005).

Indirect effects on sea turtles could persist from the bottomfish fishery including distraction of hatchlings by fishing vessel lights. 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. 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 historical bottomfish fishing effort has taken place in the vicinity of FFS where most of the green turtle egg deposition and hatching takes place. In recent years, a maximum of 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.

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. Interactions were characterized by attempted bait theft. Although there is a possibility of accidental hooking, the 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 through 2004) show five interactions with seabirds during 18 observed fishing trips. Four were hooked or entangled while the vessels were trolling and one was caught during bottomfishing 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.

An active NWHI lobster fishery could potentially affect monk seals if lobster are an important part of the diet of monk seals. However given that the Crustaceans FMP only allows the harvest of 13% of each area's exploitable population, it appears unlikely that these removals will jeopardize monk seals or their populations. In addition, under the FMP (which must comply with the Endangered Species Act) no harvest guideline will be issued until a ESA consultation is conducted and concludes that a lobster fishery can continue without jeopardizing the continued existence of monk seals.

An active NWHI precious corals fishery under current FMP regulations is unlikely to affect monk seals, sea turtles, or seabirds as only selective gear can be used and harvests would continue to be limited by bed quotas, size limits and other measures as described in Chapter 5. Although there has been some information showing that monk seals may use gold coral beds as important foraging habitats, more recent studies have cast doubt on this finding (see Chapter 7). There is no evidence that sea turtles rely on precious coral beds and interactions with seabirds are highly unlikely as submersible vehicles or SCUBA are used in harvesting operations.

Continuation of NWHI pelagic fishing under current FMP regulations is not anticipated to result in adverse impacts to protected species as this is small hook-and-line fishery (e.g. trolling and pelagic handlining) that is not believed to interact with sea turtles or monk seals. Seabird interactions may occur and NMFS has provided pamphlets on avoiding and mitigating such interactions to Hawaii's small boat fishermen. The small scale of this fishery (due in large part to the remote location) means that these interactions are anticipated to remain at low levels for the foreseeable future.

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

the fishery will close. This will remove all potential federal bottomfish fishery impacts on NWHI protected species.

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

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

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

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

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

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

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

Impacts of Alternative 5 on Protected Species:
Alternative 5 (NMSP Recommendation) would apply to both state and federal waters and would

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

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

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

Impacts of Alternative 7 on Protected Species:
Alternative 7 (Council Recommendation) would continue management of NWHI fisheries under the MSFCMA and establish moratoriums for fishing for NWHI lobster, precious corals and coral reef associated species until one or more science-based fishery ecosystem management plans for the NWHI are developed by the Council in consultation with the NMSP, and implemented by NOAA Fisheries under the MSFCMA. In the interim: bottomfishing would be managed under a limited entry system that would allow up to 17 vessels maximum to fish the entire 1,200 mile NWHI chain without "use-or-lose" annual minimum landing requirements for permit renewal; pelagic fishing would be allowed by use of trolling or handline hook-and-line gear, with longline, trawls, purse seines, set nets and other fishing gears prohibited throughout the proposed sanctuary; all fishing vessels would also be subject to federal permitting and logbook requirements; no-take marine protected areas would be implemented within federal waters from 0-10 fathoms around each emergent island or atoll and from 0-50 fathoms around French Frigate Shoals, Laysan Island and the northern half of Midway Atoll; preferential Native Hawaiian participation would occur through the issuance of two of the ten Mau Zone limited access bottomfishing permits under the MSFCMA Western Pacific Community Development Program; preferential Native Hawaiian subsistence use could occur as Community Development Programs are developed for other NWHI fisheries; non-preferential access would be available to Native Hawaiians through participation in NWHI pelagic troll and handline fisheries and; all permits and fisheries would be required to be consistent with all applicable laws. It is likely that some or all of these interim measures would also be incorporated into any NWHI fishery ecosystem management plans. Monitoring by NOAA Fisheries would continue and marine research by NOAA Fisheries, the National Ocean Service, the U.S. Fish and Wildlife Service, the University of Hawaii and other research partners would be coordinated under the Hawaii Archipelagic Living Marine Resource Research Plan currently under development by the NOAA Fisheries' Pacific Islands Fisheries Science Center and other NWHI research and management agencies.

This research would continue to be independently peer-reviewed and to provide the scientific basis for adaptive management of NWHI fisheries.

Although NWHI fishery interactions with protected species are currently at virtually zero levels, Alternative 7's no-take marine protected areas may provide precautionary protection to protected species from adverse impacts due to fishing activities within these areas. Similarly, moratoriums on fishing for lobster, precious corals and coral reef species pending implementation of fishery ecosystem management plans would provide precautionary protection for protected species and ultimately result in the management of these fisheries under plans that consider the full range of ecological impacts of these fisheries.

