Chapter 4 Environmental Consequences

4.1 Introduction

This chapter analyzes the impacts of each alternative for seabird interaction mitigation methods and pelagic squid management by alternative for each environmental resource category. In some instances the impacts of various alternatives are sufficiently similar that the analyses are consolidated. Direct and indirect impacts are discussed in the individual resource sections of this chapter; cumulative impacts are discussed separately afterwards. The two sets of alternatives are treated separately as they have no interactive effects. The two sets of measures would apply to two different fishing fleets with different operating characteristics, different target species, and different bycatch patterns. While the four known U.S. pelagic squid jigging vessels list Honolulu as their home port, in recent years they have spent more time in New Zealand waters, so economic and social impacts to Hawaii are currently insignificant.

4.2 Impacts to the Pelagic Environment

4.2.1 Seabird Interaction Mitigation Methods

Only Alternative SB1, the current measures, and the alternatives that offer an option to employ current measures, Alternatives SB2-SB8, SB10 and SB11, potentially impact the pelagic environment, and that would be through the discharge of offal and spent bait. Direct impacts would include insignificant, transient and localized reductions of water quality. There would be no detectable indirect effects to the pelagic environment.

4.2.2 Squid Management Alternatives

Squid vessels have the typical discharges associated with any ocean-going vessel, including bilge water, sanitary waste, garbage, etc. They also discharge offal from the on-board processing of the squid. With the possible exception of Alternative SQB.2, cessation of issuing HSFCA permits for squid fishing, none of the alternatives for squid management would change current impacts of these vessels. Alternative SQB.2 would eventually (when current permits expire) result in fewer vessels fishing for squid. To the extent these vessels would be completely removed from service of any kind, there would be fewer ships at sea, with concomitantly reduced discharges of solid and liquid wastes. It is more likely however, these vessels would be reconfigured for other uses, including service in other fisheries. In that event, the direct impact on the pelagic environment would be a reduction of wastes discharged from squid vessels, and the indirect impact would be an increase in the discharge of waste from the rededicated vessels. The net effect would depend on the wastes generated in the new use or uses to which the vessels are put as compared with current discharges, but given the current number of vessels involved in the squid fishery, these impacts would be insignificant.

4.3 Impacts to Squid

4.3.1 Seabird Interaction Mitigation Methods

As for the pelagic environment, only Alternative SB1, the current measures, and the alternatives that offer an option to employ current measures, Alternatives SB2-SB8, SB10 and SB11, potentially impact squid resources. The impacts would be indirect and caused by strategic offal and spent bait discard and minimization of lights during nighttime operations. Offal discharge would represent a food subsidy to squid as it sinks through the water column. Minimization of lights would incrementally reduce the attraction of squid prey and squid to a vessel at night compared to the situation without light minimization. Neither of these impacts would be significant.

4.3.2 Squid Management Alternatives

The alternatives for management of the U.S. pelagic squid fishery are, for the most part, not designed to control the take of squid and limit fishing mortality of squid, but rather to better understand the fishery and the condition of the squid resources so that control measures could be instituted at some future time should the condition of the resources require it. Again with the exception of Alternative SQB.2, cessation of issuing HSFCA permits for squid fishing, none of the alternatives for squid management would change current impacts of U.S. vessels on squid resources. Impacts on the resource base could increase with increased future effort. This is why increasing our understanding of the status of the stocks and fishing mortality would be an important outcome of this action. Alternative SQB.2 would eventually (when current permits expire) result in fewer vessels fishing for squid and reduced squid harvests. The U.S. involvement in this fishery however, is very small compared with the aggregated foreign effort and harvests. The U.S. squid fisheries, including net fisheries, are responsible for less than 3.5% of the world's harvest (see section 3.7.3.1.1), with the squid jigging fishery a small percentage of that. It is unlikely that cessation of U.S. squid jigging effort would have any discernable effect on squid stocks.

4.4 Impacts to PMUS and Non-PMUS

4.4.1 Seabird Interaction Mitigation Methods

The current measures of Alternative SB1 may indirectly and insignificantly affect PMUS or other pelagic species by providing a localized food subsidy through strategic offal or spent bait discard. To the extent any of the other alternatives would facilitate bait retention on the hook, either through reduced bird depredation or reduced mechanical loss, catch rates of PMUS and non-PMUS could increase somewhat. Given however, that most baits are not taken during a set, such an effect is not likely to be significant. None of the seabird deterrent measure alternatives would directly affect PMUS or other pelagic species.

4.4.2 Squid Management Alternatives

It is unlikely that any of the squid management alternatives would have a significant direct or indirect impact on PMUS or non-PMUS. The bycatch in the squid jigging fishery is reported to be extremely small (Alverson et al., 1992 cited in Harris and Ward, 1999). Sharks are occasionally hooked, but break the relatively weak squid lines before being boated. Only Alternative SQB.2 would alter the current U.S. pelagic squid fishery by phasing it out as permits expire. The indirect effect of this alternative on PMUS or non-PMUS would depend on the use or uses to which the displaced vessels are put. However, even if all four current squid vessels were to begin fishing for PMUS, their landings would be insignificant in the context of the international fisheries for these species in the Pacific.

There do not appear to be substantive bycatch issues in the fishery at present. Alts SQA.3, SQA.4, SQB.4, SQB.5 and SQB.6 would provide a mandatory level of monitoring that provides a suitable level of confidence that bycatch is not a concern and a mechanism for considering and responding to changes in circumstances affecting bycatch

4.5 Impacts to seabirds

The objective of the proposed action is to reduce the incidental catch of seabirds by pelagic fishing vessels operating under the Pelagics FMP. The Hawaii-based longline fishery is the only fishery operating under the Pelagics FMP with observed catches of seabirds, predominately black-footed and Laysan albatrosses that breed in the NWHI. Besides the direct mortality to juvenile or adult birds, fishing-related deaths may also have a negative affect on chick survival if one or both parent birds are killed. Thus, the impact of the interactions is more serious if the albatrosses killed are predominantly adult birds because this results not only in the consequent loss of chicks they are caring for, but also the loss of many breeding seasons as the surviving mate must find another mate and establish a pair bond.

For the purposes of this assessment, it is assumed that the Hawaii longline fishery as it operated prior to 1999, had the greatest mortality factor on the albatross populations. If this assumption is correct, then in the short-term reductions in the incidental catch of seabirds by the Hawaii longline fishery would most likely result in: 1) increases in chick survival as both parents would be available to feed the chick; and 2) increases in breeding frequency due to decreases in mate loss. In the long-term, seven to eight years after implementing a regulatory action to reduce seabird bycatch, albatross populations would most likely see an increase in juvenile recruitment as juveniles tend to be the birds most susceptible to being caught by longline gear (Brothers, 1991; Cousins, 2001).

4.5.1 Alternative SB1: No action

Alternative SB1 is considered the baseline case against which all other alternatives are compared. Alternative SB1 reflects the Terms and Conditions outlined in the BiOp for short-tailed albatrosses published by the USFWS in November 2000, and subsequently updated on October 18, 2001, and November 18, 2002 (Table 4.5-1). The proposed management area is north of 23°N latitude as this reflects the lower limit of observations of short-tailed albatrosses in the

NWHI, as well as the concentration of black-footed and Laysan albatross interactions by the Hawaii longline fishery north of 25°N latitude.

In general, under Alternative SB1 the operators of all vessels registered for use under a Hawaii longline limited access permit operating with longline gear north of 23°N, must ensure the use of thawed blue-dyed bait and strategic offal discards to distract birds during setting and hauling of longlines. The offal discard must be made from the opposite side of the vessel from which the longline is being set or hauled (no fish, fish parts, or bait may be discarded from the side of the vessel where the longline is being set or hauled), and all hooks must be removed from discarded fish, fish parts or bait prior to its discard. When making deep-sets (targeting tuna) north of 23°N, Hawaii longline vessel operators must employ a line-setting machine with weighted branch lines (minimum weight = 45 g), or employ basket-style longline gear. Other mitigation measures such as tori lines, use of weighted branch lines without a line-setting machine (in the case of swordfish or mixed-sets) are optional. If a short-tailed albatross is brought onboard alive, vessel operators and crew must ensure that the albatross displays four traits before release, and they must notify NOAA Fisheries immediately. Included in this alternative is a requirement that all seabirds brought onboard alive must be handled in a manner that maximizes the probability of their long-term survival once released. Also, vessel captains, as well as vessel owners, must annually complete a protected species workshop conducted by NOAA Fisheries. Current regulations (69 FR 17329, April 2, 2004) allow a limited amount of shallow-set longline effort (2,120 sets annually) by Hawaii-based longline vessels using circle hooks with mackerel-type bait. Vessel operators making shallow-sets must begin setting the longline at least one hour after local sunset and complete the setting process by local sunrise, using only the minimum vessel lights necessary.

Table 4.5-1 Current seabird deterrent measures contained in the USFWS BiOp on the Effects of the Hawaii Longline Fishery on the Short-tailed Albatross; Amended October 18, 2001 and November 11, 2002.

Seabird Measures	**Above 23°N Lat.**	
A. Deterrent Methods	Tuna (deep) set	Swordfish/Mixed (shallow) set
1. Thawed, blue- dyed bait	Required	Required
2. Strategic Offal Discharge	Required	Required
3. Line-Setting machine with weighted branch lines (minimum wt. = 45 gm); or employ basket-style longline gear [a]	Required	Not Required (Optional)
4. Night Setting	Not Required (Optional)	Required
5. Towed deterrent (buoy/tori line)	Not Required (Optional)	Not Required (Optional)
6. Weighted branch lines (min wt =45 gm)	Not Required (Optional)	Not Required (Optional)

Seabird Measures	Above 23°N Lat.	
A. Deterrent Methods	Tuna (deep) set	Swordfish/Mixed (shallow) set
B. Careful handling of hooked seabirds	Vessel operators must contact NMFS immediately if they have a hooked/entangled STAL. Specific handling guidelines required for STAL. Other hooked seabirds must be handled in a manner to maximize survival.	
C. Annual Protected Species Workshops	Required	

[a] The October 18, 2001 USFWS BiOp allowed basket-style, tarred mainline gear as an alternative to monofilament gear set with a line-setting machine and weighted branch lines. Only one vessel in the Hawaii longline fleet uses basket-style, tarred mainline gear.

Any one measure employed north of 23°N is estimated to reduce the catch of black-footed and Laysan albatrosses in the Hawaii fishery by 51% to 100% as compared to the 1994-1999 average (Table 4.5-2). As no short-tailed albatrosses have been reported captured in the Hawaii-based longline fishery the potential reduction rate is unknown. Further, the mitigation measures described in this document were only tested on black-footed and Laysan albatrosses, and no observations were made of short-tailed albatrosses. However, is assumed that the measures prescribed by the USFWS BiOp will be as effective in ensuring the short-tailed albatross is not captured by Hawaii longline vessels.

Still, each seabird deterrent method listed under Alternative SB1 and currently required to be employed or optionally employed by Hawaii-based longline vessels north of 23°N (Table 4.5-1) has some limitations to its effectiveness. For instance, researchers noted that some individual seabirds either are not scared away from baited hooks at the water's surface during their initial encounter with tori lines or towed buoys or lose their fear of these devices over time (McNamara et al., 1999). Also, tori lines are less effective in reducing mortalities of Laysan albatross than mortalities of black-footed albatross, possibly because Laysan albatross have a more aggressive or methodical foraging behavior that causes them to continue to dive on baited hooks (McNamara et al., 1999). The effectiveness of tori lines may be greatly reduced in rough weather, and tori lines may become entangled with fishing gear if not closely monitored. An entanglement leaves baited hooks accessible to seabirds unless another tori line is immediately deployed (McNamara et al., 1999).

With regards to using strategic offal discards as a mitigation method, there is little or no offal generally available during setting operations. Also, the supply of offal may be low when fish catch rates are low or tuna are the target species. Consequently, this mitigation method requires the preparation and storage of offal for use during the longline set, especially when catches are low. Further, this mitigation measure may have the negative effect of teaching seabirds that longline fishing vessels are a source of fast food.

Night setting is less effective in reducing interactions with Laysan albatross than with black-footed albatross, possibly because Laysan albatross are more likely to forage at night (Harrison and Seki, 1987). Aft-facing deck lights aboard the vessel or bright moonlight also can reduce the effectiveness of this measure by illuminating baited hooks at the water's surface.

Although the actual sink rate of a baited hook deployed with a line-setting machine has not been measured, use of a line-setting machine is likely to increase the hook sink rate by removing line tension during the set. NOAA Fisheries observer records from 1994 to 1999 show that Hawaii-based longline vessels targeting tuna (0.012 birds hooked/set) had substantially lower seabird interactions than those that vessels targeted swordfish (0.615 birds hooked/set). However, a rigorous comparative test will need to be performed before a conclusion about the effects of using a line-setting machine can be made. Anecdotal accounts from longline fishermen deploying longline gear with a line-setting machine and weighted hooks in areas of high seabird abundance suggest that birds still have opportunities to dive on baited hooks. In areas of high seabird abundance, these fishermen advocated using a second mitigation measure like a tori line or towed buoy to avoid incidentally catching seabirds.

Tuna-targeting vessels in the Hawaii-based longline fleet already use line-setting machines and weighted branch lines as part of their standard operating procedures. Tuna vessels, however, are likely to have less opportunity to accumulate quantities of offal in the same manner as swordfish-targeting vessels, which dress the swordfish carcasses, removing bill, fins, tails, gills and guts before storing the trunk in the hold. A swordfish head, when frozen and split, makes an ideal offal discard for seabirds, since it is a sizeable oily morsel which floats and around which the albatrosses can flock and feed. Longline fishermen targeting tuna store their fish whole, apart from removing fins, so these fishermen may need to store some of their normal discards, such as unmarketable species or shark damaged fish to be able to conduct strategic offal discards.

Table 4.5-2 Comparing the percentage reduction of different seabird deterrent methods to that of using no deterrent methods and the predicted annual seabird incidental catch of the Hawaii-based longline fleet under Alternative SB1. Note that Hawaii longline vessels setting deep are usually targeting tuna and do not use squid as bait, nor do they set at night. Hawaii longline vessels that set shallow are usually targeting swordfish and do not use a line-setting machine, nor do they use weights near the hook. The predicted annual seabird incidental catch was calculated by subtracting birds saved from the combined 1994-1999 average annual black-footed and Laysan albatross catch (2,563 birds per year).

Seabird Deterrent Method	Percent Reduction with Gear		Predicted Annual Seabird Incidental Catch (birds/year)	
	Contact with Gear	Captures	Deep-sets	Shallow/Mixed Sets
Blue-dyed bait[1]	60-94	63-95	NA	136 - 1,029
Streamer or tori line	52-76	79	7	584
Towed buoy[2]	51	88	4	334
Strategic offal discards	53	86	4	389
Night setting	93	73-98	NA	56 - 751
Line-setting machine (+ 45 g swivels within 1 m of the hook)	NA	97-98	1	NA

Seabird Deterrent Method	Percent Reduction with Gear		Predicted Annual Seabird Incidental Catch (birds/year)	
	Contact with Gear	Captures	Deep-sets	Shallow/Mixed Sets
Night setting and blue-dyed bait[1]	99	100	NA	0

[1] Blue-dyed bait was only tested on Hawaii longline vessels targeting swordfish and using squid as bait. [2] A towed buoy is defined as a tori line with a buoy on the end of the tori line. Some longline fishermen have towed a buoy or other objects such as an inflated garbage bag or broom stick to deter seabirds from diving on the baited hooks. These makeshift methods have not been comprehensively investigated for apparent effectiveness.

The targeting of swordfish by the Hawaii-based longline fishery was greatly constrained from late August 2000, to the outright ban on shallow-setting north of the equator in the NOAA Fisheries emergency rule published June 12, 2001. The impacts of these constraints on albatross takes after August 2000 led to a significant decline in the incidental catch of albatrosses by Hawaii-based longline vessels. Further, between July and September 2001, there were no observed interactions with seabirds by the Hawaii longline fishery (with over 20% coverage of the fleet) following the complete ban on shallow-set longline fishing for swordfish north of the equator. It is unknown if the incidental catch of seabirds by Hawaii longline vessels using circle hooks with mackerel-type bait will be similar to or less than that of vessels setting shallow and operating as they did prior to 1999 (i.e, targeting swordfish using J-hooks with squid as bait). For the purposes of this assessment it is assumed that vessels setting shallow will have similar seabird interaction rates as those vessels that set shallow between 1994 and 1999. Given this assumption, it is estimated that longline vessels using no seabird deterrent methods, setting shallow and employing circle hooks with mackerel bait might incidentally catch as many as 1,300 albatrosses (the product of 2,120 sets and 0.615 bird catch rate per set). If these vessels use the prescribed seabird mitigation measures, such as dying the bait blue and setting at night, the predicted annual incidental catch of seabirds is about zero birds (Table 4.5-2). However, the effectiveness of blue-dyed bait was not tested on mackerel-type bait, and night setting alone could result in the capture of 26 to 321 albatrosses (Table 4.5-2).

