Chapter 2 Alternatives

Chapter 2 presents the alternatives being considered in this EIS for reduction of seabird interactions in the Hawaii-based longline fishery and for management of the U.S. Pacific squid fishery. NEPA requires that a broad range of reasonable alternatives be analyzed, whether or not the lead agency has the authority to implement all of the alternatives. If alternatives have been eliminated from detailed analyses, the EIS must discuss the reasons for their elimination. A "no action" alternative that examines the consequences of continuation of the current management regime must be evaluated. Separate sets of alternatives were developed for the two independent management objectives (seabird interaction reduction and squid fishery management) described in Chapter 1.

2.1 Seabird Interaction Reduction Alternatives

This section first describes potential seabird interaction mitigation methods being considered for implementation in the Hawaii-based longline fishery. Individual mitigation methods are then evaluated in combination with one another to determine if there are combinations of mitigation methods that may materially improve the performance of a single method. Finally, a broad range of alternatives is described for impacts evaluation in Chapter 4.

2.2.1 Potential Methods to Reduce Longline-Seabird Interactions and Their Consequences

There are numerous seabird mitigation methods developed by fishermen and scientists that are aimed at keeping or deterring albatrosses from baited longline hooks. In 1991, Brothers had a fishing master deploy a diversion steamer line and found that it reduced bait loss to birds by 69% (Brothers 1991). Prior to 1991, fishing masters had tried towing buoys, throwing explosives, towing artificial lures and adding weights to sink baits faster (Brothers 1991). Since then additional mitigation methods have been invented (Alexander et al., 1997; Brothers et al., 1999ab; McNamara et al., 1999; Boggs, 2001; Melvin et al., 2001; Gilman et al., 2002, 2003;). All mitigation methods, regardless of the details of their design or implementation methodologies, attempt to do one of the following in order to keep albatrosses away from baits or minimize the effects of their being hooked:

- Make baits difficult for birds to detect;
- Make baits difficult for birds to reach;
- Frighten, physically deter or draw birds away from baits;
- Reduce the chance of a bird being hooked if it does swallow a bait;
- Reduce the number of birds congregating around the fishing vessel; and
- Increase the survival of hooked birds.

The following sections review the characteristics of individual seabird deterrent methods considered in formulating a new management regime. The potential deterrents include those that were specified by the FWS in its 2000 BiOp on effects of the fishery (thawed blue-dyed bait, strategic offal discard, line shooter with weighted branch lines, seabird handling techniques, protected species workshop, night setting), a deterrent that has proven effective elsewhere in other fisheries (towed deterrent), and two more recently developed “hardware” solutions (setting chute and side-setting).

2.1.1.1 Blue-dyed and Thawed Bait

Operational characteristics
Blue dye has been shown to be effective at mitigating seabird interactions when used with squid bait, which readily absorbs the dye, and thus disguises the bait on immersion in the sea. McNamara et al. (1999) in tests using Hawaii longline shallow-set gear reported a 77% reduction in gear contacts and a 95% reduction in bird capture rates using blue-dyed squid bait. The shallow-set component of the Hawaii longline fleet formerly used squid for bait, but is now required to use mackerel-type bait. Blue dye is taken up less readily by fish baits such as sanma or sardines, and fishermen report difficulty in achieving the desired intensity of blue color as specified in the regulations, due to the shedding of the deciduous scales of the commonly used bait fish. Data on the effectiveness of blue-dyed fish bait are lacking. Pre-dyed blue bait is not commercially available, requiring fishermen to dye the bait blue as it is thawed before each set. The use of blue dye is messy, dyeing the hands and clothes of the crew and the deck of the vessel. The use of blue dye also requires the crew to deploy the baited hooks away from the propeller wash, where the white water makes the blue-dyed bait more apparent to seabirds. Crews untrained or unfamiliar with the use of blue-dyed bait may reduce its effectiveness by not deploying baited hooks away from the propeller wash.

Cost
There is a cost of about $14.00/set (Gilman et al., 2003) associated with dyeing bait blue in the Hawaii longline fishery. Over the period of year, a vessel might be expected to make 100 sets, amounting to a total blue dye cost of $1,400.