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 appreciably affect individual monk seals or their populations.

The recovery plan for the green turtle (NMFS and FWS 1998) lists the primary threats for Hawaii 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 Hawaii 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 2005).

Indirect effects on sea turtles could persist from the bottomfish fishery including distraction of hatchlings by fishing vessel lights. 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. 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 historical bottomfish fishing effort has taken place in the vicinity of FFS (WPRFMC, 2003a) where most of the green turtle nesting and hatching takes place. In recent years, a maximum of six bottomfish vessels have fished in the entire Ho'omalu zone and under Alternative 7 no more than 7 would be permitted to fish in this area. 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. This is consistent with the 30-year recovery trend for Hawaii's green sea turtles observed by Balazs and Chaloupka (2004).

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. Interactions were characterized by attempted bait theft. Although there is a possibility of accidental hooking, the 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 through 2004) show five interactions with seabirds during 18 observed fishing trips. Four were hooked or entangled while the vessels were trolling and one was caught during bottomfishing 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.

Alternative 7's requirement that pelagic fishing be limited to troll and handline gears is not anticipated to have any impact on protected species as this is a small fishery which is believed to already be limited to these gear types and is not believed to interact with sea turtles or monk seals. Seabird interactions may occur and NMFS has provided pamphlets on avoiding and mitigating such interactions to Hawaii's small boat fishermen. The small scale of this fishery (due in large part to the remote location) means that these interactions are anticipated to remain at low levels for the foreseeable future.

8.4 Anticipated Impacts on Fisheries and Fishery Participants

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

Impacts of Alternative 1B on Fisheries and Fishery Participants:
Under Alternative 1B (Reserve Status Quo), both short and long-run impacts on fisheries and fishery participants are anticipated to be adverse. Bottomfish landings would be capped to those made in 2000 through a series of fathom-based area closures around most NWHI, as well as the imposition of non-transferable vessel quotas. The implementation of area closures may result in local depletions of some species as fishery participants will be forced to concentrate their effort in smaller available open areas. These local depletions may reduce catch rates and associated fishery revenues. The use of fishing caps and vessel specific quotas will have varying impacts depending on each participant's catch record during 2000. Participants who were active and had higher landings will obviously fare better than those who were relatively inactive during 2000, with some in the latter group potentially being left with too small a quota to make fishing

worthwhile. In the long-run, the non-transferable nature of the vessel quotas means as fishery participants age and leave the fishery, there will be no new entrants to take their place and the fishery will close.

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

Alternative 1B would allow some NWHI pelagic trolling to occur within limited areas by individuals who could demonstrate use in the year 2000. Landings would be limited to each individual's 2000 catch. In the short-term this will allow these individuals to continue fishing, in the long-term they will age and leave the fishery, there will be no new entrants to take their place and this fishery will close.

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

Impacts of Alternative 2 on Fisheries and Fishery Participants:
Under Alternative 2 (Council Recommendations to Date), no-take and low-use MPAs recommended under the Coral Reef Ecosystems FMP would prohibit or restrict fishing in federal waters within 50 fm of all NWHI. These restrictions would not be anticipated to have adverse impacts to the bottomfish, precious corals or pelagic fisheries as these fisheries generally occur

outside the no-take areas. The crustacean fishery is already subject to this alternative's 10 fm no-take MPA and would thus be unaffected. The potential coral reef fishery would be affected as the MPAs would cover virtually all NWHI federal coral reef areas. Under this alternative, any individual who wanted to fish for coral reef associated species in the NWHI would have to apply to NMFS for a special permit which would be issued on a case-by-case basis and which may be rejected if anticipated to lead to adverse impacts to the coral reef ecosystem. Overall the additional measures that would be implemented under the bottomfish (suspend use-or-lose requirements, new entry criteria, CDP permits) and precious corals (mega-refugia, a prohibition on the harvest of gold corals etc.) FMPs are anticipated to have potentially positive impacts on fishery participants. Suspension of the use-or-lose requirement for annual permit renewal will allow NWHI bottomfish fishery participants to reduce their effort in accordance with markets or other economic or personal conditions without losing their permits. The establishment of new entry criteria for bottomfishing in the Mau Zone will provide managers with a mechanism to maintain effort at target levels through the limited entry program. The issuance of CDP permits will allow managers to allocate some of this available effort to qualified CDP applicants. The creation of a precious corals mega-refugia will reduce harvest opportunities for potential future participants, as will several other measures for precious corals such as and a prohibition on the harvest of gold corals throughout the NWHI. However at the same time this alternative would replace the existing exploratory area quota with a system designed to allow further exploration under carefully monitored conditions which could lead to increased harvests in the future.