Under Alternative SB1, the total incidental capture of seabirds by Hawaii-based longline vessels is expected to be about 1,800 birds per year. The predicted annual seabird catches for each mitigation measure presented in Table 4.5-2 are ideal numbers, meaning that it is assumed that 1) vessel operators always correctly deploy seabird deterrents, 2) that the sea state allows for the proper functioning of deployed seabird deterrents, and 3) that the vessel is surrounded by an average number of about 20 seabirds. These assumptions are almost never exactly met, which means that more birds than what is predicted may be caught. Thus, Hawaii-based pelagic longline vessels setting their gear deep are expected to incidentally catch as many as 500 birds per year, while vessels setting the longline shallow and using circle hooks with mackerel bait are expected to catch up to 1,300 birds per year.

4.5.2 Alternative SB2A: Use either current methods or side-setting north of 23°N

Under this alternative, operators of Hawaii longline vessels could elect to either (a) continue to use the current measures described under Alternative SB1, or (b) employ side-setting with 60 g swivels within one meter of the hook when fishing north of 23°N. Hawaii longline vessel operators opting to side-set would be required to comply with the following specifications:

1. Side set as far forward from the stern as possible;
2. Deploy a bird curtain between the setting position and the stern, constructed consistent with the specifications given by NOAA Fisheries;
3. Throw baited hooks forward as close to the vessel hull as possible; and,
4. Clip deployed branchlines to the mainline the moment that the vessel passes the baited hook to minimize tension in the branchline, which could cause the baited hook to be pulled towards the sea surface.

Alternative SB2A offers Hawaii-based longline fishermen greater flexibility to achieve the regulatory objective (i.e., fishermen can elect to maintain operating under the current suite of measures or use side setting). The side-setting method requires the use of 60 g of weight within one meter of the hooks as well as the deployment of a bird curtain. Researchers did not test how much the bird curtain contributed to the effectiveness of the side-setting method (Gilman et al., 2003), nor did the researchers note seabirds becoming acclimated to the bird curtain. If used as specified, the side-setting seabird deterrent method could reduce the incidental catch of seabirds by the Hawaii-based longline fishery by 99-100% (Gilman et al., 2003).

If the majority of these vessels operators choose the side-setting option under Alternative SB2A, then this could greatly reduce the incidental catch of seabirds in the fishery. Under Alternative SB1, it is predicted that longline vessels setting deep might catch up to 500 birds per year and vessels setting shallow and employing circle hooks with mackerel bait might incidentally catch as many as 1,300 albatrosses. However, only about 10-20 albatrosses might be incidentally caught by these vessels if they all switched to using the side-setting seabird deterrent method. Overall, it is estimated that the use of either the current seabird mitigation measures outlined under Alternative SB1 or the side-setting method would reduce total seabird incidental catch from 2,563 (the 1994-1999 average) to about 100-200 birds per year. This estimate would be further reduced to between 10-20 birds captured per year if the majority of the participants in the fishery choose to employ the side-setting seabird deterrent method.

4.5.3 Alternative SB2B: Use either current methods or side-setting in all areas

The effects would be similar to those described for Alternative SB2A, except that this alternative would provide additional protection to albatrosses and other seabird species foraging below 23°N latitude. Fishermen would be required to use in all areas the suite of mitigation measures currently required of vessels operating north of 23°N. The effects would be similar to those described for Alternative SB2A, except that this alternative would provide additional protection to albatrosses and other seabird species foraging south of 23°N latitude.

4.5.4 Alternative SB3A: Use either current methods or underwater setting chute north of 23°N

In comparison to Alternative SB1, this alternative offers fishermen flexibility to achieve the regulatory objective by allowing them to choose to use either the current seabird deterrent methods (Table 4.5-1) or to set the longline using an underwater setting chute.

Trials with underwater setting chutes on Hawaii-based longline vessels resulted in 38-88% reductions in the incidental catch of seabirds (Gilman et al., 2002; 2003). If all fishermen used the underwater setting chute, then the predicted annual incidental catch of seabirds would be between 338-1,743 birds per year. If all fishermen used the current methods, then the effects would be similar to those described for Alternative SB1.

4.5.5 Alternative SB3B: Use either current methods or underwater setting chute in all areas

The effects would be similar to those described for Alternative SB3A, except that this alternative would provide additional protection to albatrosses and other seabird species foraging below 23°N latitude.

4.5.6 Alternative SB4A: Use either current methods or tori line (i.e., paired streamer lines) north of 23°N

This alternative differs from Alternative SB1 by offering longline fishermen the option to either use the suite of mitigation measures as described in Table 4.5-1 or to use a paired tori line system. Paired tori lines have proven effective in demersal longline fisheries in Alaska (Melvin et al., 2001), where baited hooks quickly sink and remain in the seabed, but have not been tried in pelagic longline fisheries such as Hawaii, where baited hooks remain relatively near the ocean's surface.

There is a risk of entanglements between tori lines and the longline. Rough seas and high winds also reduce the effectiveness of tori lines and increase the risk of entanglements. Further, when a longline vessel stops during hauls, the streamers attached to the tori line may cause the tori line to sink, increasing the risk of entanglement with the fishing gear or the vessel's propeller. This also reduces the effectiveness of the tori line to deter birds from the gear. Thus, under Alternative SB4A, the predicted incidental catch of seabirds would be similar to that under Alternative SB1.

4.5.7 Alternative SB4B: Use either current methods or tori line (i.e., paired streamer lines) in all areas

The effects would be similar to those described for Alternative SB4A, except that this alternative would provide additional protection to albatrosses and other seabird species foraging below 23°N latitude.

4.5.8 Alternative SB5A: Use either current methods or side-setting or underwater setting chute north of 23°N

The effects would be similar to those described for Alternatives SB1, SB2A and SB3A, except that this alternative would provide fishermen with flexibility to achieve the regulatory objective (e.g., fishermen that have vessels unsuitable for side-setting may install an underwater setting chute).

Overall, it is estimated that the use of the current seabird mitigation measures outlined under Alternative SB1 would result in a seabird incidental catch of 1,800 birds per year. If all of the vessels in the Hawaii longline fishery switched to the side-setting seabird deterrent method, then between 10-20 birds might be captured per year. If all Hawaii-based longline fishermen used an underwater setting chute, then the predicted annual incidental catch of seabirds would be between about 338 birds per year setting deep and 1,743 birds per year for vessels setting shallow.

4.5.9 Alternative SB5B: Use either current methods or side-setting or underwater chute in all areas

The effects would be similar to those described for Alternative SB5A, except that this alternative would provide additional protection to albatrosses and other seabird species foraging below 23°N latitude.

4.5.10 Alternative SB6A: Use either current methods or side-setting or underwater chute or tori line north of 23°N

The effects would be similar to those described for Alternative SB5A, except that this alternative would provide fishermen with even greater flexibility to achieve the regulatory objective (e.g., fishermen that have vessels unsuitable for side-setting may install an underwater setting chute or use a tori line).

The reduction in the incidental catch of seabirds would be dependent upon the number of vessels using the various methods. If all the vessels switched to the side-setting method, then the predicted incidental catch of seabirds per year might be between 10-20 birds. If fishermen chose other methods, then the incidental catch of seabirds would be greater than those using the side-setting deterrent method. For instance, if all fishermen choose to use the current methods, then about 1,800 seabirds may be incidentally caught by the fishery.

4.5.11 SB 6B: Use either current methods or side-setting or underwater chute or tori line in all areas

The effects would be similar to those described for Alternative SB6A, except that this alternative would provide additional protection to albatrosses and other seabird species foraging below 23°N latitude.

4.5.12 Alternative SB7A: Use either current measures or side-setting or tori line (i.e., paired streamer lines) north of 23°N

The effects would be similar to those described for Alternatives SB2A and SB4A. The predicted number of seabirds incidentally caught by the fishery would depend on the number of vessels using the various methods. Thus, if all vessels used the current measures, then about 1,800 albatrosses per year may be incidentally caught by the fishery.

4.5.13 SB 7B: Use either current measures or side setting or tori line in all areas

The effects would be similar to those described for Alternative SB7A, except that this alternative would provide additional protection to albatrosses and other seabird species foraging below 23°N latitude.

4.5.14 Alternative SB7C: For shallow-sets: use either current measures (without blue-dyed bait) or underwater chute or side-setting or tori line (i.e., paired streamer lines) in all areas. For deep-sets: use either current measures (without blue-dyed bait) or underwater chute or side-setting or tori line (i.e., paired streamer lines) north of 23°N

The effects would be similar to those described for Alternative SB6A, except those fishermen that choose to use current measures would avoid the operational difficulties of using blue-dyed bait. The predicted number of seabirds incidentally caught by the fishery would depend on the number of vessels using the various methods. Thus, if all vessels used the current measures, then about 1,800 albatrosses per year might be incidentally caught by the fishery. If all vessels used the side-setting method, then up to 20 albatrosses might be incidentally caught by the fishery. If all vessels used the underwater setting chute, then the vessels setting deep might catch up to 338 birds and the vessels setting shallow might catch as many as 1,743 birds per year.

4.5.15 Alternative SB8A: Use current mitigation measures plus side-setting north of 23°N

Under Alternative 8A, all mitigation measures are non-discretionary. In addition, the requirement to side-set may eliminate fishing opportunities north of 23°N for some longline vessels in the fleet which can not be readily reconfigured for side-setting. Some smaller vessels may be unable to be reconfigured for side-setting because of structural limitations. It is estimated that between 10-20 birds would be captured per year because all Hawaii-based longline vessels would be required to use the side-setting seabird deterrent method. It is unknown if the additional use of the current mitigation measures would further reduce the estimated catch of seabirds by the fishery.

4.5.16 Alternative SB8B: Use current mitigation measures plus side-setting in all areas

The effects would be similar to those described for Alternative SB8A, except that this alternative would provide additional protection to albatrosses and other seabird species foraging below 23°N latitude. Smaller vessels that are unable to be reconfigured for side-setting would be prevented from fishing with pelagic longline gear.

4.5.17 Alternative SB9A: Use side-setting north of 23°N

The effects would be similar to those described for Alternative SB8A, except fishermen will avoid the operational difficulties of using current measures. Thus, under Alternative SB9A it is predicted that the annual incidental catch of seabirds north of 23° N might be between 10-20 birds.

4.5.18 Alternative SB9B: Use side-setting in all areas

The effects would be similar to those described for Alternative SB9A, except that this alternative would provide additional protection to albatrosses and other seabird species foraging below 23°N latitude.

4.5.19 Alternative SB10A: Use-side setting unless technically infeasible in which case use current measures north of 23°N

The effects would be similar to those described for Alternative SB2A. Alternative SB10A allows those longline vessels that are unable to adapt their vessels to side-setting to still fish using the current measures. If all the vessels are able to side set, then approximately 10-20 birds might be caught each year by the fishery. The number of seabirds expected to interact with the fishery would increase with the number of vessels using the current methods.

4.5.20 Alternative SB10B: Use side-setting unless technically infeasible in which case use current measures in all areas

The effects would be similar to those described for Alternative SB10A, except that this alternative would provide additional protection to albatrosses and other seabird species foraging below 23°N latitude.

4.5.21 Alternative SB11A: Use side setting unless technically infeasible, in which case use an underwater setting chute or a tori line or current measures without blue bait or strategic offal discards (shallow-setting vessels set at night, deep-setting vessels use line shooters with weighted branch lines), when fishing north of 23°N

The effects would be similar to those described for Alternative SB6A, except those fishermen that choose to use current measures will avoid the operational difficulties of using blue-dyed bait and strategic offal discard. If all the fishermen are able to side set, then approximately 10-20 birds might be caught each year by the fishery. The number of seabirds expected to interact with the fishery would increase with the number of vessels using the current methods, tori lines or the underwater setting chute.

4.5.22 Alternative SB11B: Use side setting unless technically infeasible, in which case use an underwater setting chute or a tori line or current measures without blue bait or strategic offal discards (shallow-setting vessels set at night, deep-setting vessels use line shooters with weighted branch lines), in all areas

The effects would be similar to those described for Alternative SB11A , except that this alternative would provide additional protection to albatrosses and other seabird species foraging below 23°N latitude.

4.5.23 Alternative SB12: Voluntarily use night-setting or underwater chute or tori line or line-shooter with weighted branch lines south of 23°N

This alternative would not deter seabird interactions north of 23°N, where the albatrosses are most abundant and where the majority of the interactions occur with the Hawaii longline fishery. Further, the majority of Hawaii-based longline vessels fishing south of 23°N already use a line-shooter with weighted branch lines, as this gear increases the speed at which the mainline is set, which causes the mainline to sag in the middle (more line between floats), allowing the middle hooks to fish deeper.

Under Alternative SB12, it is predicted that the annual incidental catch of albatrosses would be 2,563 (the 1994-1999 average). About 1,200 Laysan albatrosses and 1,400 black-footed albatrosses would interact with the Hawaii-based pelagic fishery each year.

4.6 Impacts to Sea Turtles

4.6.1 Seabird Interaction Mitigation Methods

Current seabird deterrent measures (Alternative SB1) and those alternatives that contain current measures as an option (Alternatives SB2-SB8, SB10 and SB11) may have minor indirect effects on sea turtles through attraction to offal or reduced attraction by minimization of nighttime lighting on the vessel. Use of a line shooter with weighted branch lines speeds the longline through the shallow "turtle zone," but this is not required for shallow-sets. To the extent any of the other alternatives would facilitate bait retention on the hook, either through reduced bird depredation or reduced mechanical loss, turtle hookings could increase somewhat for turtles attracted to the bait. On the other hand, leatherback turtles are usually snagged in an extremity, so retained bait could shield the hook. These potential indirect effects would be insignificant. None of the seabird deterrent measure alternatives would directly affect sea turtles.

4.6.2 Squid Management Alternatives

Impacts of the squid management alternatives to sea turtles would be much the same as for PMUS. It is unlikely that any of the squid management alternatives would have a significant direct or indirect impact on sea turtles. Only Alternative SQB.2 would alter the current U.S. pelagic squid fishery by phasing it out as permits expire. The indirect effect of this alternative on sea turtles would depend on the use or uses to which the displaced vessels are put. However, even if all four current squid vessels were to enter fisheries where turtles are incidentally hooked, their impact would be insignificant in the context of the total effort in international fisheries in the Pacific.

4.7 Impacts to Marine Mammals

4.7.1 Seabird Interaction Mitigation Methods

Hawaii-based longline vessels do interact with marine mammals when using current seabird deterrent measures (Alternative SB1). Direct interactions include bait and catch depredation, hookings, and effects of increased underwater noise. Collisions with fishing vessels are possible, but none have been documented. The other alternatives all involve options or requirements to use alternative methods of delivering the baits to depth and no direct impacts to marine mammals would be expected. To the extent any of the other alternatives would facilitate bait retention on the hook, either through reduced bird depredation or reduced mechanical loss, interactions with marine mammals could increase somewhat. Given however, that hookings of marine mammals are statistically very rare events, such an effect is not likely to be significant.

4.7.2 Squid Management Alternatives

It is unlikely that any of the squid management alternatives would have a significant direct or indirect impact on marine mammals. The bycatch in the squid jigging fishery is purported to be extremely small, and if marine mammals are occasionally hooked, they would break the relatively weak squid lines before being boated. Only Alternative SQB.2 would alter the current U.S. pelagic squid fishery by phasing it out as permits expire. The indirect effect of this alternative on marine mammals would depend on the use or uses to which the displaced vessels are put.

4.8 Economic Impacts

4.8.1 Seabird Mitigation Measures

<u>4.8.1.1 Alternative SB1: No action</u>

Alternative SB1 is considered the baseline case against which all other alternatives are compared. In general, the description of Alternative SB1 is a projection of the economic performance of the Hawaii-based longline fishery based on the current management regime. The estimation of future economic impacts is difficult because of recent significant regulatory changes, the most notable being the reopening of the swordfish portion of the Hawaii longline fishery in April 2004. The expected conditions are likely to differ from the conditions that prevailed in 2003, but uncertainty both about fishermen's responses to the new measure and about trends in factors external to the fishery management regime, such as the condition of pelagic fish stocks and market demand for pelagic fish, hampers reliable estimations of future economic activity. Nevertheless, a projection of conditions expected to exist in the future in the absence of any additional changes in the management regime has been made based on the best data available.

Table 4.8-1 summarizes the projected catches of the Hawai‘i-based longline fleet under Alternative SB1 for a one-year period.

Table 4.8-1 Predicted Annual Catch of the Hawaii-based Longline Fleet Under Alternative SB1. Source: WPFMC (2004b) and NOAA Fisheries PIRO

	Projected Catch (million lbs)	Percent Change from 1994-1999 Average	Percent Change from 2002[1]
Bigeye tuna	5.9	+ 12.8%	- 39.0%
Albacore tuna	3.0	+ 18.6%	+ 159.5%
Yellowfin tuna	1.9	+ 12.1%	+ 51.2%
Swordfish	3.6[2]	- 44.8%	+ 700.0%
Miscellaneous	4.2	+ 6.9%	+ 6.1%
Sharks	2.8	- 37.1%	+ 621.6%

[1] 2003 data were not used because the data for that year are still preliminary.
[2] Modeling for this estimate did not take into account a possible increase in swordfish catches when circle hooks with mackerel bait are used. Swordfish catches increased by 30% when this gear and bait were used in the Atlantic longline fishery.