Compliance and enforcement
Monitoring of compliance of the use of blue bait is very difficult in the absence of an observer. Vessels can be checked for tins of blue bait by being boarded at sea or during dockside inspections, but this does not ensure that the dye is being used. The messiness and poor dye retention of fish bait are unlikely to encourage voluntary compliance from fishermen.

2.1.1.2 Strategic Offal Discard

Operational characteristics
Offal discards have been shown to be effective in reducing interactions with longlines during the period when lines are set. Offal discards were shown to reduce gear contacts by 51% and captures by 88% in tests by McNamara et al (1999) with Hawaii longline swordfish gear. Operationally, offal discards are more appropriate for vessels targeting swordfish than tuna, because the carcasses of swordfish are headed and gutted before being packed on ice in the ship’s 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.

There are also mixed evaluations of the effectiveness of strategic offal discharge (Cherel et al., 1996; Brothers, 1995 and 1996; McNamara et al., 1999). In the long-term, strategic offal discharge may reinforce the association that birds make with specific longline vessels being a source of food. While discharging offal and fish bycatch during setting can distract birds from baited hooks (Cherel and Weimerskirch, 1995; Cherel et al., 1996; McNamara et al., 1999), this practice is believed to have the disadvantage of attracting birds to the vessel, increasing bird abundance, searching intensity, and capture (Brothers et al., 1999). Brothers (1996) hypothesizes that seabirds learn to recognize by smell specific vessels that provide a source of food, implying that vessels that consistently discharge offal and fish bycatch will have higher seabird abundance and capture than vessels that do not discharge offal and fish waste.

Cost
There are no financial costs associated with strategic offal discards other than the need to purchase containers in which to store the offal.

Compliance and enforcement
Monitoring of compliance of the use of strategic offal discards on longline sets is very difficult in the absence of an observer. Fishermen may voluntarily use this method as it has been shown to be effective and has no cost associated with it, particularly for swordfish targeting vessels which dress the carcass prior to stowing the fish in the hold. For tuna targeting vessels, the crew would have to retain and cut up fish which might normally be discarded as bycatch in order to have offal for discarding, and which may discourage compliance.

2.1.1.3 Line-shooter with Weighted Branch Lines

Operational characteristics
The use of a line shooter and weighted branch lines is used to target deep swimming tuna by Hawaii-based longline vessels, and due to the rapid sinking rate of the hooks this gear has inherent seabird mitigation properties. Weighted branch lines, however, can be dangerous to crew, as they tend to sling the hooks around when setting and hauling the longline. The heavier the weight, the greater the danger. Vessels targeting tuna in the Hawaii-based fleet universally employ line shooters, except for one vessel which used traditional tarred rope basket gear, but which has since left the fleet. Line shooters are not used when setting shallow for swordfish at night, however.

Cost
The cost of a hydraulic line shooter of the types employed by the Hawaii-based longline fleet, and its installation amounts to about $5,700 (Jim Cook, Pacific Ocean Producers, pers. comm.).

Compliance and enforcement
As noted above, a line shooter and weighted branchlines are standard gear for targeting tuna in the Hawaii-based fleet, and therefore vessels targeting tuna north of 23°N are automatically complying with current regulations.

2.1.1.4 Seabird Handling Techniques

This measure does not reduce the contact or capture of seabirds but mitigates the effects of hooking.

Operational characteristics
The 2000 BiOp (USFWS, 2000) provides guidelines for handling hooked seabirds in a manner that maximizes the probability of their long-term survival. Vessel operators and crew are instructed that when a bird is hooked, the vessel should be stopped to release tension on the line and the bird lifted on board with a long-handled dip net. Birds should be covered with clean towels or blankets to protect the feathers from oil or mechanical damage during handling. Trailing line and hooks should be carefully removed, if possible cutting off the hook tip with bolt cutters before removing the remainder of the hook. Deeply ingested hooks are more problematic, and may not be possible to remove.