Impacts of Alternative 3 on Fisheries and Fishery Participants:
Alternative 3 (Precautionary Modification 1) would create two additional no-take MPAs in federal waters around the NWHI in which all fishing would be prohibited. These would be in addition to the measures discussed in Alternative 2. The impacts of the measures resulting from Alternative 2 are described above. The two additional no-take MPAs would be anticipated to have adverse impacts on fishery participants through the potential for local depletions of some species as fishery participants will be forced to concentrate their effort in smaller available open areas. These local depletions may reduce catch rates and associated fishery revenues. 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 Hawaii. 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 implementation of area closures 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 area closures would accrue to the current generation of bottomfish fishermen.

Impacts of Alternative 4 on Fisheries and Fishery Participants:
Alternative 4 (Precautionary Modification 2) would create two additional no-take MPAs in federal waters around the NWHI in which all fishing would be prohibited. The northern of these two additional no-take MPAs would be significantly larger than under Alternative 3. These

would be in addition to the measures discussed in Alternative 2. The impacts of the measures resulting from Alternative 2 are described above. The two additional no-take MPAs would be anticipated to have adverse impacts on fishery participants through the potential for local depletions of some species as fishery participants will be forced to concentrate their effort in smaller available open areas. These local depletions may reduce catch rates and associated fishery revenues. Due to the larger size of the additional no-take MPAs, this adverse impact would be larger than under Alternative 3. Again, 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 Hawaii. 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 implementation of area closures 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 area closures would accrue to the current generation of bottomfish fishermen.

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

Under Alternative 5, commercial harvests of bottomfish would be capped to those made in 2000 through a series of fathom-based area closures around most NWHI, as well as the imposition of non-transferable vessel quotas and a requirement that landings be in species specific ratios. In the short-run the vessel quotas and landing ratio requirements are likely to result in some level of discarding, as species targeting is difficult and limits will be met for some species before others. In this situation, fishery participants are likely to discard those fish for which they are over their quota, while continuing to fish for species for which they are under their quota. However the fact that 2000 landings were well below MSY for this fishery means that it is unlikely that these discards will have an adverse impact on species populations or the NWHI ecosystem. The implementation of area closures may result in local depletions of some species as fishery participants will be forced to concentrate their effort in smaller available open areas. 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 Hawaii. 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 implementation of area closures 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 area closures would accrue to the current (and under this alternative, the last) generation of bottomfish fishermen.

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

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

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

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

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

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

foreclose the opportunity for future harvests of NWHI and MHI bottomfish.

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

Impacts of Alternative 7 on Fisheries and Fishery Participants:
Alternative 7 (Council Recommendation) would continue management of NWHI fisheries under the MSFCMA and establish moratoriums for fishing for NWHI lobster, precious corals and coral reef associated species until one or more science-based fishery ecosystem management plans for the NWHI are developed by the Council in consultation with the NMSP, and implemented by NOAA Fisheries under the MSFCMA. In the interim: bottomfishing would be managed under a limited entry system that would allow up to 17 vessels maximum to fish the entire 1,200 mile NWHI chain without "use-or-lose" annual minimum landing requirements for permit renewal; pelagic fishing would be allowed by use of trolling or handline hook-and-line gear, with longline, trawls, purse seines, set nets and other fishing gears prohibited throughout the proposed sanctuary; all fishing vessels would also be subject to federal permitting and logbook requirements; no-take marine protected areas would be implemented within federal waters from 0-10 fathoms around each emergent island or atoll and from 0-50 fathoms around French Frigate Shoals, Laysan Island and the northern half of Midway Atoll; preferential Native Hawaiian participation would occur through the issuance of two of the ten Mau Zone limited access bottomfishing permits under the MSFCMA Western Pacific Community Development Program; preferential Native Hawaiian subsistence use could occur as Community Development Programs are developed for other NWHI fisheries; non-preferential access would be available to Native Hawaiians through participation in NWHI pelagic troll and handline fisheries and; all permits and fisheries would be required to be consistent with all applicable laws. It is likely that some or all of these interim measures would also be incorporated into any NWHI fishery ecosystem management plans. Monitoring by NOAA Fisheries would continue and marine research by NOAA Fisheries, the National Ocean Service, the U.S. Fish and Wildlife Service, the University of Hawaii and other research partners would be coordinated under the Hawaii Archipelagic Living Marine Resource Research Plan currently under development by the NOAA Fisheries' Pacific Islands Fisheries Science Center and other NWHI research and management agencies. This research would continue to be independently peer-reviewed and to provide the scientific basis for adaptive management of NWHI fisheries.