As a result of the predicted change in pelagic fish landings, ex-vessel revenues in the Hawaii longline fishery are anticipated to increase to $38.9 million, a 4% increase over revenues in 2002. The impact on the seafood marketing sector, fishing supply businesses, and other associated businesses is expected to be proportional to the impact on ex-vessel revenue.

It is possible that the increase in landings and revenues in the Hawaii longline fishery will be even larger if the swordfish vessels that relocated in California after the closure of the swordfish component of the Hawaii longline fishery return to Hawaii. Under the regulations for the re-opened swordfish fishery, a total of 2,120 swordfish sets will be allowed per calender year, or about half of the 1994-1998 average annual number of longline sets targeting swordfish. The average number of vessels targeting swordfish during the 1994-1998 period was 42 (NMFS, 2001). Should the 20 or so California-based longline vessels return to Hawaii, they could conceivably harvest the entire effort limit. Under this scenario the projected decrease in catch of bigeye tuna would be less, as no Hawaii-based tuna vessels would switch to swordfish fishing.

Up until April 2004, the only Hawaii limited access longline permit holders affected by the seabird interaction mitigation measures were those making deep-sets, as shallow “swordfish-style"” setting was prohibited to protect sea turtles. With the reopening of the swordfish-targeting segment of the Hawaii longline fishery under new regulations in April 2004, it is anticipated that the impacts of employing the methods to reduce seabird interactions will be concentrated among vessels targeting swordfish, as these vessels will likely account for most the total longline fishing effort (sets) above 23°N, the fishing area in which the use of the mitigation methods is required.

The current methods to mitigate seabird interactions are expected to continue to have a low economic impact on fishing operations. Vessels targeting tuna (i.e., making deep-sets) routinely use a line-shooter and weighted branch lines. Although vessels targeting swordfish (i.e., making shallow-sets) routinely set at night, the requirement to begin setting the longline at least one hour after local sunset and complete the setting process by local sunrise could potentially have a negative effect on catch rates. Some fishermen claim that hooks set before dusk are more effective. In addition, the night setting requirement may provide less soak time for vessels fishing at high latitudes during summer months. While there is insufficient information to quantify these effects on catch rates, the impact on the overall economic performance of individual fishing enterprises is expected to be low.

The investment and operational costs of dying bait are small, although some preparation time is required (pre-dyed bait is not commercially available, requiring fishermen to dye the bait blue as it is thawed before each set). The cost of dyeing bait blue using a dye such as Virginia Dare FDC No. 1 Blue Food Additive is about $14 per set (Gilman et al., 2003). Assuming a typical longline vessel makes 100 sets per year, the total annual cost of dyeing bait is about $1,400. Dyeing bait requires that crew spend significant extra time preparing the bait in lieu of personal time. In addition, blue-dyed bait is messy, dying the crew's hands and clothes and the vessel deck. Notwithstanding these difficulties, some participants in the Hawaii longline fishery routinely dye a portion of their bait blue in order to increase its allure to target fish species.

There are no costs associated with strategic offal discards other than the need to purchase containers to store offal for discarding on the set (these costs are estimated to be about $400 per year). Operationally, however, offal discards are more appropriate for vessels targeting swordfish, since the carcasses of swordfish are headed and gutted before being packed on ice in the ships hold. A supply of offal is therefore generated for the next set. On most tuna-targeting longliners tuna are not dressed like swordfish, with only fins and tails cut off for storage. Accumulating offal for the next set on tuna targeting vessels is more problematic. Tuna vessels have to retain some valueless bycatch species to convert to offal, or gut and gill the fish to have a supply of offal for strategically discarding.

The equipment required for careful handling of hooked seabirds, including bolt cutters, pliers, knives, and long-handled dip nets, is routinely carried aboard fishing vessels (purchase costs are about $100) (WPFMC, 2004c). The costs to vessel operators of participating in annual protected species workshops are the costs of the participants' time spent at the meetings.

The cost-earnings study by O'Malley and Pooley (2003) described in Section 3.7 reports that the average annual total costs of operating a swordfish vessel and tuna vessel are about $462,000 and $441,000, respectively. Assuming the costs of dyeing bait and strategically discarding offal are about $1,800 per year, the additional costs of employing current seabird interaction mitigation methods represent a small fraction (less than 0.5%) of a typical vessel's expenses.

The addition of weight near the hook can be a danger to fishermen if hooks are suddenly pulled loose from the weight of a captive fish. Night setting is another mitigation method that could be dangerous if vessels are not equipped for this type of operation. However, vessel operators that target swordfish often set at night, and vessel operators targeting tuna often use line-setting machines and weights of up to 60 g. It is expected that vessels operators employing these mitigation methods would not compromise the safety of human life at sea as they are already familiar with these techniques.

During 2002 and 2003, additional seabird mitigation research field tests were conducted aboard Hawaii-based longline vessels with underwater setting chutes, blue-dyed bait and side setting (see, for example, Gilman et al., 2003). Side setting, as the term implies, means setting the longline from the side, rather than from the stern of the vessel. The results of these tests suggested that there may be a wider array of cost-effective methods to reduce seabird interactions in the Hawaii longline fishery.

Table 4.8-2 summarizes the socioeconomic characteristics of the various mitigation methods that the Hawaii longline fleet is currently required to employ or that have been examined as additional or alternative methods. These characteristics include the direct costs to fishery participants of employing the mitigation methods, the potential impact of measures on fishing efficiency (an increase in which is assumed to result in a higher target fish CPUE), the effect of the mitigation methods on fishing vessel safety, and the operational difficulty of using the mitigation methods. Also summarized are possible ancillary effects of seabird interaction mitigation methods, one of the most important being the impact of a method on the incidental catch of sea turtles. Under the new regulations for the swordfish-targeting segment of the Hawaii longline fishery, no swordfish fishing is allowed for the remainder of the year if a total of either 16 leatherback turtles or 17 loggerhead turtles are hooked. Thus, those fishermen targeting swordfish may be less negatively affected overall by a higher cost seabird mitigation method if it helps them avoid attaining the “hard limit”on hookings of leatherback and loggerhead turtles (alternatively, fishermen targeting swordfish may be more negatively affected overall by a lower cost seabird interaction mitigation method if it increases hookings of sea turtles).

Table 4.8-2 Estimated Socioeconomic Effects of Various Mitigation Methods that May Reduce Seabird Interactions in the Hawaii-Based Longline Fishery. Sources: Gilman et al. (2003); pers. comm., Eric Gilman, Blue Ocean Institute, 6/13/04; McNamara et al. (1999); WPFMC (2004c)

Method	Direct compliance costs		Fishing efficiency [1]			Other factors			
	Mitigation method installation/set-up costs	Mitigation method annual costs [2]	Bait retention [3]	Hook setting rate	Fish attraction	Safety of human life at sea	Risk of entanglement	Crew convenience	Ancillary effects
		Current Mitigation Methods							
Blue-dyed bait	None.	$1,400 for dye (estimated to cost $14 per set).	Expected to increase but effect may be reduced if birds are able to more easily remove thawed bait and if thawed fish bait tends to fall apart when baiting the hook through the fish head. In addition, birds may become habituated to blue-dyed bait.	No effect.	May increase for some species. [4]	No effect.	No effect.	Requires preparation time and is messy.	

Strategic offal discard	None.	$400 for replacement containers to store offal.	Expected to increase but effect may be reduced if offal discards attract birds to the vessel.	No effect.	No effect.	No effect.	No effect.	Requires the preparation of offal for use during the longline set, especially when catches are low.	Requires the storage of offal for use during the longline set, especially when catches are low. Accumulating offal on tuna targeting vessels is especially problematic. Piles of offal floating at the surface may attract sea turtles and increase the incidental catch.
Night-setting	Small cost may be incurred to make vessel lighting appropriate.	None.	Expected to increase but effect may be reduced during a full moon.	No effect.	May decrease for some species (some fishermen claim that hooks set before dusk are more effective than those set after). In addition, fishing time during the summer at high latitudes would be shorter because the night-time period is shorter.	May be dangerous if vessels are not equipped for night setting.	No effect.	No effect.	
Line-shooter	$5,700 for line-shooter installation.	$1,200 for depreciation and maintenance.	Expected to increase if weighted branch lines are also used.	No effect.	May increase for deep-swimming species; may decrease for shallow-swimming species.	No effect.	No effect.	No effect.	May reduce turtle interactions by decreasing the time that baited hooks are near the surface and accessible to feeding turtles.

Weighted branch lines	No effect.	$1,200 year for replacement swivels and crimps.	Expected to increase.	No effect.	No effect.	Adding weight to hooks may increase the danger to fishermen of being hit by flying hooks that pull loose from fish as branch lines are hauled.	No effect.	No effect.	May reduce turtle interactions by decreasing the time that baited hooks are near the surface and accessible to feeding turtles.
Seabird handling techniques	No effect.	Replacement cost of equipment is negligible (approx. $100).	No effect.	No effect.	No effect.	No effect.	No effect.	No effect.	
Protected species educational workshop	No effect.	Costs of the participants' time spent at the meetings.	No effect.	No effect.	No effect.	No effect.	No effect.	No effect.	
Other Mitigation Methods That Have Been Evaluated									
Side-setting	$1,500 for deck modifications. These expenses could be substantially higher if reconfiguration of the entire deck is required. In addition, some vessels would have to replace 45g swivels with 60g swivels (about $2,500 for new swivels and crimps).	Replacement cost of a bird curtain is negligible (approx. $50).	Expected to increase.	May increase hook setting rate.	No effect.	Increases risk of injury from hooks when there are tote tangles. May decrease safety when swells come onto the side where setting is occurring.	May decrease gear tangles.	May increase discomfort when swells come onto the side where setting is occurring.	May provide an opportunity for more efficient use of deck space.
Underwater setting chute	$1,000 for chute installation.	$125- $250 for depreciation. In addition, there may be maintenance costs.	Expected to increase.	Decreases hook setting rate.	No effect.	Safety hazard when tangles cause hooks to come up prong first during hauling.	Tangles occur around chute if main line is slack during setting.	Reduces bait splatter during setting.	Requires substantial deck space to stow.

Tori lines (e.g., paired streamer lines)	$1,000 for tori pole installation and $500 for materials	$4,800 for replacement poles and streamer lines	Expected to increase but effect may be reduced in rough weather or if seabirds become habituated	No effect	No effect	Entanglement risk and constant attention needed to ensure proper functioning may increase risk of accidents during setting operations.	May become entangled with fishing gear or vessel's propeller if not closely monitored.	Requires frequent adjustment	

[1]An increase in a fishing efficiency factor is assumed to result in a higher target fish CPUE
[2]The straight-line method of calculating depreciation is used. The life expectancy of an underwaters setting chute and line-shooter is assumed to be 20 years and 25 years, respectively (pers. comm., Eric Gilman, Blue Ocean Institute, 6/13/04). Assets were assumed to have a salvage value of zero.
[3] Incidence of loss of bait due to seabird interactions and to the mechanical process of setting baited hooks
[4] A research study conducted aboard Hawaii-based longline vessels found that the catch rate of swordfish and other commercially valuable fish was higher when blue-dyed bait was tested than when natural bait was used, but the difference was not statistically significantly (McNamara et al., 1999).

4.8.1.2 Alternative SB2A: Use either current methods or side setting north of 23°N

In comparison to Alternative SB1, this alternative is not expected to result in a significant change in the economic performance of the Hawaii-based longline fishery in terms of fleet size and composition, fishing trips, quantities produced, gross revenue or fishing costs.

However, by offering fishermen a seabird interaction mitigation method option this alternative provides regulated vessels greater flexibility to achieve the regulatory objective in a more cost-effective way in comparison to Alternative SB1 (i.e., fishermen can elect to maintain operating under the current suite of mitigation methods or use side setting). Several vessels in the fleet have already converted to side setting because of perceived operational benefits (beyond the minimization of bait theft and bird capture) (WPFMC, 2004c). Given the comparative benefits of side setting versus current mitigation methods, it is likely that many, if not most, of the vessels in the Hawaii longline fleet would adopt side setting as their mitigation method of choice. By allowing vessel operators to choose between employing current mitigation methods or side setting, this alternative addresses potential safety concerns associated with side setting and recognizes that configuring some vessels for side setting may be costly.

Gilman et al. (2003) indicate that it is likely that side setting can be feasibly employed on all vessels in the Hawaii longline fleet, although some vessel owners may incur costs to alter their vessel's deck design for side setting. Several aspects of a vessel's layout need to be considered when planning to convert to side setting, including the feasibility of setting from the port versus starboard side; new position for the line-shooter; and location for buoy, radio beacon, and branch line tote storage. A central principle is that the further forward the setting position is, the more effective this method is at avoiding seabird interactions and thus reducing the loss of bait to birds (also, the further forward the setting position, the easier it is to contend with tote tangles and inadvertently badly thrown baits). Sea trials described by Gilman et al. demonstrated that it is possible to adjust the gear to side set from various deck positions without any apparent compromise to the effectiveness of the method at avoiding seabird interactions. indicating that it is most likely a feasible seabird avoidance method on a variety of vessel deck designs. However, a small number of vessels may have limited options to mount line-shooters for side setting from a position far forward from the stern. Gilman et al. state that a vessel needs a minimum of 0.5m from the stern corner to allow space to mount a bird curtain aft of the line-shooter (according to Gilman et al., a bird curtain is estimated to cost about $50). Industry representatives have stated that some boats may need to reconfigure their entire deck, including moving the mainline spool (pers. comm., Karla Gore, NOAA Fisheries Pacific Islands Fisheries Regional Office, 4/28/04). Such a reconfiguration could entail substantial expenses for labor and materials as well as lost fishing time.

Because reconfiguring some vessels for side setting may be costly, the WPFMC has recommended that NOAA Fisheries provide low-interest loans or State of Hawaii Fisheries Disaster Relief Program funds to fishermen to reduce these costs.[29] There is no cost associated with side setting after any initial expense of adjusting the vessel deck design, fabricating or purchasing a bird curtain, and switching from 45 g to 60 g weighted swivels (the higher swivel

[29] The 2003 Omnibus Appropriations bill appropriated a lump sum of $5 million for economic assistance to Hawaii fisheries affected by federal fishery management regulations.

weight is recommended by Gilman et al. to increase the bait sink rate). The total cost of converting to side setting for a typical vessel is estimated to be about $4,000 (WPFMC, 2004c).

Gilman et al. note that, in comparison to conventional stern setting, side setting may improve fishing efficiency by increasing the hook setting rate. Moreover, the increased retention of bait by avoiding bird interactions may increase target fish CPUE. Gilman et al. also identified the following significant operational benefits to side setting, especially for vessels with an aft wheelhouse and main work deck forward of the vessel's wheelhouse:
1) Side setting allows for better supervision of fishing operations by the vessel captain from his work station on the bridge, providing safety and efficiency advantages;
2) Instead of having two separate work areas as is necessary when line setting is carried out from the vessel stern, at the stern for line setting and at midship for line hauling, side setting permits a vessel to have a single work area. When side setting, all of the gear can be stored at a single area, allowing for the area where the gear is stored to be condensed, which could be a significant benefit for smaller vessels. Side setting would provide significantly more deck room on all vessels, even those with a forward wheelhouse;
3) Vessels conventionally setting from the stern would move totes, line buoys, and radio beacons between the mid-ship hauling position and the stern setting position when stern setting. They also would move large quantities of bait from the forward storage freezer to the stern for line setting. Some of these vessels have very narrow passageways along the starboard side of the vessel where they have to move the gear back and forth between each set and haul, forcing some vessels to use narrow and small bins. Some vessels have a conveyer belt system down the port side to transport fishing gear from the line haul work area to the aft line setting work area. Crew would no longer have to move the gear from setting to hauling positions when side setting, and a significant amount of valuable deck space would be freed up now that the vessel no longer has to accommodate an aft line setting position.

In addition, Gilman et al. state that there may be fewer gear tangles when side setting compared to conventional stern setting. During sea trials there were no incidences of gear being fouled in the propeller while side setting from various setting positions. On a few occasions, researchers had the vessel turn hard starboard and hard port in an attempt to determine of this would foul the gear during side setting, and found that it did not. However, Gilman et al. recommend that sea trials be conducted on a variety of vessel lengths and designs to determine if bait loss off hooks and line tangling or cutting such as from contact with propellers are problematic.

Gilman et al. state that a possible negative effect of side setting on fishing vessel safety is that the crew member clipping branch lines has an increased risk of injury from hooks when there are tote tangles, because of the direction branch lines go off of the vessel, as compared to conventional stern setting. Some fishermen have also expressed concern about the 60 g weights recommended for use with side setting. The requirement to use lead weights on monofilament line always carries with it an element of danger. A lead swivel propelled towards a boat by a snapping nylon leader has sufficient force to cause serious injury, and a 60 g weight would present more of a danger than a 45 g swivel. It is estimated that about 70% of the longline vessels currently fishing in Hawaii already use 60 g weighted swivels (WPFMC, 2004c), with the remaining vessels using the required 45 g weight when deep-set fishing north of 23°N.

Gilman et al. indicate that there may be occasional inconvenience and discomfort for crew when side setting in heavy weather when it cannot be avoided to have the swell come onto the side where setting is occurring. This would be a more noticeable problem on smaller vessels.