If a short-tailed albatross is hooked and recovered alive, it must be retained unless it exhibits all of the following traits:
1. head is held erect
2. bird responds to noise and motion stimuli
3. bird breathes without noise
4. both wings can flap and retract to normal folded position on back
5. bird can stand on both feet with toes pointed forward
6. feathers are dry

If a short-tailed albatross is brought on board alive, the vessel operator must contact the USCG, NMFS or the FWS immediately for expert advice on handling and release. If contact is not possible, the position of the hook should be assessed for further action. If the bird is lightly hooked (hook clearly visible on bill, leg, feet or wing) attempt contact for 24 hours If the bird is medium hooked (hook located in mouth or throat, but still visible) attempt contact for 48 hours. Place the bird in a dry, well-ventilated area for 4-24 hours. Do not release the bird unless it meets the release criteria above. If the bird is deeply hooked, place it in a dry safe place until further instructions are received. If recovered dead, the short-tailed albatross must be frozen and surrendered as soon as possible to NMFS or FWS.

Cost
The equipment required for careful handling of seabirds, including bolt cutters, pliers, knife, long-handled dip net, is all either required by turtle mitigation regulations or routinely carried aboard fishing vessels anyway. Initial costs would be on the order of $100.

Compliance and enforcement
Monitoring compliance with the use of proper handling methods on longline sets is very difficult in the absence of an observer. Vessels can be checked for the presence of required tools by being boarded at sea or during dockside inspections, but this does not ensure that the required methods are followed when necessary.

2.1.1.5 Protected Species Workshops

This is another measure that does not reduce seabird interactions, but is intended to minimize the effects of hooking.

Operational characteristics
Hawaii-based longline vessel operators are required to attend annual workshops at PIRO where various protected species issues are discussed. Sea turtle handling, release, and resuscitation guidelines are presented in an instructional video. Sea turtle biology, species identification and mitigation regulations are covered. Seabird identification, life history, distribution and mitigation methods are described and a video on handling techniques is shown. Marine mammal species identification, gear disentanglement and the Marine Mammal Authorization Program are also covered. Workbooks containing current regulations, species guides and informational placards are distributed to workshop participants.

Cost
There are no direct costs to participants, but labor hours that could be used for other purposes are consumed.

Compliance and enforcement
Operators are required to have on board a current certificate of workshop completion. Enforcement is easily accomplished during at sea or in dockside boardings, and PIRO can cross-reference lists of permit holders and workshop attendees.

2.1.1.6 Towed Deterrent

Operational characteristics
Towed deterrents include devices such as a tori line. Other towed deterrents including trash bags and buoys have been tried by fishermen, but no data are available on their effectiveness. Tori lines may include a terminal buoy to stabilize the line. McNamara et al. (1999) and Boggs (2001) have evaluated the effectiveness of towed deterrents, including streamer or tori lines on Hawaii-based longline vessels and using a research vessel, respectively. The observations conducted by these authors were on longline gear rigged to fish shallow for swordfish. The tori lines used in these trials reduced seabird captures by more than 75% compared to no mitigation. Tori lines protect baited hooks which are accessible to seabirds at the water's surface, and force birds to forage further behind the fishing vessel, giving the baits a chance to sink. However, the tori line covers only one side of the mainline and is only effective over the aerial portion of its length.

Paired tori lines have proven effective in demersal longline fisheries in Alaska (Melvin et al., 2001), where baited hooks quickly sink and remain on the seabed, but have not been tried in pelagic longline fisheries such as Hawaii, where baited hooks remain relatively near the ocean's surface for a longer period. Because of this there is a risk of entanglements between the tori line and the longline. Seabirds were noted by McNamara et al. (1999) to occasionally contact branchlines and carry these over the tori line, leading to entanglements. 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 and the constant attention needed to ensure the proper functioning of the tori line may increase the risk of accidents or injury to fishermen during setting operations.

Cost
The equipment for a tori line amounts to about $2,000 for the fiberglass pole and $300 for the streamer line. Installation of a mount for the tori line is estimated to cost about $1,000. Total costs associated with the tori line are likely to be about $1,500..

Compliance and enforcement
If vessels elect to use this method, they can be checked at dockside to ensure that appropriate gear is on board. The deployment of a tori line is also highly visible, allowing at-sea monitoring of compliance from an aircraft or cutter. However, as with blue bait and offal discards, ensuring full compliance at-sea would be problematic in the absence of on-board observers.