Additional measures that would be implemented under Alternative 7 for the bottomfish fishery (suspend use-or-lose requirements, new entry criteria, CDP permits) are anticipated to have potentially positive impacts on fishery participants. Suspension of the use-or-lose requirement for annual permit renewal will allow NWHI bottomfish fishery participants to reduce their effort in accordance with markets or other economic or personal conditions without losing their permits. The establishment of new entry criteria for bottomfishing in the Mau Zone will provide managers with a mechanism to maintain effort at target levels through the limited entry program. The

issuance of CDP permits will allow managers to allocate some of this available effort to qualified CDP applicants.

Although moratoriums on fishing for lobster, precious corals and coral reef species pending implementation of fishery ecosystem management plans would preclude participation in these fisheries in the short-term, they would maintain the option value of existing investments by lobster permit and vessel owners and would ultimately result in the management of these fisheries under plans that consider the full range of ecological impacts of these fisheries, thus ensuring the maintenance of healthy and sustainable NWHI fisheries for many future generations. Although additional precautionary measures may be found to be required, it is anticipated that these would be science-based and designed to result in appropriate and necessary regulations implemented through a participatory process that allows directly affected stakeholders to understand and contribute to the management of these fisheries. Such participation has been found to result in improved management and high levels of voluntary compliance (Hampshire et al. 2004).

8.5 Anticipated Impacts on Fishing Related Economic Activities

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

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

The historical contribution of NWHI fisheries to Hawaii's economy is small. However, given the vulnerability of the economies of Hawaii 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. Commercial fishing appears to be one of the few economic sectors outside the mainstay of tourism in which substantial economic growth is possible.

Impacts of Alternative 1B on Fishing Related Economic Activities:
Under Alternative 1B (Reserve Status Quo), both short and long-run impacts on fishing related economic activities are anticipated to be adverse. Bottomfish landings would be capped to those made in 2000 through a series of fathom-based area closures around most NWHI, as well as the imposition of non-transferable vessel quotas. The implementation of area closures may result in local depletions of some species as fishery participants will be forced to concentrate their effort in smaller available open areas. These local depletions may reduce catch rates and associated

fishery landings, thus reducing the amount of product available to wholesalers, retailers and other marketers. This in turn will reduce the revenue realized by these industries. The use of fishing caps and vessel specific quotas will have varying impacts depending on each participant's catch record during 2000. Participants who were active and had higher landings will obviously fare better than those who were relatively inactive during 2000, with some in the latter group potentially being left with too small a quota to make fishing worthwhile. As these vessels leave the fishery, revenues to fishery supply shops, fuel, ice, bait and other vendors will be reduced.

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

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

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

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 Hawaii. 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 (and under this alternative, the last) generation of bottomfish fishermen. In addition, recent information indicates that larval transfer is more likely to flow from the MHI to the NWHI than the reverse. Thus closing NWHI fisheries may be unlikely to increase MHI stocks. Moreover, if fishing effort is allowed to increase in the MHI, any economic gains from closing the NWHI will be dissipated over the long-run.

Impacts of Alternative 2 on Fishing Related Economic Activities:
Under Alternative 2 (Council Recommendations to Date), no-take and low-use MPAs recommended under the Coral Reef Ecosystems FMP would prohibit or restrict fishing in federal

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

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

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

Impacts of Alternative 3 on Fishing Related Economic Activities:
Alternative 3 (Precautionary Modification 1) would create two additional no-take MPAs in federal waters around the NWHI in which all fishing would be prohibited. These would be in addition to the measures discussed in Alternative 2. The impacts of the measures resulting from Alternative 2 are described above. The two additional no-take MPAs would be anticipated to have adverse impacts on fishery related economic activities through the potential for local depletions of some species as fishery participants will be forced to concentrate their effort in smaller available open areas. These local depletions may reduce catch rates and associated fishery revenues, thus reducing the amount of product available to wholesalers, retailers and other marketers. This in turn will reduce the revenue realized by these industries. It is possible that closed areas could serve as reservoirs to help augment stocks and increase catch rates in surrounding fishing grounds and increase harvests, thereby mitigating the revenue reductions from fishing restrictions. However, the ability of closed areas to increase yields or catch rates has not been demonstrated for bottomfish fisheries in Hawaii. 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 implementation of area closures 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 area closures would accrue to the current generation of bottomfish fishermen.

Impacts of Alternative 4 on Fishing Related Economic Activities:
Alternative 4 (Precautionary Modification 2) would create two additional no-take MPAs in federal waters around the NWHI in which all fishing would be prohibited. The northern of these two additional no-take MPAs would be significantly larger than under Alternative 3. These would be in addition to the measures discussed in Alternative 2. The impacts of the measures resulting from Alternative 2 are described above. The two additional no-take MPAs would be anticipated to have adverse impacts on fishing related economic activities through the potential for local depletions of some species as fishery participants will be forced to concentrate their effort in smaller available open areas. These local depletions may reduce catch rates and associated fishery revenues, thus reducing the amount of product available to wholesalers, retailers and other marketers. This in turn will reduce the revenue realized by these industries.