4.8.1.3 Alternative SB2B: Use either current methods or side setting in all areas

The effects would be similar to those described for Alternative SB2A.

4.8.1.4 Alternative SB3A: Use either current methods or underwater chute north of 23°N

In comparison to Alternative SB1, this alternative is not expected to result in a significant change in the economic performance of the Hawaii-based longline fishery in terms of fleet size and composition, fishing trips, quantities produced, gross revenue or fishing costs.

However, by offering fishermen an option this alternative provides regulated vessels greater flexibility to achieve the regulatory objective in a more cost-effective way in comparison to Alternative SB1 (i.e., fishermen can elect to maintain operating under the current suite of mitigation methods or use an underwater setting chute). Given the comparative costs of the underwater chute versus current mitigation methods, it is likely that most of the Hawaii longline fleet would continue to choose to employ the current methods. By allowing vessel operators to choose between employing current mitigation methods or an underwater setting chute, this alternative addresses the high initial costs and potential operational difficulties associated with using underwater setting chutes.

The Mustad funnel and Albi Save are two commercially available underwater setting devices. Both are large metal chutes attached to the stern, which deliver the line into the water up to 2 m below the surface. According to Gilman et al (2003)., the cost of the Mustad underwater setting funnel is $5,000 for the hardware, while the underwater setting chute manufactured by Albi Save for use by pelagic longliners is about $2,500. There is an additional cost associated with installation, and a chute may require periodic maintenance (pers. comm., Eric Gilman, Blue Ocean Institute, 6/13/04). Use of the underwater setting device is expected to increase fishing efficiency due to increased bait retention from avoiding bird interactions and mechanical effectiveness. But these positive effects would be offset to a degree by the slower hook setting rate in the tuna longline fishery compared to conventional setting. The hook setting rate with the chute is expected to be suitable for the swordfish fishery where the conventional hook set interval is slower.

During sea trials described by Gilman et al. crew perceived the underwater chute to be unwieldy to deploy and retract. However, a more efficient system to deploy and retract the chute could be designed and installed if a vessel were to install a chute for permanent use. Crew found setting with the chute to be less messy than conventional setting, as bait does not splatter and hit the crew when setting bait through the chute

Gilman et al. note that there is concern that, even if all the chute's engineering deficiencies were fixed, it may be an insurmountable problem to avoid having gear getting occasionally tangled around the chute for vessels that set their main line slack, such as in the Hawaii longline tuna fleet. In particular, when there is a large swell use of the chute causes fouled hooks and gear tangles. When tangles cause hooks to come up prong first during hauling a safety hazard is created for crew. The two causes of the increased incidence of gear tangles when using the chute, timing of crew clipping branch lines to the main line and bin tangles, are avoidable, but they may be frequent with new and inattentive crew. An additional potential drawback of the underwater chute is that it requires substantial deck space to stow, which may be a significant problem on smaller vessels.

4.8.1.5 Alternative SB3B: Use either current methods or underwater chute in all areas

The effects would be similar to those described for Alternative SB3A.

4.8.1.6 Alternative SB4A: Use either current methods or tori line (e.g., paired streamer lines) north of 23°N

In comparison to Alternative SB1, this alternative is not expected to result in a significant change in the economic performance of the Hawaii-based longline fishery in terms of fleet size and composition, fishing trips, quantities produced, gross revenue or fishing costs.

However, by offering fishermen a seabird interaction mitigation method option this alternative provides regulated vessels greater flexibility to achieve the regulatory objective in a more cost-effective way in comparison to Alternative SB1 (i.e., fishermen can elect to maintain operating under the current suite of mitigation methods or use a tori line (e.g., paired streamer lines)). Given the comparative costs and benefits of tori lines versus current mitigation methods, it is likely that most of the Hawaii longline fleet would continue to choose to employ the current methods. According to McNamara et al. (1999), a tori pole can be purchased or constructed for approximately $1,500. However, several on-board replacements may be required because of the likelihood of breakage due to entanglements. While the costs of maintaining a supply of tori lines would represent a small fraction of the total annual operating costs of a Hawaii longline vessel, these additional costs and other factors are likely to create a disincentive for vessel owners to adopt this mitigation method. By allowing vessel operators to choose between employing current mitigation methods or a tori line, this alternative addresses the potential costs and operational difficulties associated with using a tori line.

McNamara et al. (1999) noted that rough weather may substantially decrease the effectiveness of tori lines, and these devices can quickly become entangled with fishing gear if not closely monitored. An entanglement leaves baited hooks accessible to seabirds unless another tori line is immediately deployed. The problem of keeping the bird scaring line clear of fishing gear and positioned over the baited hooks was particularly acute at night because of reduced visibility and during the haul back because of frequent changes in the vessel's direction. Incorporating break-aways (weak-links) of about 100 to 200 pound tensile strength into the streamer line is highly recommended should the streamer line foul on the groundline. Break-aways at the drag buoy are a minimum precaution.

4.8.1.7 Alternative SB4B: Use either current methods or tori line (e.g., paired streamer lines) in all areas

The effects would be similar to those described for Alternative SB4A.

4.8.1.8 Alternative SB5A: Use either current methods or side setting or underwater chute north of 23°N

The effects would be similar to those described for Alternatives SB2A and SB3A, except that this alternative would provide fishermen with even greater flexibility to achieve the regulatory objective in a more cost-effective way (e.g., fishermen that have vessels unsuitable for side setting may find the installation of an underwater setting chute to be cost-effective).

4.8.1.9 Alternative SB5B: Use either current methods or side setting or underwater chute in all areas

The effects would be similar to those described for Alternative SB5A.

4.8.1.10 Alternative SB6A: Use either current methods or side setting or underwater chute or tori line (e.g., paired streamer lines) north of 23°N

The effects would be similar to those described for Alternative SB5A, except that this alternative would provide fishermen with even greater flexibility to achieve the regulatory objective in a more cost-effective way (e.g., fishermen that have vessels unsuitable for side setting may find the installation of an underwater setting chute or use of a tori line to be cost-effective).

4.8.1.11 Alternative SB6B: Use either current methods or side setting or underwater chute or tori line (e.g., paired streamer lines) in all areas

The effects would be similar to those described for Alternative SB6A.

4.8.1.12 Alternative SB7A: Use either current methods or side setting or tori line (e.g., paired streamer lines) north of 23°N

The effects would be similar to those described for Alternatives SB2A and SB4A, except that this alternative would provide fishermen with even greater flexibility to achieve the regulatory objective in a more cost-effective way (e.g., fishermen that have vessels unsuitable for side setting may find the use of a tori line to be cost-effective).

4.8.1.13 Alternative SB7B: Use either current methods or side setting or tori line (e.g., paired streamer lines) in all areas

The effects would be similar to those described for Alternative SB7A.

4.8.1.14 Alternative SB7C: For shallow-sets: use either current methods (without blue-dyed bait) or underwater chute or side setting or tori line (e.g., paired streamer lines) in all areas. For deep-sets: use either current methods (without blue-dyed bait) or underwater chute or side setting or tori line (e.g., paired streamer lines) north of 23°N

The effects would be similar to those described for Alternative SB6A, except those fishermen that choose to use the current mitigation methods would no longer incur the costs and operational difficulties of using blue-dyed bait.

4.8.1.15 Alternative SB8A: Use current mitigation methods plus side setting north of 23°N

In comparison to Alternative SB1, this alternative provides regulated vessels a similar lack of flexibility to achieve the regulatory objective in a cost-effective way. All mitigation methods are non-discretionary. The annual operating costs of longline vessels would not increase significantly under this alternative. However, the requirement to side set may eliminate fishing opportunities north of 23°N for some longliners in the fleet which can not be readily reconfigured for side setting, thereby creating economic hardship for those fishermen. As noted in Section 4.8.2, reconfiguring some vessels for side setting may be costly. The WPFMC has recommended that NOAA Fisheries provide low-interest loans or State of Hawaii Fisheries Disaster Relief Program funds to fishermen to reduce these costs. However, some smaller vessels may be unable to be reconfigured for side setting because of structural limitations.

4.8.1.16 Alternative SB8B: Use current mitigation methods plus side setting in all areas

The effects would be similar to those described for Alternative SB8A, except those smaller vessels that are unable to be reconfigured for side setting would be prevented from fishing with pelagic longline gear. Displaced fishermen would have to relocate their fishing activities to an alternative pelagic longline fishery, shift to fisheries on other stocks or tie up their vessels.

The ability of displaced fishermen to recover the revenue previously generated from the Hawaii longline fishery by shifting to alternative longline fisheries in the U.S. may be limited. For example, shallow longlining targeting swordfish on the high seas in the Pacific Ocean east of 150°W is prohibited for west-coast-based vessels. Inside 200 miles off Washington and California the use of any pelagic longline gear is prohibited, and Oregon only allows the limited use of this gear with a special permit.

Some displaced fishermen may own vessels already outfitted to participate in fisheries on other stocks in Hawaii, but other boat owners may not be capable of shifting into other fisheries without significant additional capital outlays. Conversion to charter fishing may be a feasible option for some vessels. However, the charter fishing fleets in most of Hawaii's ports are already over-capitalized (Hamilton, 1998).

Given that opportunities for displaced fishermen to recover their lost harvest and income are likely to be limited, it is probable that some fishermen would be forced to sell out or retire. It is uncertain how active the Hawaii or nationwide market is for the types of vessels, gear and other investment capital used in the Hawaii longline fishery. If the immediate resale market for pelagic longline fishing vessels and equipment is small, those displaced fishermen who are relying on money earned from selling their fishing assets to supplement their retirement funds would suffer economic hardship.

4.8.1.17 Alternative SB9A: Use side setting north of 23°N

The effects would be similar to those described for Alternative SB8A, except fishermen would no longer incur the costs and operational difficulties of using the current mitigation methods.

4.8.1.18 Alternative SB9B: Use side setting in all areas

The effects would be similar to those described for Alternative SB8B, except fishermen would no longer incur the costs and operational difficulties of using the current mitigation methods.

4.8.1.19 Alternative SB10A: Use side setting unless technically infeasible in which case use current methods north of 23°N

The effects would be similar to those described for Alternative SB2A.

4.8.1.20 Alternative SB10B: Use side setting unless technically infeasible in which case use current methods in all areas

The effects would be similar to those described for Alternative SB10A.

4.8.1.21 Alternative SB11A: Use side setting unless technically infeasible, in which case use an underwater setting chute or a tori line or current measures without blue bait or strategic offal discards (shallow-setting vessels set at night, deep-setting vessels use line shooters with weighted branch lines), when fishing north of 23°N

The effects would be similar to those described for Alternative SB6A, except those fishermen that choose to use the current mitigation methods would no longer incur the costs and operational difficulties of using blue-dyed bait and strategic offal discard.

4.8.1.22 Alternative SB11B: Use side setting unless technically infeasible, in which case use an underwater setting chute or a tori line or current measures without blue bait or strategic offal discards (shallow-setting vessels set at night, deep-setting vessels use line shooters with weighted branch lines), in all areas

The effects would be similar to those described for Alternative SB11A.

4.8.1.23 Alternative SB12: Voluntarily use night setting or underwater chute or tori line (e.g., paired streamer lines) or line shooter with weighted branch line south of 23°N

This alternative would have no effects on fishery participants in comparison to Alternative SB1. It is unlikely that any fishing enterprises that experienced significant negative effects from the use of voluntary mitigation methods would continue to employ those methods. Given the costs and operational difficulties of using an underwater chute or tori line, it is unlikely that many vessels would voluntarily adopt these mitigation methods. The majority of vessels may also be hesitant to employ night setting because of concerns that it would decrease catch rates of certain target species and could be dangerous if vessels are not suitably equipped. The majority of Hawaii-based longline vessels fishing south of 23˚N already use a line-shooter with weighted branch line, as this gear increases the speed at which the mainline is set, which causes the mainline to sag in the middle (more line between floats), allowing the middle hooks to fish deeper.

4.8.2 Squid Management Measures

4.8.2.1 Alternative SQA.1: No action

Sec. 2(a)(8) of the MSA states that the collection of reliable data is essential to the effective conservation, management, and scientific understanding of the fishery resources of the United States. Under the no action alternative, there would be no short term economic impacts on participants in the squid fisheries within the jurisdiction of the WPFMC. The short term economic performance of the squid fisheries in terms of fleet size and composition, fishing trips, quantities produced, gross revenue and fishing costs is expected to continue as described in Section 3.7. However, in the long term, the lack of consistent data collection and monitoring may result in a decline in fishery landings and revenue.

4.8.2.2 Alternative SQA.2: Improve voluntary monitoring by the optional use of logbooks designed specifically for use by domestic pelagic squid vessels, and by the voluntary placement of federal observers on these vessels

In comparison to Alternative SQA.1, this alternative is not expected to result in a significant change in the economic performance of squid fisheries within the jurisdiction of the WPFMC in terms of fleet size and composition, fishing trips, quantities produced, gross revenue or fishing costs.

Under this alternative the additional regulatory costs to the fishing industry are zero; vessels that do not wish to accept NOAA Fisheries observers or use logbooks designed specifically for use by domestic pelagic squid vessels would not be required to do so. However, a voluntary reporting and observer program may not be able to achieve the same level of data collection as a mandatory program. The lack of consistent data collection and monitoring may result in a decline in fishery landings over the long term.

4.8.2.3 Alternative SQA.3: Improve mandatory monitoring and establish mechanisms for management by including pelagic squid in the Council's existing Pelagics Fishery Management Plan. Replace HSFCA logbooks currently used with logbooks specifically designed for squid harvesting, and require operators of squid vessels licensed under the HSFCA to also include any EEZ harvests in this logbook. Require vessels that harvest pelagic squid solely in EEZ waters to either use this logbook or to participate in local reporting systems

In comparison to Alternative SQA.1, this alternative is not expected to result in a significant change in the short term economic performance of squid fisheries within the jurisdiction of the

WPFMC in terms of fleet size and composition, fishing trips, quantities produced, gross revenue or fishing costs. A positive impact of recordkeeping and reporting requirements on participants in the squid fisheries is that they may provide sufficient data to assess the current stock condition of target species, thereby assisting in the effective long term management of the fisheries.

The burden for recordkeeping and reporting requirements include the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. U.S. vessels fishing on the high seas are currently subject to reporting requirements under the HSFCA, The operator of a vessel with a HSFCA permit must report identification information for vessel and operator; operator signature; crew size; whether an observer is aboard; target species; gear used; dates, times, locations, and conditions under which fishing was conducted; species and amounts of fish retained and discarded; and details of any interactions with sea turtles or birds (50 CFR 300.17(a)). Similarly, vessels fishing in the U.S. EEZ may already be subject to state or other reporting requirements. For example, vessel operators holding a HDAR commercial marine license must submit a monthly report with respect to marine life taken and any bait used. For vessels fishing on the high seas or in the EEZ the incremental reporting costs associated with using a logbook specifically designed for squid harvesting are expected to be minimal.[30]

Should the use of electronic logbooks be required, in which vessels would be required to submit catch reports via e-mail or direct from a modem from a computer on board, vessels may incur an added cost and require initial training (the one company engaging in distant-water squid fisheries in the Pacific Ocean reportedly already uses a custom electronic logbook system; therefore, the costs of a mandatory electronic logbook system to this firm are likely to be negligible). Electronic logbooks can benefit fishermen by making the reporting process simpler and more accurate.

The inclusion of pelagic squid in the Council's existing Pelagics FMP would not in itself result in additional regulatory costs for participants in the fisheries. A potential positive effect of inclusion of pelagic squid in the FMP may be the facilitation of effective management of squid fisheries, thereby helping ensure their long term sustainability. The guidelines for fishery management plans published by NOAA Fisheries require that a stock assessment and fishery evaluation (SAFE) report be prepared and reviewed annually for each fishery management plan (50 CFR 602). The SAFE reports are intended to summarize the best available scientific information concerning the past, present and future condition of the stocks, marine ecosystems, and fisheries under federal management. This information forms the basis for establishing measures applicable to the fishery which are necessary and appropriate for the conservation and management of the fishery resource involved.

<u>4.8.2.4 Alternative SQA.4: Improve mandatory monitoring and establish mechanisms for management by developing a new Squid Fishery Management Plan for pelagic squid. Replace HSFCA logbooks currently used with logbooks specifically designed for squid harvesting, and</u>

[30] Except for certain fisheries, the HSFCA requires a permit holder to report high seas catch and effort by maintaining and submitting records, specific to the fishing gear being used, on forms provided by the Regional Administrator of the NMFS Region which issued the permit holder's HSFCA permit (50 CFR 300.17(b)(3)).

require operators of squid vessels licensed under the HSFCA to also include any EEZ harvests in this logbook. Require vessels that harvest pelagic squid solely in EEZ waters to either use this logbook or to participate in local reporting systems

The effects would be similar to those described for Alternative SQA.3.

4.8.2.5 Alternative SQA.5: Improve mandatory international monitoring and establish mechanisms for both domestic and international management by pursuing and participating in international management agreements for Pacific pelagic squid

This alternative would have the potential for positive impacts on participants in squid fisheries by establishing domestic and/or international mechanisms to quickly implement regulatory controls, should such management become necessary.