<u>2.1.1.7 Night Setting</u>

Operational characteristics
This deterrent is predicated on birds' inability to see gear and bait in the dark, so its effectiveness likely is influenced by cloud cover, moon phase, vessel lighting and use of light sticks. Night setting is more effective at minimizing interactions with black-footed albatross than with Laysan albatross, which may continue to feed after dark and therefore may dive on baited hooks being deployed after dusk. Boggs (2003) showed that shallow-setting at night reduced captures by 98% and contacts by 93%. Setting longlines at night has historically been part of the standard operating procedures for Hawaii-based longline vessels making shallow-sets targeting swordfish. Most of the hooks in a shallow swordfish targeting set are deployed after dark and pose little threat to seabirds. Hooks set at or before dusk, however, are a threat to crepuscular feeders such as albatross. However, there is a common belief among some fishermen that the hooks deployed before dark are generally more effective than those set after dusk (Brian MacNamarra, pers comm.).

Cost
There are no additional financial costs known to be specifically associated with night setting, however when fishing at high latitudes in summer, nights are short, giving fishermen less time to set and soak gear.

Compliance and enforcement
Vessels opting to target swordfish in the newly reopened fishery will have to declare their intent to make shallow-sets prior to departure. They will be required to carry an observer, who will note the start and finish times of sets as part of their duties, and therefore establish a record of compliance with the requirements for the timing of the start and termination of sets. In the absence of an observer, it may also be possible to determine if a vessel is setting its longline by remotely observing the track it makes from its VMS beacon.

2.1.1.8 Setting Chute

Operational characteristics
Trials with underwater setting chutes on Hawaii-based longline vessels have been conducted by Gilman et al. (2002; 2003). Initial trials with a Hawaii study of a 9m chute in the longline tuna fishery, where the chute deployed baited hooks 5.4m underwater, eliminated bird captures. However, both lengths of chutes used in the 2003 study were found to have design flaws that affected their performance. The 9m chute fractured and bent on one fishing trip, and even when repaired had a markedly reduced performance in terms of mitigating seabird interactions. The chute also requires a lot of deck space to stow when not fishing and in transit to and from fishing grounds, which may be a problem for smaller vessels.

Cost
The construction of a setting chute is a significant expense, currently estimated to be about $5,000, with additional costs for installation. Custom fabrication is necessary, as setting chutes are not mass produced.

Compliance and enforcement
The deployment of a setting chute could be monitored from an aircraft or cutter. However, as with blue bait, offal discards and towed deterrents, ensuring full compliance at-sea would be problematic in the absence of on-board observers. The presence of a setting chute on-board a vessel at the dock does not insure its use at sea.

2.1.1.9 Side Setting

Operational characteristics
Side setting has been shown to virtually eliminate bird capture. In trials conducted by Gilman et al. (2003) during deep-sets, side setting was also shown to perform significantly better at reducing interactions and mortalities than sets with two types of underwater setting chute or with blue-dyed bait (Table 2.1-1). Vessels with the wheel house positioned amidships or aft of the vessel conventionally set their lines from the aft deck, and retrieve the line from the foredeck. All the retrieved gear is then carried manually to the aft deck for baiting and setting. Side setting eliminates this step.

There are concerns from some fishermen about the 60 g weights as recommended for use with side setting by Gilman et al. (2003). 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 60g weight would present more of a danger than a smaller 45g swivel. However, it is estimated that about 70% of the vessels currently fishing in Hawaii already use 60g weighted swivels (Sean Martin, Hawaii Longline Association, pers. comm.), while other vessels are using the currently required 45 g weight when deep-set fishing north of 23°N.

Cost
Conversion to side setting means that all operations can be conducted from the foredeck with the elimination of the gear transfer between sets. The initial expense of adjusting the vessel deck

design, fabricating or purchasing a bird curtain, and switching from 45g to 60 g weighted swivels is estimated to be about $4,000, with little or no additional costs thereafter.

Compliance and enforcement
Side setting is relatively easy to enforce as vessel operations can be readily observed at sea and the orientation of the gear on deck can be checked through dockside inspection. It is difficult to accomplish such a reconfiguration at sea. Side setting is likely to be the most acceptable bird interaction mitigation method for the fishing industry, and several vessels in the Hawaii longline fleet have made the conversion, recognizing that there are operational benefits beyond the minimization of bait theft and bird capture (Sean Martin, Hawaii Longline Association, pers. comm.).