Due to the larger size of the additional no-take MPAs, this adverse impact would be larger than under Alternative 3. It is possible that closed areas could serve as reservoirs to help augment stocks and increase catch rates (thus reducing fishing costs) in surrounding fishing grounds and increase harvests, thereby mitigating the revenue reductions from fishing restrictions. However, the ability of closed areas to increase yields or catch rates has not been demonstrated for bottomfish fisheries in Hawaii. 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 implementation of area closures 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 area closures would accrue to the current generation of bottomfish fishermen.

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

Bottomfish landings would be capped to those made in 2000 through a series of fathom-based area closures around most NWHI, as well as the imposition of non-transferable vessel quotas and a requirement that landings be in species specific ratios. In this situation, fishery participants are likely to discard those fish for which they are over their quota, while continuing to fish for species for which they are under their quota. However the fact that 2000 landings were well below MSY for this fishery means that it is unlikely that these discards will have an adverse impact on species populations, the NWHI ecosystem or fishery landings. The implementation of area closures may result in local depletions of some species as fishery participants will be forced to concentrate their effort in smaller available open areas. These local depletions may reduce catch rates and associated fishery landings, thus reducing the amount of product available to

wholesalers, retailers and other marketers. This in turn will reduce the revenue realized by these industries. It is possible that closed areas could serve as reservoirs to help augment stocks and increase catch rates (thus reducing fishing costs) in surrounding fishing grounds and increase harvests, thereby mitigating the revenue reductions from fishing restrictions. However, the ability of closed areas to increase yields or catch rates has not been demonstrated for bottomfish fisheries in Hawaii. 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 implementation of area closures 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 area closures would accrue to the current (and under this alternative, the last) generation of bottomfish fishermen.

The use of fishing caps and vessel specific quotas will have varying impacts depending on each participant's catch record during 2000. Participants who were active and had higher landings will obviously fare better than those who were relatively inactive during 2000, with some in the latter group potentially being left with too small a quota to make fishing worthwhile. As these vessels leave the fishery, revenues to fishery supply shops, fuel, ice, bait and other vendors will be reduced. In addition, reductions in landings will limit the amount of product available to wholesalers, retailers and other marketers and thus reduce their revenue. In the long-run, the non-transferable nature of the vessel quotas means as fishery participants age and leave the fishery, there will be no new entrants to take their place and the fishery will close. Again, as these vessels leave the fishery, revenues to fishery supply shops, fuel, ice, bait and other vendors will be reduced as will revenues to wholesalers, retailers and other fish marketers. This alternative would also foreclose the opportunity for future harvests of NWHI bottomfish.

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

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

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

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

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

Impacts of Alternative 7 on Fishing Related Economic Activities:
Alternative 7 (Council Recommendation) would continue management of NWHI fisheries under the MSFCMA and establish moratoriums for fishing for NWHI lobster, precious corals and coral reef associated species until one or more science-based fishery ecosystem management plans for the NWHI are developed by the Council in consultation with the NMSP, and implemented by NOAA Fisheries under the MSFCMA. In the interim: bottomfishing would be managed under a limited entry system that would allow up to 17 vessels maximum to fish the entire 1,200 mile NWHI chain without "use-or-lose" annual minimum landing requirements for permit renewal; pelagic fishing would be allowed by use of trolling or handline hook-and-line gear, with longline, trawls, purse seines, set nets and other fishing gears prohibited throughout the proposed sanctuary; all fishing vessels would also be subject to federal permitting and logbook requirements; no-take marine protected areas would be implemented within federal waters from 0-10 fathoms around each emergent island or atoll and from 0-50 fathoms around French Frigate Shoals, Laysan Island and the northern half of Midway Atoll; preferential Native Hawaiian participation would occur through the issuance of two of the ten Mau Zone limited access bottomfishing permits under the MSFCMA Western Pacific Community Development Program; preferential Native Hawaiian subsistence use could occur as Community Development Programs are developed for other NWHI fisheries; non-preferential access would be available to Native Hawaiians through participation in NWHI pelagic troll and handline fisheries and; all permits and fisheries would be required to be consistent with all applicable laws. It is likely that some or all of these interim measures would also be incorporated into any NWHI fishery ecosystem management plans. Monitoring by NOAA Fisheries would continue and marine research by NOAA Fisheries, the National Ocean Service, the U.S. Fish and Wildlife Service, the University of Hawaii and other research partners would be coordinated under the Hawaii Archipelagic Living Marine Resource Research Plan currently under development by the NOAA Fisheries' Pacific Islands Fisheries Science Center and other NWHI research and management agencies. This research would continue to be independently peer-reviewed and to provide the scientific basis for adaptive management of NWHI fisheries.