4.8.2.6 Alternative SQB.1: No action

The effects would be similar to those described for Alternative SQA.1.

4.8.2.7 Alternative SQB.2: Stop issuing HSFCA permits for the high seas domestic squid fishery

Under the HSFCA vessels fishing on the high seas must obtain a HSFCA permit. This alternative would eliminate permitting of vessels in the high seas domestic squid fishery, thereby effectively closing the fishery.

One company is currently engaged in distant-water squid fisheries in the Pacific Ocean. During part of the year the operation fishes on the high seas north of the Hawaiian Archipelago. In addition, during part of the year the operation fishes in the New Zealand EEZ where it operates under charter to a New Zealand owned company. The proportion of the operation's total revenue derived from fishing on the high seas is unknown. However, it is likely that the elimination of the high seas fishery would have a significant adverse impact on the economic viability of the firm. The company would have to concentrate their fishing activities in squid fisheries occurring inside the U.S. EEZ or the EEZ of another nation, shift to fisheries on other stocks or tie up their vessels.

The ability of the company to recover the revenue previously generated from the high seas fishery by shifting to alternative squid fisheries in the U.S. EEZ or another nation's EEZ may be limited. As noted in Section 3.7, a moratorium has been placed on the number of vessels in the California fishery for *L. opalescens* and both the *L. pealei* and *I. illecebrosus* fisheries off the East Coast are managed under limited entry programs. The major squid fisheries occurring in the EEZs of other nations tend be highly competitive, with participation by fleets from several countries, and the license fees to acquire access to the more productive fisheries can be high. Moreover, the abundance of squid in the EEZ of any particular country tends to be highly variable from year to year.

As discussed in Section 3.7, the four catcher boats of the company currently fishing on the high seas are converted crab boats from Alaska. Fitting out the vessels for squid fishing was costly (the least expensive boat was $1.2 million) because of the need to install blast freezers aboard each boat. Refitting the boats for crab fishing may be prohibitively expensive. Furthermore, the Alaska crab fisheries are over-capitalized; NOAA Fisheries is currently implementing a $100 million vessel buyback program for the Bering Sea/Aleutian Islands king and tanner crab fishery. Given that opportunities for the company to recover its lost harvest and income are likely to be limited should the high seas squid fishery be closed, it is probable that the firm would be forced to sell out. It is uncertain how active the nationwide or international market is for the types of vessels, gear and other investment capital employed by the firm. If the immediate resale market for these assets is small, the vessel owners would experience a significant economic hardship. Unemployed crew members would also suffer from a loss of income; the ability of these individuals to find suitable alternative employment is unknown. Based on the vessel crew sizes presented in Section 3.7, it is estimated that about 54 individuals would be affected.

This alternative would also foreclose the option for any other domestic fishing enterprise to pursue a high seas squid fishery in the future, although it is unlikely that a large number of U.S. vessels would choose this option given the fact that the fishery is unfamiliar to most fishermen in the United States and that entry into the fishery requires substantial specialized capital investment.

4.8.2.8 Alternative SQB.3: Improve voluntary monitoring by the optional use of logbooks designed specifically for use by domestic pelagic squid vessels, and by the voluntary placement of federal observers on these vessels.

The effects would be similar to those described for Alternative SQA.2.

4.8.2.9 Alternative SQB.4: Improve mandatory monitoring by replacing the HSFCA logbooks currently used with required logbooks specifically designed for squid harvesting. Centralize this data into a database easily available to resource managers. In addition, revise HSFCA permit applications to indicate the specific fisheries (including both gears and target species) in which permittees anticipate fishing on the high seas (e.g., jigging for pelagic squid)

In comparison to Alternative SQA.1, this alternative is not expected to result in a significant change in the short term economic performance of squid fisheries within the jurisdiction of the WPFMC in terms of fleet size and composition, fishing trips, quantities produced, gross revenue or fishing costs. A positive impact of recordkeeping and reporting requirements on participants in the squid fisheries is that they may provide sufficient data to assess the current stock condition of target species, thereby assisting in the effective long term management of the fisheries.

The burden for recordkeeping and reporting requirements include the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. U.S. vessels fishing on the high seas are currently subject to reporting requirements under the HSFCA, The operator of a vessel with a HSFCA permit must report identification information for vessel and operator; operator signature; crew size; whether an observer is aboard; target species; gear used; dates, times, locations, and conditions under which fishing was conducted; species and amounts of fish retained and discarded; and details of any interactions with sea turtles or birds (50 CFR 300.17(a)). For vessels fishing on the high seas the incremental reporting costs associated with using a logbook specifically designed for squid harvesting are expected to be minimal.[31]

Should the use of electronic logbooks be required, in which vessels would be required to submit catch reports via e-mail or direct from a modem from a computer on board, vessels may incur an added cost and require initial training (the one company currently engaged in fishing for squid on the high seas in the Pacific Ocean reportedly already uses a custom electronic logbook system; therefore, the costs of a mandatory electronic logbook system to this firm are likely to be negligible).

4.8.2.10 Alternative SQB.5: Establish domestic management mechanisms by categorizing all domestic vessels harvesting squid on the high seas as under the jurisdiction of one or more fishery management Councils and asking the relevant Council(s) to include pelagic squid in their fishery management plans

The effects would be similar to those described for Alternative SQA.3.

4.8.2.11 Alternative SQB.6: Improve mandatory international monitoring and establish mechanisms for both domestic and international management by pursuing and participating in international management agreements for Pacific pelagic squid.

The effects would be similar to those described for Alternative SQA.1.

4.9 Social Impacts

This analysis examines the following three types of potential social impacts for each alternative:

- Sustained participation of fishing communities. An analysis of these impacts is consistent with the MSA and National Standard 8. The focus is on those socioeconomic impacts that follow from the links between fishing sectors and communities.
- Group and cultural issues. This portion of the analysis is intended to identify specific social groups and cultural factors with the potential to be adversely impacted in ways that may be substantially different from those seen at the level of the community as a whole or are not captured in an analysis of sustained community participation.
- Environmental justice issues. An analysis of these issues is consistent with Executive Order 12898. The objective is to identify potential disproportionately high and adverse impacts to minority populations or low income populations.

4.9.1 Seabird Mitigation Measures

4.9.1.1 Alternative SB1: No action

4.9.1.1.1 Sustained Participation of Fishing Communities

[31] Except for certain fisheries, the HSFCA requires a permit holder to report high seas catch and effort by maintaining and submitting records, specific to the fishing gear being used, on forms provided by the Regional Administrator of the NMFS Region which issued the permit holder's HSFCA permit (50 CFR 300.17(b)(3)).

Oahu is the relevant fishing community to assess in this EIS with respect to seabird interaction measures, as it the home port for nearly the entire Hawaii-based longline fleet. Other fishing communities in Hawaii and the fishing communities of American Samoa, Guam and the Northern Mariana Islands would not be affected by any of the alternatives considered. Fishing vessels and seafood processors based in those communities would not benefit from the alternatives, nor would they experience any adverse effects.

Under the no action alternative the sustained participation of Oahu in the Hawaii longline fishery would be unaffected. and Oahu would continue to benefit from the fishery as described in Sections 3.7 and 3.8.

4.9.1.1.2 Group and Cultural Issues

One group that may be negatively affected by the no-action alternative are those members of the general public who are concerned about protected species issues and protection of seabirds. In recent years, seabird mortality in longline fisheries worldwide has been the subject of considerable concern to various environmental advocacy groups. Moreover, it is likely that some members of the general public ascribe the same high value to preserving the short-tailed albatross and other seabirds that they assign to the preservation of other endangered "charismatic megafauna." The reopening of the swordfish-targeting segment of the Hawaii longline fishery is likely to increase public concern, as the problem of incidental seabird catch in the Hawaii pelagic longline fishery occurs mainly among those fishing vessels targeting swordfish or a mixture of swordfish and bigeye tuna in the U.S. EEZ and on the high seas adjacent to the Northwestern Hawaiian Islands. By not taking action to further reduce the number of seabird interactions in the Hawaii-based longline fishery, this alternative may heighten public concerns about the incidental mortality of seabirds in the fishery and its effects on seabird populations.

4.9.1.1.3 Environmental Justice

With the reopening of the swordfish-targeting segment of the Hawaii longline fishery, the compliance costs of current measures to reduce seabird interactions are anticipated to become concentrated among swordfish vessels, as these vessels will likely account for most the total longline fishing effort (sets) above 23˚N, the fishing area in which the use of the mitigation methods is required. Prior to the closure of the swordfish portion of the Hawaii longline fishery in 2001, swordfish-targeting vessels were closely associated with a single ethnic or sociocultural group—Vietnamese Americans. As indicated in Section 3.8, nearly all of the owners and captains of swordfish vessels belonged to this ethnic group. However, under the regulations for the newly re-opened swordfish component of the Hawaii longline fishery, the annual effort limit of 2,120 swordfish sets is divided and distributed each calendar year in equal portions (in the form of transferable single-set certificates valid for a single calendar year) to all holders of Hawaii longline limited access permits that provide written notice to NOAA Fisheries no later than November 1 prior to the start of the calendar year of their interest in receiving such certificates (for the 2004 fishing year the deadline was May 1, 2004). The discussion in Section 3.8 also noted that about two-thirds of the 164 Hawaii longline limited access permit holders requested and received shallow-set certificates for 2004. Many of those receiving certificates are permit holders who currently own vessels categorized as swordfish boats in 1999 and are likely of Vietnamese ancestry. However, many permit holders who currently own vessels categorized as tuna boats in 1999 also received certificates. The majority of these boat owners are of European or Korean descent. Consequently, it is uncertain if the swordfish-targeting portion of the Hawaii longline fleet that develops will be closely associated with Vietnamese Americans or any other single ethnic or sociocultural group.

Even if the impacts of current measures to reduce seabird interactions are concentrated among fishing vessels owned and operated by a particular minority group, these impacts would likely be insignificant. The current measures have a minimal economic or social effect on fishing enterprises. The required use of strategic offal discharge, blue dyed bait and thawed bait have a negligible impact on catch rates, and the direct cost of employing these mitigation methods is small. Further, it is likely that swordfish vessels will experience few problems adopting night setting as an additional mitigation method, as these vessels routinely set at night. The requirement to begin setting the longline at least one hour after local sunset and complete the setting process by local sunrise could potentially have a negative effect on catch rates. Some fishermen claim that hooks set before dusk are more effective. Moreover, the night setting requirement may provide less soak time for vessels fishing at high latitudes during summer months. While there is insufficient information to quantify these effects on catch rates, the impact on the overall economic performance of individual fishing enterprises is expected to be low. Therefore, it is unlikely that this alternative has environmental justice implications for minority populations or low-income populations in Hawaii.

4.9.1.2 Alternative SB2A: Use either current methods or side setting north of 23°N

4.9.1.2.1 Sustained Participation of Fishing Communities

Impacts would be similar to those under Alternative SB1. The sustained participation of MSA fishing communities in Western Pacific pelagic fisheries would be unaffected.

4.9.1.2.2 Group and Cultural Issues

By taking action to further reduce the number of seabird interactions in the Hawaii-based longline fishery, this alternative further allays public concerns about the negative effects that the incidental mortality of seabirds in the fishery may have on seabird populations. Additional benefits will accrue to members of the general public who value the protection of seabirds if the mitigation methods are transferred successfully to other U.S. longline fleets and to foreign longline fleets.

Recently, interviews were conducted with a representative of the Korean Longline Association who explained that his group fishes for tuna primarily south of 23°N and birds are not considered a problem. They feel no necessity to convert to side-setting to continue their operations. A second interview was conducted with a representative of the Hawaii Longline Association (HLA) who reported that his group is generally favorable towards side-setting, but noted that to reconfigure smaller vessels may be difficult and to reconfigure those with one side of the vessel blocked off will require an entire deck reconfiguration. A side-setting configuration works best for an aft cabin vessel. He also noted that a typical (not extensive) reconfiguration would require about two days in port (K. Gore, PIRO, pers. comm.).

4.9.1.2.3 Environmental Justice

This alternative has no environmental justice implications for minority populations or low-income populations in Hawaii.

4.9.1.3 Alternative SB2B: Use either current methods or side setting in all areas

The effects would be similar to those described for Alternative SB2A.

4.9.1.4 Alternative SB3A: Use either current methods or underwater chute north of 23°N

The effects would be similar to those described for Alternative SB2A.

4.9.1.5 Alternative SB3B: Use either current methods or underwater chute in all areas

The effects would be similar to those described for Alternative SB2A.

4.9.1.6 Alternative SB4A: Use either current methods or tori line (e.g., paired streamer lines) north of 23°N

The effects would be similar to those described for Alternative SB2A.

4.9.1.7 Alternative SB4B: Use either current methods or tori line (e.g., paired streamer lines) in all areas

The effects would be similar to those described for Alternative SB2A.

4.9.1.8 Alternative SB5A: Use either current methods or side setting or underwater chute north of 23°N

The effects would be similar to those described for Alternative SB2A.

4.9.1.9 Alternative SB5B: Use either current methods or side setting or underwater chute in all areas

The effects would be similar to those described for Alternative SB2A.

4.9.1.10 Alternative SB6A: Use either current methods or side setting or underwater chute or tori line (e.g., paired streamer lines) north of 23°N

The effects would be similar to those described for Alternative SB2A.

4.9.1.11 Alternative SB6B: Use either current methods or side setting or underwater chute or tori line (e.g., paired streamer lines) in all areas

The effects would be similar to those described for Alternative SB2A.

4.9.1.12 Alternative SB7A: Use either current measures or side setting or tori line (e.g., paired streamer lines) north of 23°N

The effects would be similar to those described for Alternative SB2A.

4.9.1.13 Alternative SB7B: Use either current measures or side setting or tori line (e.g., paired streamer lines) in all areas

The effects would be similar to those described for Alternative 2SBA.

4.9.1.14 Alternative SB7C: For shallow-sets: use either current measures (without blue-dyed bait) or underwater chute or side setting or tori line (e.g., paired streamer lines) in all areas. For deep-sets: use either current measures (without blue-dyed bait) or underwater chute or side setting or tori line (e.g., paired streamer lines) north of 23°N

The effects would be similar to those described for Alternative SB2A, except those fishermen that choose to use current measures would no longer incur the costs and operational difficulties of using blue-dyed bait.

4.9.1.15 Alternative SB8A: Use current mitigation measures plus side setting north of 23°N

As discussed in section 4.8.15, this alternative may impose an economic hardship on vessels for which conversion to side setting is too costly or unfeasible because of vessel structural limitations. Those vessels that are unable to be reconfigured for side setting would be precluded from fishing north of 23°N. Small longliners, in particular, may not be readily reconfigured for side settings. Data presented in section 3.8 indicate that about two-thirds of the small (<56 ft) vessels in the Hawaii-based longline fleet are owned by individuals of Korean descent. Consequently, it is possible that this minority population in Hawaii would experience disproportionate high and adverse impacts under this alternative.

4.9.1.16 Alternative SB8B: Use current mitigation measures plus side setting in all areas

As discussed in section 4.8.15, this alternative may impose an economic hardship on vessels for which conversion to side setting is too costly or unfeasible because of vessel structural limitations. Those vessels that are unable to be reconfigured for side setting would be prevented from fishing with pelagic longline gear. Displaced fishermen would have to relocate their fishing activities to an alternative pelagic longline fishery, shift to fisheries on other stocks or tie up their vessels. Small longliners, in particular, may not be readily reconfigured for side settings. Data presented in section 3.8 indicate that about two-thirds of the small (<56 ft) vessels in the Hawaii-based longline fleet are owned by individuals of Korean descent. Consequently, it is possible that this minority population in Hawaii would experience disproportionate high and adverse impacts under this alternative.

4.9.1.17 Alternative SB9A: Use side setting north of 23°N

The effects would be similar to those described for Alternative SB8A, except fishermen would avoid the costs and operational difficulties of using current mitigation methods.

4.9.1.18 Alternative SB9B: Use side setting in all areas

The effects would be similar to those described for Alternative SB8B, except fishermen would avoid the costs and operational difficulties of using current mitigation methods.

4.9.1.19 Alternative SB10A: Use side setting unless technically infeasible in which case use current measures north of 23°N

The effects would be similar to those described for Alternative SB2A.

4.9.1.20 Alternative SB10B: Use side setting unless technically infeasible in which case use current measures in all areas

The effects would be similar to those described for Alternative SB2A.

4.9.1.21 Alternative SB11A: Use side setting unless technically infeasible, in which case use an underwater setting chute or a tori line or current measures without blue bait or strategic offal discards (shallow-setting vessels set at night, deep-setting vessels use line shooters with weighted branch lines), when fishing north of 23°N

The effects would be similar to those described for Alternative SB2A, except those fishermen that choose to use current measures would no longer incur the costs and operational difficulties of using blue-dyed bait and strategic offal discard.

4.9.1.22 Alternative SB11B: Use side setting unless technically infeasible, in which case use an underwater setting chute or a tori line or current measures without blue bait or strategic offal discards (shallow-setting vessels set at night, deep-setting vessels use line shooters with weighted branch lines), in all areas

The effects would be similar to those described for Alternative SB6A, except those swordfish fishermen that choose to use the current mitigation methods would no longer incur the costs and operational difficulties of using blue-dyed bait and strategic offal discard.