2.1.1.10 Comparison of Individual Seabird Deterrent Methods

Table 2.1-1 summarizes the available information on seabird interaction deterrence from studies done in the Hawaii-based longline fishery.

Table 2.1-1 Albatross interaction rates for seabird avoidance methods tested in North Pacific Ocean pelagic longline swordfish and tuna fisheries. (Interaction rates are expressed normalized for seabird abundance (expressed as contacts or captures per 1000 hooks per bird) and without normalizing for bird abundance (expressed in parentheses as contacts or captures per 1000 hooks). Percent reductions are based on the normalized rates unless noted otherwise.)

Study[a] and variable	Treatment										
	Control[b]	Underwater setting chute 9 m	Blue-dyed bait	Towed Buoy	Strategic Discards	Streamer line	Night setting	Additional 60g weight at bait	Night setting & blue-dyed bait	Side-setting	Underwater setting chute 6.5 m
McNamara et al. (1999) Hawaii longline swordfish gear											
Contact rate	32.8[c] (265.7)		7.6 (61.6)	16.1 (130.4)	15.7 (124.7)	15.7 (127.2)					
Contact reduction			77%	51%	53%	52%					
Capture rate	2.23 (18.0)		0.12 (17.5)	0.26 (6.8)	0.32 (2.3)	0.47 (6.6)	(0.60)[e]				
Capture reduction			95%	88%	86%	79%	73%[e]				
Boggs (2001) Hawaii longline swordfish gear											
Contact rate[d]	7.60[c] (313.5)		0.43 (20.5)			1.82 (93.4)		0.61 (25.0)			
Contact reduction			94%			76%		92%			
Gilman et al. (2002) Hawaii longline tuna gear											
Contact rate	0.61 (75.93)	0.03 (1.85)									
Contact reduction		95%									
Capture rate	0.06 (4.24)	0.00 (0.00)									
Capture reduction		100%									

Boggs (2003) Hawaii longline swordfish gear

Contact rate	0.78 (27.1)						0.053 (4,8)		0.01 (0.98)		
Contact reduction							93%		99%		
Capture rate	0.058 (2.0)						0.0013 (0.11)		0.00 (0.00)		
Capture reduction							98%		100%		

Gilman et al. (2003) Hawaii longline swordfish gear

Contact rate		0.30 (5.0)	2.37 (64.9)							0.08 (1.9)	
Capture rate		0.03 (0.6)	0.08 (1.8)							0.01 (0.2)	

Gilman et al. (2003) Hawaii longline tuna gear

Contact rate		0.28 (10.3)	0.61 (23.8)							0.01 (0.1)	0.20 (5.6)
Contact reduction[f]		82%	60%							99%	87%
Capture rate		0.05 (1.7)	0.03 (1.2)							0.00 (0.0)	0.01 (0.5)
Capture reduction[f]		38%	63%							100%	88%

[a] Research has also been conducted by the Japan Fisheries Research Agency on the effectiveness of blue-dyed bait on reducing seabird interactions in Japan's longline tuna fishery in the western North Pacific Ocean (Minami & Kiyota 2002). Results were not published in a format that provides seabird interaction rates expressed as contact or capture per number of hooks or normalized rates for seabird abundance.

[b] Control treatments in McNamara et al.(1999) and Boggs (2001) entailed conventional swordfish fishing operations. Control treatment in Gilman et al. (2003) entailed conventional tuna fishing operations.

[c] The different contact rates observed by Boggs (2001) and McNamara et al. (1999) may be explained by the use of different definitions of what constituted a seabird contact. McNamara et al.(1999) counted the total number of times a seabird came into contact with gear near the hook, even if the same bird contacted the gear multiple times, while Boggs defined a contact where only one contact per bait was recorded as a contact regardless of whether a single bird contacted a bait multiple times.

[d] Contact rates are averages of rates reported by Boggs (2001) for Laysan and black-footed albatrosses.