The impact of Alternative7's measures that would be implemented for the bottomfish fishery (suspend use-or-lose requirements, new entry criteria, CDP permits) are anticipated to be potentially positive for fishing related economic activities. Suspension of the use-or-lose requirement for annual permit renewal will allow NWHI bottomfish fishery participants to reduce their effort in accordance with markets or other economic or personal conditions without losing their permits. This means that effort, and therefore landings, will be available when

conditions again become favorable and support industries can continue to service the fishing industry. The establishment of new entry criteria for bottomfishing in the Mau Zone will provide managers with a mechanism to maintain effort at target levels through the limited entry program and will again mean that effort, and therefore landings, remain available at target levels and support industries can continue to service the fishing industry. The issuance of CDP permits will have neutral impacts on support industries as total effort will remain at the target levels established for this fishery.

In the short-term, moratoriums on fishing for lobster, precious corals and coral reef species pending implementation of fishery ecosystem management plans would preclude opportunities for fishery landings and their associated revenues realized by fishing support industries. In the long-term these management plans would consider the full range of ecological impacts of these fisheries and maintain healthy and sustainable NWHI fisheries for the future.

8.6 Anticipated Impacts on Hawaii's Communities

In addition to their economic returns to fishery participants and support industries, Hawaii's fisheries contribute to Hawaii's broader communities as described in Chapter 7. Under all alternatives impacts on these communities are anticipated to be mixed as reactions to actions such as closing NWHI fisheries will be negative for those who believe the resources are healthy and well managed, and positive for those who believe fishery closures are the best way to manage these resources. In addition, many of Hawaii's residents are largely uninformed about NWHI fisheries and likely won't have any reaction. The proportion of the population in each group is unknown. Alternatives that limit or end the supply of NWHI fishery products to Hawaii will obviously affect consumers of these products who will have to switch to other species or imported fish. For some this will be unimportant, however others value these fish highly, especially for Hawaii's traditional Christmas and New Year celebrations. Reductions or a loss of Hawaii-caught bottomfish such as opakapaka and onaga may also reduce revenues to restaurants that depend on these world-renowned "signature" dishes. Alternatives that limit or reduce fishing effort will correspondingly reduce crew and support industry employment opportunities for Hawaii residents. Alternatives that limit or close NWHI fisheries will negatively impact Hawaii's social and technical fisheries capital, meaning that not only will a way of life be closed off, but the knowledge of how to successfully fish in these remote fisheries will also be lost. Experience in other Pacific island areas has illustrated that this knowledge can be lost in one generation and often cannot be regained.

Hawaii has suffered more than a decade of economic stagnation, and workers in both the public and private sectors have lost jobs. A study of workers that were laid off following the shut down of the sugar industry on the island of Hawaii 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 NWHI fisheries would encounter similar difficulties in finding suitable alternative jobs.

Deckhands would arguably be the most severely impacted by termination of NWHI fisheries, 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 NWHI fisheries 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 closure of NWHI fisheries.

It is likely that many families that depend on fishing and the seafood industry in Hawaii are already economically, socially and psychologically stressed because of fluctuating catch rates, increasing competition and unstable markets. In Hawaii, 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. Contributing to this stress is the imposition of ever more restrictive state and federal regulations. Undoubtedly, many fishermen in Hawaii 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 NWHI fisheries 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. 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.

Closure of NWHI fisheries would also likely have a negative impact on those who value the continued existence of Hawaii's maritime tradition and culture. Hawaii's commercial fishing industry dates back nearly 200 years, and fishermen have engaged in commercial fishing in the and NWHI since at least the early part of the last century. By reducing the diversity and economic viability of the commercial fishing life way in Hawaii, closure NWHI fisheries would diminish the influence of Hawaii's maritime culture.

In addition, closure of NWHI fisheries 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. A survey by Hamilton and Huffman (1997) of small-boat owners who engage in Hawaii'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. A 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 ethnicity of the crews, and these tend to change much more rapidly than vessel owners or captains. At the time of the 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, the Hawaii 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.

Under Alternative 7 (Council's recommendation) some NWHI bottomfishing and pelagic trolling and handlining would continue, with moratoriums on fishing for lobsters, precious corals and coral reef species imposed until fishery ecosystem management plans are developed for the NWHI. This would prevent the displacement of active fishery participants (those in the bottomfish and pelagic fisheries), while temporarily removing opportunities for potential

participants to participate in the other dormant fisheries. NWHI bottomfish would continue to be available to Hawaii's residents and visitor industry and opportunities to fish using pelagic troll or handline gear in the NWHI would be maintained. In the long-term, fishery ecosystem management plans would be developed under the MSFCMA and its associated Council process. This process requires that management measures be science-based and that the regulatory process be transparent with high levels of public participation. This approach has been proven to highly successful when used to manage natural resources (Hampshire et al. 2004, Chase et al. 2004, Mascarenhas and Scarce 20004) as it provides all stakeholders with equal opportunities to speak and all information to be both scientifically and publically reviewed.