4.9.1.23 Alternative SB12: Voluntarily use night setting or underwater chute or tori line (e.g., paired streamer lines) or line shooter with weighted branch line south of 23°N

To the extent that fishermen voluntary adopt these additional seabird interaction mitigation methods, benefits would accrue to members of the public concerned about the incidental mortality of seabirds in the Hawaii-based longline fishery. Given the costs and operational difficulties of using an underwater chute or tori line, it is unlikely that many vessels would voluntarily adopt these mitigation methods. The majority of vessels may also be hesitant to employ night setting because of concerns that it would decrease catch rates of certain target species and could be dangerous if vessels are not suitably equipped. The majority of Hawaii-based longline vessels fishing south of 23˚N already use a line shooter with weighted branch line, as this gear increases the speed at which the mainline is set, which causes the mainline to sag in the middle (more line between floats), allowing the middle hooks to fish deeper.

4.9.2 Squid Management Measures

4.9.2.1 Alternative SQA.1: No action

Under this alternative the squid fisheries would continue to benefit Hawaii fishing communities as described in Sections 3.7 and 3.8. No specific social groups and cultural factors were identified with the potential to be adversely affected by this alternative. This alternative has no environmental justice implications for minority populations or low-income populations in Hawaii.

4.9.2.2 Alternative SQA.2: Improve voluntary monitoring by the optional use of logbooks designed specifically for use by domestic pelagic squid vessels, and by the voluntary placement of federal observers on these vessels

The effects would be similar to those described for Alternative SQA.1.

4.9.2.3 Alternative SQA.3: Improve mandatory monitoring and establish mechanisms for management by including pelagic squid in the Council's existing Pelagics Fishery Management Plan. Replace HSFCA logbooks currently used with logbooks specifically designed for squid harvesting, and require operators of squid vessels licensed under the HSFCA to also include any EEZ harvests in this logbook. Require vessels that harvest pelagic squid solely in EEZ waters to either use this logbook or to participate in local reporting systems

The effects would be similar to those described for Alternative SQA.1.

4.9.2.4 Alternative SQA.4: Improve mandatory monitoring and establish mechanisms for management by developing a new Squid Fishery Management Plan for pelagic squid. Replace HSFCA logbooks currently used with logbooks specifically designed for squid harvesting, and require operators of squid vessels licensed under the HSFCA to also include any EEZ harvests in this logbook. Require vessels that harvest pelagic squid solely in EEZ waters to either use this logbook or to participate in local reporting systems

The effects would be similar to those described for Alternative SQA.1.

4.9.2.5 Alternative SQA.5: Improve mandatory international monitoring and establish mechanisms for both domestic and international management by pursuing and participating in international management agreements for Pacific pelagic squid

The effects would be similar to those described for Alternative SQA.1.

4.9.2.6 Alternative SQB.1: No action

The effects would be similar to those described for Alternative SQA.1.

4.9.2.7 Alternative SQB.2: Stop issuing HSFCA permits for the high seas domestic squid fishery

As discussed in section 4.8.15, this alternative would impose a significant economic hardship on the one domestic operation currently engaged in fishing for squid on the high seas in the Pacific Ocean. Without a HSFCA permit the operation would no longer be able to legally participate in the highs seas squid fishery. The discussion in section 4.8.15 notes that opportunities for the operation to recover its lost harvest and income are likely to be limited, and it is probable that the firm would be forced to sell out. It is uncertain how active the nationwide or international market is for the types of vessels, gear and other investment capital employed by the firm. If the immediate resale market for these assets is small, the vessel owners would experience a significant economic hardship. Unemployed crew members would also suffer from a loss of income; the ability of these individuals to find suitable alternative employment is unknown. Based on the vessel crew sizes presented in Section 3.7, it is estimated that about 54 individuals would be affected. The ethnic composition and income of the vessels' owners and crews are unknown. Consequently, it is uncertain if minority populations or low income populations would be disproportionately affected by this alternative.

4.9.2.8 Alternative SQB.3: Improve voluntary monitoring by the optional use of logbooks designed specifically for use by domestic pelagic squid vessels, and by the voluntary placement of federal observers on these vessels

The effects would be similar to those described for Alternative SQA.1.

4.9.2.9 Alternative SQB.4: Improve mandatory monitoring by replacing the HSFCA logbooks currently used with required logbooks specifically designed for squid harvesting. Centralize this data into a database easily available to resource managers. In addition, revise HSFCA permit applications to indicate the specific fisheries (including both gears and target species) in which permittees anticipate fishing on the high seas (e.g. jigging for pelagic squid)

The effects would be similar to those described for Alternative SQA.1.

4.9.2.10 Alternative SQB.5: Establish domestic management mechanisms by categorizing all domestic vessels harvesting squid on the high seas as under the jurisdiction of one or more fishery management Councils and asking the relevant Council(s) to include pelagic squid in their fishery management plans

The effects would be similar to those described for Alternative SQA.1.

4.9.2.11 Alternative SQB.6: Improve mandatory international monitoring and establish mechanisms for both domestic and international management by pursuing and participating in international management agreements for Pacific pelagic squid.

The effects would be similar to those described for Alternative SQA.1.

4.10 Impacts to Administration and Enforcement

4.10.1 Seabird Interaction Mitigation Methods

None of the seabird deterrent measure alternatives would substantively affect administration of the Pelagics FMP. Neither permitting nor data collection activities would be affected. Allocation of shallow-set certificates would not be altered. There would be no change to levels of observer coverage for shallow (100%) or deep (20%) fishing, or to the duties of the observers. Likewise, enforcement efforts would not require modification. The efficacy of the enforcement efforts however, would change depending on the seabird deterrent method or methods adopted. Table 2.2.9 in Chapter 2 summarizes qualitative rankings of the various deterrent methods for their ease of enforcement. Clearly side-setting, where equipment is permanently welded into place, is easily verified by dockside inspection, and assures compliance. Side-setting is optional or required in Alternatives SB2 and SB5-SB12. It may be possible to verify night-setting with VMS data, and inspection of gear at dockside or by at-sea boarding could verify use of proper branch line weighting, but each of the other methods may be problematic in some way or other. For example, a vessel could have a setting chute, blue dye, or a tori line on board, but verification of proper use can only be done if there is an observer on board or surveillance from an aircraft or cutter during a set. The same applies to use of strategic offal discards. From an enforcement standpoint, those alternatives requiring the use of side setting (Alternatives SB8 and SB9) are preferred.

4.10.2 Squid Management Alternatives

<u>4.10.2.1 Alternative SQA.1: No Action</u>

The No Action Alternative for management of squid fisheries within Council jurisdiction would continue the current situation of no administration or enforcement under the MSA. There would be no impacts to current administrative or enforcement activities.

<u>4.10.2.2 Alternative SQA.2: Improve voluntary monitoring by the optional use of logbooks designed specifically for use by domestic pelagic squid vessels, and by the voluntary placement of federal observers on these vessels. Centralize this data into a database easily available to resource managers</u>

Improvement of voluntary monitoring of the squid fishery would entail some additional administrative efforts. It is expected that fishers would complete and submit a logbook and at least one observer would be deployed in the fleet. Administrative costs and efforts would be expended in designing, distributing, and collecting logbooks, deploying and supporting the observer, and collating and analyzing logbook and observer data. No enforcement costs would be incurred in implementing this voluntary alternative.

<u>4.10.2.3 Alternative SQA.3: Improve mandatory monitoring and establish mechanisms for management by including pelagic squid in the Council's existing Pelagics Fishery Management Plan. Replace HSFCA logbooks currently used with logbooks specifically designed for squid</u>

harvesting, and require operators of squid vessels permitted under the HSFCA to also include any EEZ fishing activities in this logbook(Council Preferred)

Adding species of squid to the list of PMUS in the Pelagics FMP would trigger all of the administrative activities under the MSA including collection of data on catch and effort, bycatch and protected species interactions, etc., and inclusion of these data in the Pelagics Annual Report. Submission of the data would become compulsory rather than voluntary, and a mechanism would be available for expeditious regulatory changes to be made if necessary. Fishers would be required to complete and submit a logbook and at least one observer would be deployed in the fleet. Administrative costs and efforts would be expended in designing, distributing, and collecting logbooks, deploying and supporting the observer, and collating and analyzing logbook and observer data. At this time it is not expected that there would be imposed any rules controlling fishery operations, so enforcement activities would be limited to insuring data submittals.

4.10.2.4 Alternative SQA.4: Improve mandatory monitoring and establish mechanisms for management by developing a new Squid Fishery Management Plan for pelagic squid. Replace HSFCA logbooks currently used with logbooks specifically designed for squid harvesting, and require operators of squid vessels permitted under the HSFCA to also include any EEZ fishing activities in this logbook

This alternative would have the greatest administrative costs of the first set of alternatives. Whereas under Alternative SQA.3, the squid fishery efforts would be appended to an existing FMP that has a functional Plan Team and well-established procedures for monitoring the fisheries and producing the annual report, creation of a new FMP would entail a great deal of redundant effort to comply with the requirements of the MSA for FMPs, including establishing a new plan team, producing an annual report, etc. A mechanism would be available for expeditious regulatory changes to be made if necessary. In addition, separating the analyses of the squid species from the remainder of the pelagic species would not further the movement towards ecosystem-based fishery management, and at some future time the two FMPs might have to be consolidated, which would entail additional administrative costs. At this time it is not expected that there would be imposed any rules controlling fishery operations, so enforcement activities would be limited to insuring data submittals.

4.10.2.5 Alternative SQA.5: Improve mandatory international monitoring and establish mechanisms for both domestic and international management by pursuing and participating in international management agreements for Pacific pelagic squid. Consider the use of mandatory observers on vessels harvesting squid

Administrative and enforcement efforts and costs associated with this alternative are uncertain, as they would be determined after agreement on a management regime in a future international forum. It’s reasonable to expect however, that costs and efforts would be less than those under a MSA FMP.

4.10.2.6 Alternative SQB.1: No Action

The "B" series of squid management alternatives address the squid fishery outside current Council jurisdiction. No Action would leave the current management regime under the HSFCA unchanged. Administrative costs would continue to be incurred in managing the permit system, but the incremental cost due to squid jigging vessels is quite small. Logbook information would continue to be collected and archived, but not collated, analyzed or distributed. Enforcement would be limited to ensuring vessels are permitted and logbooks are submitted.

4.10.2.7 Alternative SQB.2: Cease issuing HSFCA permits for the high seas domestic squid fishery

This alternative would result in a phase-out of squid fishing as current permits expire. Ultimately efforts and costs associated with administration and enforcement for the U.S. high seas squid jigging fishery would cease. It is possible however, that the affected vessels would be returned to service in another high seas fishery requiring HSFCA permits, in which case the net impact would be zero.

4.10.2.8 Alternative SQB.3: Improve voluntary monitoring by the optional use of logbooks designed specifically for use by domestic pelagic squid vessels, and by the voluntary placement of federal observers on these vessels

Impacts would be similar to those of Alternative SQA.2.

4.10.2.9 Alternative SQB.4: Improve mandatory monitoring by replacing the HSFCA logbooks currently used with required logbooks specifically designed for squid harvesting. Centralize this data into a database easily available to resource managers (Council Preferred)

Under this alternative the HSFCA logbooks currently employed would be replaced with new ones designed specifically for squid jigging operations. Data collected via the logbooks would be collated, analyzed and distributed, as appropriate. In addition, the HSFCA permit applications would be modified to specify the applicant's intended fishery and gear. New permit application forms and logbooks would be designed and distributed and data management requirements would increase.

4.10.2.10 Alternative SQB.5: Establish domestic management mechanisms by categorizing all domestic vessels harvesting squid on the high seas as under the jurisdiction of one or more fishery management Councils and asking the relevant Council(s) to include pelagic squid in their fishery management plans

The impacts of this alternative would be similar to those of Alternatives SQA.3 or SQA.4, depending on whether the Council(s) decided to add squid to an existing FMP or create a new FMP specifically for squid. If more than one Council were involved, additional costs could be incurred in coordination of efforts.

4.10.2.11 Alternative SQB.6: Improve mandatory international monitoring and establish mechanisms for both domestic and international management by pursuing and participating in international management agreements for Pacific pelagic squid

Impacts of this alternative would be similar to those of Alternative SQA.5.

4.11 Cumulative Effects

Analysis of the potential cumulative effects of a proposed action and its alternatives is a requirement of NEPA. Cumulative effects are those combined effects on the quality of the human environment that result from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions, regardless of what Federal or non-Federal agency or person undertakes such other actions (40 CFR 1508.7, 1508.25(a), and 1508.25 (c). Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. The concept behind cumulative effects analysis is to capture the total effects of many actions over time that could be missed by evaluating each action individually. At the same time, the CEQ guidelines recognize that it is not practical to analyze the cumulative effects of an action on the universe but to focus on those effects that are truly meaningful. To avoid piecemeal assessment of environmental impacts, cumulative effects were included in the 1978 CEQ regulations, which led to the development of the CEQ's cumulative effects handbook (CEQ, 1997) and Federal agency guidelines based on that handbook (e.g., EPA, 1999).

Cumulative effects would occur when direct and indirect effects of the alternatives combine with effects of factors exogenous to fisheries managed under the FMP for Pelagics Fisheries of the Western Pacific Region to produce a net effect different than the separate effects or the exogenous factors. These net effects can be beneficial or adverse. Principles of cumulative effects analysis identified by the Council on Environmental Quality include the following:

1. Cumulative effects are the total effect, including both direct and indirect effects, on a given resource, ecosystem, and human community of all actions taken, no matter who (Federal, other government, or private) has taken the actions.
2. Cumulative effects must be analyzed in terms of the specific resource, ecosystem, and human community being affected.
3. It is not practical to analyze the cumulative effects of an action on the universe; the list of environmental effects must focus on those that are truly meaningful. In addition, there must be a relationship or "nexus" between the direct and indirect effects of the alternatives being evaluated and external effects.
4. Cumulative effects on a given resource, ecosystem, and human community are rarely aligned with political or administrative boundaries.
5. Cumulative effects may result from the accumulation of similar effects or the synergistic interaction of different effects.
6. Cumulative effects may last for many years beyond the life of the action that caused the effects.
7. Each affected resource, ecosystem, and human community must be analyzed in terms of its capacity to accommodate additional effects, based on its own time and space parameters.

4.11.1 Methodology

This section assesses the cumulative effects of the alternatives following a standard methodology:

1. The exogenous factor(s) that may directly effect each resource component are summarized. The list of exogenous factors and the overall conclusions for each factor remain constant across all of the alternatives. The potential impacts of fisheries not managed under the Pelagics FMP are considered as exogenous factors.
2. The potential direct effects of the alternatives are summarized for each major resource component. Each alternative may have a different effect on a particular resource.
3. The potential indirect effects of the alternatives are summarized for each major resource component. This procedural step only needs to be addressed if the indirect effects of alternatives affect exogenous factors. There may be no identifiable indirect effects.
4. Effects of exogenous factors (1) combined with potential direct effects of the alternatives, (2) as modified by any indirect effects (3), result in the potential cumulative effects.

4.11.2 Cumulative Impacts to the Pelagic Environment

Hawaii-based fisheries represent a small fraction of central and western Pacific pelagic longline fishing effort. Impacts to the pelagic environment from non-U.S. longline fisheries include the discharge of offal, spent bait and unwanted fish. The ecological implications of such discards are not well understood. Dead biological matter discarded in the ocean is a food subsidy and, thus, is presumably recycled. The effects may be considered positively or negatively depending on the values placed on different animals that may benefit from this food supplement and its redistribution. Many species of marine organisms have learned to use fishing activities to their advantage. Seabirds and marine mammals follow fishing vessels to catch prey that are made more vulnerable by longline fishing, steal prey from deployed gear or feed on discards. This type of interaction may have ecological consequences because the fishery may be tilting competitive equilibrium among species. The impact is difficult to quantify because it is usually not clear which species could be harmed in these situations, even when it is clear which species are benefitting.

Selective removal of upper-level predators by fishing may affect predator-prey relationships throughout the pelagic ecosystem. The fish species targeted and caught incidentally in pelagic longline fisheries are apex predators. Seki and Polovina (2001) used a dynamic ecosystem model to investigate possible impacts of fishing at lower trophic levels in oceanic gyre food webs. They found no evidence that the removal of any single high trophic level species significantly altered the food web. The lack of a keystone species appears to be due to a high degree of diet overlap among the high trophic level species. Fisheries in oceanic gyres alter the food web by reducing the biomass at the top of the food web. When this reduction becomes substantial, it may result in some increase in biomass at mid-trophic levels (Seki and Polovina, 2001: 964).

Fishing and shipping fleets in the central and western Pacific also cause transient and localized reductions of water quality and add to marine debris through accidental or deliberate discard of shipboard materials. The collective contribution of these fleets to the density of plastic debris in the central North Pacific will continue to be significant.

Analysis of neuston samples from the North Pacific central gyre found a density of small plastic particles far higher than in previous studies that included transects passing through the gyre. This provides evidence that the amount of plastic material in the ocean is increasing over time (Moore et al., 2001), which Day and Shaw (1987) previously suggested based on a review of historical studies. Plastic degrades slowly in the ocean. Some of the larger pieces may accumulate enough fouling organisms to cause them to sink but the smaller pieces are usually free of fouling organisms and remain afloat. The North Pacific Ocean has few islands and the dominant eddy currents serve as a retention mechanism that prevents small plastics from moving toward mainland coasts, where they could be washed ashore (Moore et al., 2001). The long-term ecological impacts of the increasing density of plastic debris are uncertain.

4.11.3 Cumulative Impacts to PMUS and non-PMUS

Hawaii-based fisheries account for a small fraction of the target and incidental fish catch by pelagic longline fisheries operating in the central and western Pacific. Pelagic longline fisheries are multi-species; i.e., they rely on the harvest of several ecologically-related pelagic fish species for fishing income. Thus, the impacts of longline fishing on fish populations is spread over multiple apex predator species instead of concentrated on one or two target species. With the exception of tuna and billfish species, however, there is limited information on the stock condition of PMUS and non-PMUS that are commonly caught and therefore little basis for assessing resource status. Table 4.11-1 summarizes information on the status of PMUS stocks with respect to the reference criteria for overfishing and overfished stocks, and provides an estimate of the percentage of the fishing mortality accounted for by WPRFMC fisheries. None of the PMUS stocks for which data are available appear to be overfished. There is concern that bigeye tuna may be experiencing overfishing, but this is not a concern for any other stock for which there is adequate information. The contribution of fisheries authorized under the Pelagics FMP to fishing mortality of these species is small, with the exception of swordfish. These data, however, represent the catch prior to the 2001 shallow-set ban. Currently, effort in the Hawaii-based fleet is authorized at half that level.

Table 4.11-1 Estimates of Overfishing and Overfished Reference Points for WPRFMC PMUS

Stock	Overfishing Reference Point [1.]	Is Overfishing Occurring? [1.]	Overfished Reference Point [1.]	Is the Stock Overfished? [1.]	Percentage of Stockwide Catch Taken by WPRFMC Fisheries [2.]
Skipjack Tuna (WCPO)	F_{2002}/F_{MSY} =0.12	No	B_{2002}/B_{MSY}=3.1	No	0.1%
Yellowfin Tuna (WCPO)	F_{2002}/F_{MSY}=0.71-0.91	No	B_{2002}/B_{MSY}=1.41-1.74	No	0.4%

Stock	Overfishing Reference Point [1.]	Is Overfishing Occurring?[1.]	Overfished Reference Point [1.]	Is the Stock Overfished?[1.]	Percentage of Stockwide Catch Taken by WPRFMC Fisheries[2.]
Albacore Tuna (WCPO)	F_{2002}/F_{MSY}=0.05	No	B_{2002}/B_{MSY}=1.3	No	0.7%
Bigeye Tuna (WCPO)	F_{2002}/F_{MSY}=1.11-2.0	No (2002) Yes (2003)	B_{2002}/B_{MSY}=1.35-1.72	No	1.5%
Blue Marlin (Pacific)	F_{1997}/F_{MSY}=0.50	No	B_{1997}/B_{MSY}=1.4	No	3.7%
Swordfish (N. Pacific)	F_{2001}/F_{MSY}=0.06	No	B_{2001}/B_{MSY}=1.3	No	23%
Blue Shark (N. Pacific)	F_{1999}/F_{MSY}=0.01	No	B_{1999}/B_{MSY}=1.9	No	0.01%
Other Billfishes	Unknown		Unknown		Unknown
Other Pelagic Sharks	Unknown		Unknown		Unknown
Other PMUS	Unknown		Unknown		Unknown

[1.] Source: WPRFMC, 2004
[2.] Source: Boggs et al., 2000

Pelagic longline fisheries are selective in the depth stratum where hooks are concentrated but they are relatively unselective in which species are hooked in these depth strata. The species composition of target and incidental fish catch changes with depth of set and other factors, such as type of hook and whether gear soaks during the day or night (Bartram and Kaneko, 2004). Effort in the shallow-set category of longline fishing is expanding because of increasing numbers of Taiwan-flag and China-flag vessels operating in the central and western Pacific (Simonds, 2003).

The Preparatory Conference for the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific has expressed concern about the sustainable use of bigeye and yellowfin tuna resources (Preparatory Conference 6th session, 1-23 April 2004, Bali, Indonesia). The Interim Secretariat prepared a paper on management options, some of which if adopted by the Commission in the future, could curtail further expansion of longline fishing catch or effort throughout the central and western Pacific (Interim Secretariat, 2004).

4.11.4 Cumulative Impacts to Squid

Non-U.S. fisheries have a far more significant impact on squid resources than much smaller domestic fisheries. Foreign squid fisheries are described in detail in Section 3.7.3.1.1 of this document.

4.11.5 Cumulative Effects to Seabirds

Albatross populations in the North Pacific Ocean live in an environment that has been substantially affected by anthropogenic factors. Major impacts in the past that are part of the existing baseline include the intensive collection of short-tail albatross feathers in Japan during the early 20th century; the Battle of Midway during World War II and subsequent U.S. military use of Midway Island; and Asian high-seas drift net fisheries during the 1980s. Also part of the existing baseline are 1) continuing exposure of albatrosses and other seabirds to environmental contaminants, particularly POPs; 2) the high incidence of plastic debris ingestion by North Pacific seabirds; and 3) seabird mortality resulting from incidental take in longline fisheries (both U.S. and foreign) not regulated under the Fishery Management Plan for Pelagic Fisheries of the Western Pacific Region.

4.11.5.1 Potential Degradation of Albatross Nesting Habitats

Currently active breeding colonies for the short-tailed albatross are confined to Torishima and Minami-kojima islands in Japan. The major nesting colonies of the blackfooted and Laysan albatross are in the Northwestern Hawaiian Islands. Most of these sites are in government refuges managed for the conservation of wildlife. Thus, human access and associated disturbance are limited.

Due to management changes at Midway Atoll National Wildlife Refuge, air traffic and visitor use are significantly reduced, diminishing the threats to seabirds from air strikes and ecotourism. Cruise boats occasionally land visitors at Midway and the airfield is still maintained as an emergency landing site, so there is still potential for visitor-related and aircraft-related impacts.

Exposure to lead and PCPs remain significant hazards to seabirds at the decommissioned military base in the Midway Island National Wildlife Refuge and the decommissioned LORAN station at Tern Island, French Frigate Shoals. Despite previous lead remediation (1994-1997) on Midway, Laysan albatross chicks continue to be exposed to substantially elevated levels of lead from the ingestion of lead-based paint from deteriorating buildings. This represents a significant health threat based on several reports of increased morbidity and mortality of Laysan albatross chicks nesting in the vicinity of buildings. The death of Laysan albatross chicks in a species of low productivity impedes efforts to conserve this species (Finkelstein et al., 2003). The U.S. Fish and Wildlife Service (USFWS) is attempting to assess and mitigate the lead paint problem but, under the terms of the turnover and the provisions of the Comprehensive Environmental Response, Compensation and Liability Act, it is the responsibility of the U.S. Navy to abate and remediate the lead-based paint remaining on Navy buildings when authority over Midway was ceded to the USFWS in 1997.

The future potential of Midway Atoll NWR to serve as a nesting colony for short-tailed albatross, through either natural colonization or propagation efforts, remains unknown (USFWS, 1999).

4.11.5.2 Continued Exposure to Environmental Contaminants, Especially PCBs.

Black-footed and Laysan albatrosses from the North Pacific contain higher levels of organochlorine residues (polychlorinated dibenzo-p-dioxins, PCDDS; polycholorinated dibenzofurans, PCDFs; and polychlorinated biphenyls, coplanar PCBs) than albatrosses in the South Pacific. Residue levels in albatrosses from the remote North Pacific far from point sources of pollution are comparable to or higher than those in terrestrial and coastal birds from contaminated areas in developed nations. The long life of albatross and ingestion of plastic resin pellets that account for a high percentage of marine debris in some areas of the ocean could be plausible explanations for accumulation of these persistent contaminants in albatrosses (Tanabe et al., 2004).

4.11.5.3 Continued Exposure to Concentrations of Small Plastic Debris in the North Pacific

Studies in the last 25 years have documented the prevalence of plastic in the diets of many seabird species in the North Pacific. Plastics may be consumed directly because particles resemble prey items or, indirectly, by eating prey attached to plastics or with plastics in their gut. In turn, adult seabirds may pass plastics on to chicks by regurgitation.

Studies of the distribution and abundance of small plastic particles in the North Pacific report that pelagic plastic is most abundant in the central subtropical and western North Pacific. User plastics, small, weathered remnants of larger manufactured items that are discarded or lost at sea by fishing vessels and shipping traffic, are the most abundant type of plastic ingested by seabirds in the central North Pacific (Day and Shaw, 1987). Currents and convergences of the region concentrate marine debris at levels that appear higher than for any other oceanic regions of the world and leading to some of the highest global incidence of plastic ingestion in central North Pacific seabirds (Robards et al., 1997).

Available evidence suggests that plastics are damaging to seabirds when they are consumed in sufficient quantities to obstruct the passage of food or cause stomach ulcers, through bioaccumulation of polychlorinated biphenyls (PCBs), toxic effects of hydrocarbons, diminished feeding stimulus, reduced fat deposition, lowered steroid hormone levels and delayed reproduction. However, acute effects of plastic ingestion are rarely observed and a search for correlations between plastic load and health indices for wild populations of seabirds has been generally unsuccessful in producing any more than indirect evidence of chronic health effects. Spear et al. (1995) is the only investigation to show a statistically significant negative correlation between plastic loads and seabird body weight.

4.11.5.4 Incidental Seabird Mortality in Longline Fisheries not Regulated Under the Pelagics FMP

Federal regulations require the Hawaii-based longline fishery to employ seabird deterrent measures when fishing north of 23°N. Black-footed and Laysan albatross and occasionally short-tailed albatross are incidentally captured in Alaskan demersal longline fisheries. NMFS published a final rule on January 13, 2004, to revise regulations requiring seabird avoidance measures in hook-and-line fisheries of the Bering Sea and Aleutian Islands management area and

Gulf of Alaska and in the Pacific halibut fishery in U.S. Convention waters off Alaska. This action is intended to improve the current requirements and further mitigate interactions with the short-tailed albatross and other species of seabirds in hook-and-line fisheries in and off Alaska (Federal Register, Vol. 69, No. 8, Jan. 13, 2004: 1930-1951).

Reducing seabird mortality in Hawaii pelagic longline fisheries alone will not significantly reduce this threat to North Pacific albatross populations. The Hawaii longline fleet is a small component of total pelagic longline fishing effort in the North Pacific. Pelagic longline fishing effort continues to expand in the North Pacific by Asian fleets that are known to set gear using "shallow " swordfish and "mixed" tuna/billfish methods (as characterized by NMFS, 2001 BiOp) that have levels of interactions with seabirds 40-70 times higher than deep-set methods (Cousins et al., 2001). The Japanese swordfish-directed longline fishery operating between 140°-180°E and 20°-45°N may annually catch 10,500 albatross if average take rates are similar to those of Hawaii's "mixed" tuna/swordfish longline fishery that operated east of the Higashioki grounds during 1994-1998 (Cousins et al., 2001).

The National Research Institute of Far Seas Fisheries of Japan's Fisheries Research Agency has initiated scientific activities to develop, evaluate and improve various kinds of seabird mitigation measures. Of the many methods tested in Japan, blue-dyed bait has proven to be the most effective in reducing visibility of baits and in preventing bait-taking by seabirds. Japan's National Plan of Action for Seabirds requires longline vessels operating north of 20°N in the North Pacific o adopt at least one mitigation measure to avoid interactions with seabirds. Longline vessels that operate within 20 miles of Torishima island, the major breeding island of the short-tailed albatross, are required to adopt two or more seabird avoidance measures (Kiyota et al., 2003).

Since 1997, fishing by the Taiwan freezer longline fleet has been increasing in waters north of the Hawaiian Islands. In 2000, effort by this fleet between 25°-40°N and between 180°-140°W exceeded 6 million hooks (Wang et al., 2002: Figure 1). This level of effort represents about 6,000 sets. If the average seabird interactions with the Taiwan freezer longline fleet are similar to those for the 1994-1998 "mixed" Hawaii tuna/swordfish longline fishery (0.5 birds/set from Cousins et al., 2001) that operated in the same general area, the annual seabird interactions of the Taiwan vessels may be on the order of 3,000 albatrosses.

Bycatch management needs to be multilateral. Unilateral management of one area or one fishery encourages production and market leakages that transfer bycatch to places where there may be higher levels of bycatch and/or less regulation and monitoring of bycatch (Ahmed and Squires, 2003). There are numerous regional and international organizations and several multilateral agreements that could address the problem of seabird interactions in North Pacific longline fisheries. However, few actions have been taken to coordinate policies, research, monitoring and enforcement by national governments and the majority of longline fishing, except U.S. and Japan vessels, in the North Pacific continues without use of seabird avoidance measures or reporting of seabird bycatch.

Several seabird avoidance methods are capable of nearly eliminating longline bycatch of seabirds (Gilman et al., 2004). Gilman et al (2004) argue that broad multi-national longline industry compliance can be achieved through adoption and enforcement of national regulations to control seabird bycatch and practical demonstrations of seabird deterrent effectiveness. There are two levels at which practical information about seabird avoidance measures can be transferred. The first level is to disseminate written material and videotapes, translated into appropriate languages for the target longline fishing nations, at international trade shows and other meetings (particularly International Fishers' Fora), where there is exchange among fishermen, scientists and resource managers. The second level is industry-to-industry transfer of seabird deterrent technology under arrangements between fishing organizations in longline fishing nations. Both levels of activities can occur with or without formal government-to-government agreements. There is precedent for such a program in the cooperative efforts of the Hawaii Longline Association, the Western Pacific Fishery Management Council, the National Marine Fisheries Service and Blue Ocean Institute to conduct research and commercial demonstration on a Hawaii longline vessel of three seabird avoidance methods (Gilman et al., 2003).

Strong economic incentives or disincentives may be needed, however, to encourage widespread, multi-national use of seabird bycatch deterrents in the North Pacific. During the 1990s, the World Trade Organization (WTO) rejected unilateral efforts by the U.S. to promote conservation of protected marine species through trade sanctions against other governments. Because of this experience, the U.S. is unlikely to impose new trade restrictions against pelagic fish imports from nations that fail to comply with standards for longline bycatch. Under WTO rules, countries may restrict imports if they fail to meet domestic standards and regulations relating to the physical characteristics of the product but the power to restrict imports based on standards pertaining to production processes and methods is contested. Environmental impacts are concerned with non-product related criteria, particularly those associated with harvesting methods, sustain ability of resources, level of bycatch and compliance with management (Deere, 1999). The key to future international marine conservation will be a multilateral framework rather than a unilateral approach (Joyner and Tyler, 2000).

Current marketing and pricing mechanisms do not incorporate the environmental impact costs, such as seabird bycatch levels, associated with purchasing fish from different sources. Seafood consumers, therefore, are often unaware of, or indifferent to, the negative or positive environmental consequences they may be endorsing when buying fish from different fleets (Sproul, 1998).

To guide consumers toward "environmentally friendly" seafood purchasing decisions, several organizations issue advice to seafood consumers, often in the form of buyers' guides that color code marine species. Although the criteria considered in preparing such guides are sound (sustainable stocks, level of bycatch, protected species and habitat impacts), ultimately all of these guidance systems involve an advisory body that makes qualitative decisions about marine species and product sources. Simple messages, such as buying "dolphin-safe" canned tuna, have proven easier to communicate to consumers than more general objectives, such as promoting "sustainable fisheries."

Consumer purchasing power, especially in the U.S., could be mobilized against imports from longline fishing nations that do not comply with standards for reducing seabird or other bycatch. In late 2004, seafood that is retailed in the U.S. will be required to have a country of origin label.

To bear the U.S. country of origin label, wild fish and shellfish must be caught in U.S. waters or by a U.S.-flagged vessel and processed in the United States or aboard a U.S.-flagged vessel (SEAFOOD.COM NEWS, Feb. 4, 2004). This new rule may aid U.S. consumers in identifying products from countries whose fish exports are associated with high levels of seabird bycatch or other undesirable environmental impacts.

Seabird bycatch in multi-national pelagic longline fisheries could be stabilized indirectly if total longline fishing catch and/or effort in the North Pacific is limited through international management agreements. The Preparatory Conference for the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific has expressed concern about the sustainable use of bigeye and yellowfin tuna resources (Preparatory Conference 6th session, 1-23 April 2004, Bali, Indonesia). The Interim Secretariat prepared a paper on management options, some of which if adopted by the Commission in the future, could curtail further expansion of longline fishing catch or effort throughout the central and western Pacific (Interim Secretariat, 2004).

Seabird bycatch is linked to fishing effort, that in turn is linked to market and consumer demand for pelagic fish products. Factors that could affect market and consumer demand for pelagic fish species in the future are analyzed elsewhere in this document.