Although additional precautionary measures may be found to be required, it is anticipated that these would be science-based and designed to result in appropriate and necessary regulations implemented through a participatory process that allows directly affected stakeholders to understand and contribute to the management of these fisheries. Such participation has been found to result in improved management and high levels of voluntary compliance.

8.7 Anticipated Impacts on Native Hawaiians

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

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

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

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

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

but given the stresses on this fishery it may be difficult for them to achieve catch rates or revenues comparable to those in the NWHI. This additional MHI effort may also negatively impact current MHI fishery participants as catch competition may further reduce MHI catch rates.

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

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

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

participation and could potentially increase Native Hawaiian participation. The issuance of CDP permits will allow managers to allocate some of this available effort to qualified CDP applicants, who by definition must be Native Hawaiians. The creation of a precious corals mega-refugia will reduce harvest opportunities for potential future participants (Native Hawaiians and others), as will several other measures for precious corals such as and a prohibition on the harvest of gold corals throughout the NWHI. However at the same time this alternative would replace the existing exploratory area quota with a system designed to allow further exploration under carefully monitored conditions which could lead to increased harvests in the future.

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

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

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

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

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

will preclude their continued participation in the fishery, as well that of any others who might participate in this or other NWHI fisheries in the future.

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

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

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

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

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

measures resulting from Alternative 2 are described above. This alternative would remove all NWHI and MHI bottomfish effort and landings and their associated revenues.

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

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

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

Both NWHI and MHI bottomfish fishery participants may replace some effort with pelagic trolling as many vessels already participate in both fisheries. Given the long travel time and relatively low value of trolling catches, it is unlikely that participants will continue or increase NWHI pelagic trolling effort.

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

Impacts of Alternative 7 on Native Hawaiians:
Alternative 7 (Council Recommendation) would continue management of NWHI fisheries under the MSFCMA and establish moratoriums for fishing for NWHI lobster, precious corals and coral reef associated species until one or more science-based fishery ecosystem management plans for the NWHI are developed by the Council in consultation with the NMSP, and implemented by NOAA Fisheries under the MSFCMA. In the interim: bottomfishing would be managed under a limited entry system that would allow up to 17 vessels maximum to fish the entire 1,200 mile NWHI chain without "use-or-lose" annual minimum landing requirements for permit renewal; pelagic fishing would be allowed by use of trolling or handline hook-and-line gear, with longline, trawls, purse seines, set nets and other fishing gears prohibited throughout the proposed

sanctuary; all fishing vessels would also be subject to federal permitting and logbook requirements; no-take marine protected areas would be implemented within federal waters from 0-10 fathoms around each emergent island or atoll and from 0-50 fathoms around French Frigate Shoals, Laysan Island and the northern half of Midway Atoll; preferential Native Hawaiian participation would occur through the issuance of two of the ten Mau Zone limited access bottomfishing permits under the MSFCMA Western Pacific Community Development Program; preferential Native Hawaiian subsistence use could occur as Community Development Programs are developed for other NWHI fisheries; non-preferential access would be available to Native Hawaiians through participation in NWHI pelagic troll and handline fisheries and; all permits and fisheries would be required to be consistent with all applicable laws. It is likely that some or all of these interim measures would also be incorporated into any NWHI fishery ecosystem management plans. Monitoring by NOAA Fisheries would continue and marine research by NOAA Fisheries, the National Ocean Service, the U.S. Fish and Wildlife Service, the University of Hawaii and other research partners would be coordinated under the Hawaii Archipelagic Living Marine Resource Research Plan currently under development by the NOAA Fisheries' Pacific Islands Fisheries Science Center and other NWHI research and management agencies. This research would continue to be independently peer-reviewed and to provide the scientific basis for adaptive management of NWHI fisheries.

Under Alternative 7 some NWHI bottomfishing and pelagic trolling and handlining would continue, with moratoriums on fishing for lobsters, precious corals and coral reef species imposed until fishery ecosystem management plans are developed for the NWHI. This would prevent the displacement of active Native Hawaiian fishery participants (those in the bottomfish and pelagic fisheries), while temporarily removing opportunities for potential participants to participate in the other dormant fisheries. The issuance of Western Pacific CDP permits for the Mau Zone bottomfish fishery would provide significant opportunities for increased participation by Native Hawaiians, while additional CDP permits for subsistence fishing could facilitate use of the NWHI for Native Hawaiian cultural or religious activities.