4.11.6 Cumulative Effects to Sea Turtles

Comprehensive analyses of exogenous factors that contribute to cumulative impacts on sea turtles are provided in Chapter 4 of the Pelagic Fisheries FMP EIS (NMFS, 2001) and in WPRFMC (2004a, "Turtle FMP Amendment") and are not repeated in this document. The major factors can be grouped into four general categories:

1. Direct take of eggs and female adult turtles at nesting sites.
2. Degradation of nesting habitat.
3. Pollution of marine habitat
4. Incidental capture and mortality in fisheries not managed under the FMP for Pelagic Fisheries of the Western Pacific Region.

There are active efforts to mitigate each of these effects but the prognosis for the future survival and recovery of some sea turtle populations remains negative. A multi-national, holistic (covering all turtle life phases) framework for sea turtle conservation is considered essential (Bellagio Conference Nov. 2003). Efforts to conserve nesting beaches, nesting female turtles and their eggs should be supported by reduction of turtle bycatch in pelagic longline and other fisheries (Simonds, 2003).

Japanese tuna longliners, like those in Hawaii, make deep-sets that have much lower levels of interactions with sea turtles than fleets that make shallow-sets. At a bycatch working group meeting of the IATTC, held in Kobe, Japan on January 14-16, 2004, a member of the Japanese delegation stated that, based on preliminary data from 2000, the Japanese tuna longline fishery was estimated to take approximately 6,000 sea turtles, with a 50 percent mortality rate. Little information on species composition was given, however, of the estimated 160 leatherbacks taken, 25 were dead (K. Hanafusa, Fisheries Agency of Japan, pers. Comm., Jan. 2004 cited in NMFS undated: 141).

As the average turtle "take" rate is approximately 10 times higher in shallow-set longline sets than in deep longline sets, shallow-set fisheries should be a high priority for bycatch reduction (Simonds, 2003). Pelagic longline fishing effort in the shallow-set category is increasing rapidly because of expansion of the Taiwan and China fleets. . Although the Hawaii longline fishery and its impacts on marine turtles are insignificant in comparison with the overall international longline fishing effort in the Pacific Ocean, Hawaii's model shallow-set swordfish fishery could play a pivotal role in demonstrating methods of effectively reducing sea turtle bycatch (Simonds, 2003).

Pelagic longline interactions with marine turtles are often not recognized as a problem by many countries whose longline fleets are increasing the incidental catch of turtles by making shallow-sets. Even when turtle take-reducing measures are also demonstrated to retain fishing efficiency and catch rates, they may not be accepted because of their expense by fleets that operate with relatively low technology, low cost shallow gear configurations.

International codes of conduct, regional memoranda of understanding and voluntary plans of action to reduce marine turtle bycatch on the high seas need to be supported by the active engagement of longline industries at the fisherman's level (Simonds, 2003). In practical terms, this means verifying the effectiveness of specific longline gear modifications or tactics in reducing turtle bycatch and transferring this technology through fishing associations and industry working relationships (Simonds, 2003). The series of International Fishers' Fora sponsored by the Council and its partners to address longline bycatch problems in the Pacific recognized that most of the solutions have originated with fishermen (WPRFMC, 2003a).

Pacific island fishermen may be willing to go to some lengths to introduce turtle take-reducing measures in an attempt to persuade overseas buyers that their catch is conforming to best environmental practices (Adams, 2003). "Longlining has so far proven to be the only way in which Pacific Island developing states can get a significant share of the Pacific Islands' tuna fishery, which is still mainly caught by distant-water fishing nations, and it is because of longlining that this Pacific Islands' share of the fishery has doubled over the past decade. Ironically, the development of small-scale longlining in the Pacific was strongly promoted by donor countries and development agencies (including SPC) in the 1980s and 1990s as a 'dolphin friendly' as well as more cost-effective alternative to purse-seining and driftnetting, and there is some distress about the scale of animosity that has suddenly emerged towards this fishing methods in some parts of the developed world" (Adams, 2003: 10).

4.11.7 Cumulative Effects to Marine Mammals

Comprehensive analysis of exogenous factors that contribute to cumulative impacts on marine mammals is provided in Chapter 4 of the Pelagic Fisheries FMP EIS (NMFS, 2001) and is not repeated in this document. However, the impacts of two factors previously evaluated may be increasing:

- Ship traffic and anthropogenic noise.

- Interactions with pelagic longline fisheries not managed under the FMP for Pelagic Fisheries of the Western Pacific Region.

There is growing concern that increasing levels of anthropogenic noise in the ocean may be a habitat concern for whales, particularly for those species that use low frequency sound to communicate, such as baleen whales (Forney et al., 2000). Several investigators have suggested that noise may have caused humpback whales in Hawaii to avoid or leave feeding or nursery areas (Dean et al., 1985), whereas others have suggested that humpback whales may become habituate to vessel traffic and its associated noise. In Hawaii, regulations prohibit boats from approaching within 91 m of adult whales and with 274 m in areas protected for mothers with a calf. In Alaska, the number of cruise ships entering Glacier Bay has been limited to reduce possible disturbance to whales. In the coastal waters of Washington state, increase noise from tourist boat traffic may be drowning out killer whales' ability to hear one another's calls (A.R. Hoelzel, Nature, May 2004).

Small-toothed whales are known to sometimes take hooked fish and bait from longlines, a behavior known as "depredation." As longline fishing effort increases in the North Pacific, reports of these interactions have increased in recent years. It is unclear whether this is due to inaccurate reporting of shark damage to fish or a behavior that has been learned by a number of cetacean species. The SPC has estimated that the impact of depredation by whales on hooked fish in the SPC monitoring area is relatively minor (0.8 percent of observed hooks) compared to the impact of shark (Anon. 2003).

4.11.8 Cumulative Effects to Economies

Future regulatory regimes and possible changes in consumer demand for pelagic fish based on health and environmental issues have the potential for significant impacts.

NMFS has proposed a rule to implement the 2004 management measures to prevent overfishing of eastern tropical Pacific (ETP) tuna stocks, consistent with recommendations by the Inter-American Tropical Tuna Commission (IATTC). The rule proposes limited bigeye tuna catches by U.S. longliners in the IATTC convention area to 100 mt. The total annual U.S. longline catch of bigeye tuna from 106 mt to 216 mt (average = 129 mt) per year between 1999 and 2003, with the contribution from the Hawaii-based longline fleet over this period ranging from 52 mt to 171 mt (average = 162 mt) per year, or 78 percent of the total U.S. longline catch. If the proposed rule is adopted in its present form, the Hawaii longline fishery could be negatively impacted (K. Simonds, letter dated 19 July 2004, to R. McInnis, regional administrator, NMFS Southwest Region, Long Beach, CA).

Pelagic longline fisheries operating in the North Pacific supply a global market for fresh and frozen tuna, swordfish and related species. Catches by the Hawaii-based longline fishery are sold to a discerning customer base locally, in the continental U.S. and Japan. Hawaii fish have a reputation for good quality in all these markets.

There are many factors that can influence consumer preferences and demand for pelagic fish products, thereby affecting product price and fishing revenue. Health and environmental issues associated with fish and fishing have been the most publicized of these factors in recent years.

4.11.8.1 Health issues

Seafood consumers in the U.S. are exposed to two seemingly conflicting arguments about the health effects of eating tuna, swordfish and other pelagic species. The American Heart Association's dietary guidelines for reducing the risk of cardiovascular disease recommend an increase in the consumption of foods rich in omega-3 fatty acids, such as tuna. The guidelines recommend that the general population eat fish twice a week and reference numerous studies showing cardiovascular health benefits (Krauss et al., 2000). A diet that includes fatty fish has also been shown to have specific health benefits for pregnant mothers and their babies.

On the other hand, the U.S. regulates methyl mercury in seafood through the FDA "action level" of 1.0 ppm, above which fish products may be removed from the market. Brooks (2004) provides data on methyl mercury concentrations in species of pelagic fish commonly landed in Hawaii. Swordfish is the species most likely to exceed 1.0 ppm methyl mercury concentration in edible muscle. Japan has a stricter methyl mercury limit (0.5 ppm) for most fish species than the U.S. FDA but tuna and other pelagic top predator species are exempted from the Japanese regulation because of their naturally high background levels. Methyl mercury interacts with another mineral – selenium – in fish tissue that may make methyl mercury less bioavailable and thereby give some protection to marine life, as well as human consumers (Clarkson and Strain, 2003). Study of human populations co-exposed to methyl mercury and selenium through high fish consumption has begun in the Seychelle Islands.

U.S. government agencies have issued advisories warning U.S. women of child-bearing age to limit intake of some species of long-lived pelagic fish because fetuses and infants are more sensitive than adults to methyl mercury (FDA and EPA, 2004). The scientific facts about the potential danger of methyl mercury in seafood are subject to wide interpretation, however. Table 4.11-2 Compares the various guidelines for daily intake of methyl mercury from by different agencies.

Table 4.11-2 Comparison of Agency Guidelines for Methyl Mercury Intake

Agency	Recommended Safe Daily Intake of Methyl Mercury	Population Targeted for Protection	Study/Method from Which Recommendation Derived	Source of Methyl Mercury in Studied Population	Findings/ Recommendation	Questions About Findings/ Recommendation
FDA[1]	0.47 micrograms per kg of body weight per day	General public	Dosage (methyl mercury concentration x consumption by species)	Marine and freshwater fish	Limit consumption of a few species with highest methyl mercury levels	May not adequately protect pregnant women and their babies

Agency	Recommended Safe Daily Intake of Methyl Mercury	Population Targeted for Protection	Study/Method from Which Recommendation Derived	Source of Methyl Mercury in Studied Population	Findings/ Recommendation	Questions About Findings/ Recommendation
ATSDR[2]	0.3 micrograms per kg of body weight per day	Women of child-bearing age, pregnant women and their babies	9-year Seychelle Islands Child Development Study (children pre-natally exposed through mothers' consumption of fish with 12 meals per week).[5]	Marine fish, including tuna, other pelagic spp. (No whales, sharks)	Testing (with high interscore reliability among different examiners[6]) showed no detectable health risk to children resulting from their mothers' ocean fish consumption during pregnancy.	Uncertainty factor applied to account for different findings of Faroe Islands study.
WHO[3]	0.23 micrograms per kg of body weight per day	Women of child-bearing age, pregnant women and their babies	9-year Seychelle Islands Child Development Study (children pre-natally exposed through mothers' consumption of fish with 12 meals per week).[5]	Marine fish, including tuna, other pelagic spp. (No whales, sharks)	Testing (with high interscore reliability among different examiners[6]) showed no detectable health risk to children resulting from their mothers' ocean fish consumption during pregnancy.	Uncertainty factor applied to account for different findings of Faroe Islands study.
EPA[4]	0.1 micrograms per kg of body weight per day	Women of child-bearing age, pregnant women and their babies	Faroe Islands study of 7-year olds pre-natally exposed through their mothers' consumption of pilot whales containing higher methyl mercury levels than fish.[7]	Pilot whales	Statistical correlation between umbilical cord blood mercury at birth and subtle changes in neurological development based on testing of physically normal 7 year olds (Poor interscore reliability among different examiners[8]).	Source of methyl mercury (whales) also high in PCBs and cadmium, also known to be positively correlated with learning disabilities in children. Whales not fish.

[1] U.S. Food and Drug Administration.(Center for Food Safety and Applied Nutrition. Food advisory committee – methylmercury. Minutes and Transcript of July 23, 2002, meeting at Sheraton College Park Hotel, Beltsville, MD. www.fda.gov/OHRMS/DOCKETS/ac/02/transcripts/3872t1.htm.).

[2] Agency for Toxic Substances and Disease Registry (ATSDR), U.S. Department of Health and Human Services. January 2004. Minimal risk levels for hazardous substances. U.S. Department of Health and Human Services. Atlanta, GA.
[3] World Health Organization (WHO). Joint FAO/WHO Expert Committee on Food Additives. 2003. Summary and conclusions of 61th meeting. June 10-19, 2003. Rome.
[4]Environmental Protection Agency (EPA). (Center for Food Safety and Applied Nutrition. Food advisory committee – methylmercury. Minutes and Transcript of July 23, 2002, meeting at Sheraton College Park Hotel, Beltsville, MD. www.fda.gov/OHRMS/DOCKETS/ac/02/transcripts/3872t1.htm.). Also, National Research Council. 2000. Toxicological effects of methylmercury. National Academy Press. Washington, D.C. EPA derived its guideline by dividing the most sensitive observed effect from the Faroe Islands study by an uncertainty factor of 10, thereby establishing a wide margin of safety. Thus, the guideline is not the borderline between safety and potential harm.
[5] Myers, G.J., P.W. Davidson, C. Cox et al. 2003. Prenatal methylmercury exposure from ocean fish consumption: 9-year evaluations in the Seychelles child development study. Lancet 2003; 361: 1686-1692.
[6]Center for Food Safety and Applied Nutrition. Food advisory committee – methylmercury. Minutes and Transcript of July 23, 2002, meeting at Sheraton College Park Hotel, Beltsville, MD. www.fda.gov/OHRMS/DOCKETS/ac/02/transcripts/3872t1.htm.). [7]Steuerwald, U., P. Weihe, P.J. Jorgensen, et al. 2000. Maternal seafood diet, methylmercury exposure and neonatal neurologic function. Journal of Pediatrics., 136: 599-605.

Consumers are being urged to consider the potential hazard of methyl mercury in several contexts: 1) the food matrix of their diets (eating marine fish versus freshwater fish versus sharks versus whales); 2) dose rate in their diets (methyl mercury concentration in particular aquatic species x consumption of those species); and 3) the potential loss of health benefits in shifting to non-fish dietary items.

Findings of some surveys and focus groups (Davidson, 2004; Oken et al., 2003) suggest that the U.S. general population and pregnant women may heed government warnings to limit consumption of specific marine species and products, including swordfish and canned albacore tuna, because of the methylmercury issue. Other reports suggest that these advisories are not widely known or followed among U.S. seafood consumers (Center for Food Safety and Applied Nutrition. Food advisory committee – methylmercury. Minutes and Transcript of July 23, 2002, meeting at Sheraton College Park Hotel, Beltsville, MD. www.fda.gov/OHRMS/DOCKETS/ac/02/transcripts/3872t1.htm.).

4.11.8.2 Environmental Issues

U.S. consumer buying power could be a significant factor in shifting demand for particular species or sources of seafood. A poll conducted by the American Association for the Advancement of Science (AAAS, 2003) found that 60 percent were willing to eat less of certain fish if it would help to protect natural resources. The importance of product differentiation in some fisheries through labels, such as "dolphin-safe" labeling of canned tuna or "turtle-safe" labeling of shrimp, is an indication of the economic effect these environmental concerns can have. The markets impacts of eco-labeling of seafood are discussed by Roheim (2003).

The "Give Swordfish a Break" media campaign of 1998 (funded by the Pew Charitable Trusts and the Natural Resources Defense Council) is a good example of a specific impact on pelagic fish marketing. The boycott (which ended after two and one-half years) aimed to persuade chefs and consumers to avoid buying North Atlantic swordfish because of reports of a declining population. Several organizations have issued guides to encourage seafood consumers in the U.S. to make environmentally-friendly choices of marine species and product sources (http://www.consciouschoice.com/food/consumersseafoodguide1401.html).

Environmental and health issues related to fishing and fish products seem to be more important to consumers in the U.S. and Europe than in Pacific islands and Japan, where tuna and other pelagic fish are dietary staples. The mainland U.S. presently accounts for about half of the market for Hawaii pelagic fish and mainland consumer avoidance of fresh tuna and billfish could have a significant impact on overall demand. Offsetting any negative trend in the U.S. mainland would be the strengthening Japan market for *sashimi* tuna (H. Stehr, Professional Fisherman, June 2004) now that Japan's economy is once again growing after a decade of stagnation (W. Osman, 2004). In the longer term, the People's Republic of China may develop as a new market for good quality tuna (OPRT Newsletter International, Feb. 2004, No. 3, p. 3).

4.11.9 Cumulative Effects to Social and Cultural Resources

Two factors likely to be significant are:

- Options available to fishing vessel owners and crew who may be displaced by some of the alternatives; and
- Public concerns about the incidental mortality of seabirds in fisheries not managed under the FMP for Pelagic Fisheries of the Western Pacific Region and, therefore, unaffected by the proposed action and its alternatives.

The ability of displaced small-scale longline vessel owners and crews to recover the revenue previously generated from the Hawaii longline fishery by shifting to alternative longline fisheries in the U.S. was previously analyzed for seabird Alternative SB8B.

Displaced small-scale Hawaii longliners are excluded from other major Hawaii fisheries (except possibly charter fishing) that are managed under limited entry systems. If small vessels are forced out of the Hawaii longline fishery, there are potential buyers for such vessels in western Pacific islands where pelagic longline fisheries are expanding. If sold overseas, however, there would be a cost to transporting Hawaii vessels to new owners and local crews would not relocate with the vessels.

The four catcher boats of the company presently fishing for squid on the high seas are converted crab vessels from Alaska. If displaced under squid Alternative SQB.2, these boats are unlikely to be able to return to the crab fishery.

The analysis of Group and Cultural Issues identified one group that may be negatively affected by the no-action alternative as members of the general public who are concerned about protected species issues and protection of seabirds. Public concerns about the incidental mortality of seabirds are likely to continue unless the number of seabird interactions in non-U.S. Pacific pelagic longline fisheries are further reduced.