In the long-term, fishery ecosystem management plans would be developed under the MSFCMA and its associated Council process. This process requires that management measures be science-based and that the regulatory process be transparent with high levels of public participation. This approach has been proven to highly successful when used to manage natural resources (Hampshire et al. 2004, Chase et al. 2004, Mascarenhas and Scarce 20004) as it provides all stakeholders with equal opportunities to speak and all information to be both scientifically and publically reviewed.

8.8 Anticipated Impacts on the Nation

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

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

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

Impacts of Alternative 2 on the Nation:
Under Alternative 2 (Council Recommendations to Date), no-take and low-use MPAs recommended under the Coral Reef Ecosystems FMP would prohibit or restrict fishing in federal waters within 50 fm of all NWHI. Because these restrictions would not be anticipated to have adverse impacts to the bottomfish, precious corals or pelagic fisheries, they would not be expected to impact these fisheries' current or potential support industries or the nation's economy or people.

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

continue to service the fishing industry. The issuance of CDP permits will have neutral impacts on the nation's economy as total effort will remain at the target levels established for this fishery.

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

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

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

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

Impacts of Alternative 5 on the Nation:
Alternative 5 (NMSP Recommendation) would apply to both state and federal waters and would prohibit harvests of precious corals, crustaceans and coral reef associated species. It would allow

limited commercial bottomfish/pelagic trolling, commercial pelagic trolling, various forms of recreational fishing, and limited Native Hawaiian cultural and subsistence uses through a permitting process.

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

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

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

Impacts on the nation are anticipated to be mixed as reactions to actions such as closing NWHI fisheries will be negative for those who believe the resources are healthy and well managed, and positive for those who believe fishery closures are the best way to manage these resources. In

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

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

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

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

Impacts of Alternative 7 on the Nation:
Alternative 7 (Council Recommendation) would continue management of NWHI fisheries under the MSFCMA and establish moratoriums for fishing for NWHI lobster, precious corals and coral

reef associated species until one or more science-based fishery ecosystem management plans for the NWHI are developed by the Council in consultation with the NMSP, and implemented by NOAA Fisheries under the MSFCMA. In the interim: bottomfishing would be managed under a limited entry system that would allow up to 17 vessels maximum to fish the entire 1,200 mile NWHI chain without "use-or-lose" annual minimum landing requirements for permit renewal; pelagic fishing would be allowed by use of trolling or handline hook-and-line gear, with longline, trawls, purse seines, set nets and other fishing gears prohibited throughout the proposed sanctuary; all fishing vessels would also be subject to federal permitting and logbook requirements; no-take marine protected areas would be implemented within federal waters from 0-10 fathoms around each emergent island or atoll and from 0-50 fathoms around French Frigate Shoals, Laysan Island and the northern half of Midway Atoll; preferential Native Hawaiian participation would occur through the issuance of two of the ten Mau Zone limited access bottomfishing permits under the MSFCMA Western Pacific Community Development Program; preferential Native Hawaiian subsistence use could occur as Community Development Programs are developed for other NWHI fisheries; non-preferential access would be available to Native Hawaiians through participation in NWHI pelagic troll and handline fisheries and; all permits and fisheries would be required to be consistent with all applicable laws. It is likely that some or all of these interim measures would also be incorporated into any NWHI fishery ecosystem management plans. Monitoring by NOAA Fisheries would continue and marine research by NOAA Fisheries, the National Ocean Service, the U.S. Fish and Wildlife Service, the University of Hawaii and other research partners would be coordinated under the Hawaii Archipelagic Living Marine Resource Research Plan currently under development by the NOAA Fisheries' Pacific Islands Fisheries Science Center and other NWHI research and management agencies. This research would continue to be independently peer-reviewed and to provide the scientific basis for adaptive management of NWHI fisheries.

Under Alternative 7 some NWHI bottomfishing and pelagic trolling and handlining would continue, with moratoriums on fishing for lobsters, precious corals and coral reef species imposed until fishery ecosystem management plans are developed for the NWHI. This would maintain current bottomfish landings and associated direct and indirect revenues, while temporarily removing opportunities for revenues from the other dormant fisheries. The issuance of Western Pacific CDP permits for NWHI fisheries may have a positive impact for those who support preferential rights for Native Hawaiians, and a negative impact for those who don't.

Although moratoriums on fishing for lobster, precious corals and coral reef species pending implementation of fishery ecosystem management plans would preclude landings and revenues from these fisheries in the short-term, they would ultimately result in the management of these fisheries under plans that consider the full range of ecological impacts of these fisheries, thus ensuring the maintenance of healthy and sustainable NWHI fisheries for future generations.

8.9 Anticipated Impacts on Other Fisheries

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