[e] This rate is not normalized for albatross abundance. McNamara et al. (1999) could not estimate seabird abundance during night setting. McNamara et al.'s (1999) control capture rate when not normalized for albatross abundance was 18.0 captures per 1000 hooks. Night setting reduced this control capture rate by 97%.

[f] Percent reductions use the control treatment contact and capture rates of Gilman et al. (2003)

Table 2.1-2 summarizes the above quantitative information along with the qualitative appraisals of the various methods presented earlier. It can be seen that most methods are very effective at reducing contacts with gear and capture of seabirds, achieving 80% reductions or greater, as compared to fishing without any seabird mitigation methods. Caution should be exercised in comparing the quantitative results of different techniques, however, as they were tested under a variety of conditions, seabird densities, on different fishing platforms, and under different experimental protocols. Moreover, the variances about the point estimates are very wide and overlapping in many cases (Christofer Boggs, Pacific Islands Fisheries Science Center, pers. comm.).

The ideal measure or technique for mitigating interactions with seabirds should minimize seabird capture, achieve high compliance among the fishing fleet, should not be overly dependent on crew behavior, and should work consistently across a range of variables such as time, location, weather, sea state, seabird density, etc.

Table 2.1-2 Comparison of performance of seabird mitigation methods from observations conducted between 1998 and 2003 **(●= good; ●●= better; ●●●=best)**

Mitigation Measure	Percent Reduction Compared to no Mitigation Methods		Other Evaluation Parameters		
	Contact with Gear	Captures	Operational	Cost	Compliance Enforcement
Underwater setting chute	82-87%	38-88%	●	$5,000	●
Blue dyed bait	60-94%	63-95%	●●	$1,400	●
Streamer or tori line	52-76%	79%	●	$3,300	●
Towed buoy[1]	51%	88%	●	$3,300	●
Strategic offal discards	53%	86%	●●	$400	●
Night setting	93%	73-98%	●●	$0	●●
Additional 60 g weight	92%	NA	●	$1,200	●●
Night setting and blue dyed bait	99%	100%	●◖	$1,400	●●
Side setting (+ 60g swivels within 1m of the hook)	99-99.8%	99.6-100%	●●◖	$4,000	●●●

1. A towed buoy is a tori line with a buoy on at the end of the streamer line. Some fishermen have also just towed a buoy or other object such as an inflated garbage bag, or even a broom stick, to deter birds from diving on the baited hooks, which would imply a minimal cost. However, these makeshift methods have not been comprehensively investigated.

From Table 2.1-2 it appears that side-setting with 60g swivels is the best overall mitigation method currently available. Night setting with or without blue-dyed bait also compares very favorably with other methods evaluated.

2.1.2 Combinations of Methods for Reduction of Longline-Seabird Interactions

This section examines combinations of the available deterrent methods to see if any combinations would be an obvious improvement over single deterrent methods. Table 2.1.3 is a matrix for combining individual seabird deterrent methods for evaluation of all possible pairs of methods. Combinations are discussed by number in the paragraphs below.

Table 2.1-3 Seabird deterrent matrix

Deterrent Measure	Thawed Blue Bait	Strategic Offal Discard	Line-shooter	Towed Deterrent	Night Setting	Setting Chute	Side Setting
Thawed Blue Bait	Individual deterrent characteristics	1	2	3	4	5	6
Strategic Offal Discard		Individual deterrent characteristics	7	8	9	10	11
Line-shooter			Individual deterrent characteristics	12	13	14	15
Towed Deterrent				Individual deterrent characteristics	16	17	18
Night Setting					Individual deterrent characteristics	19	20
Setting Chute						Individual deterrent characteristics	21
Side Setting							Individual deterrent characteristics

Combination 1: *Blue-dyed and thawed bait with strategic offal discard*

These methods are independent of each other, and would tend to be additive in their deterrent effects. Both methods have merits, however each has intrinsic limitations in the current fishery, as described above. Blue dye is not as effective for coloring fish as it is for squid. Tests in New Zealand showed that dye uptake in bait fish was poorest for pilchards, most like mackerel of the baits tested (H. Frifeld, USFWS pers. comm.). Strategic offal discards may condition birds to associate longline vessels with food, thereby attracting more birds to the vessel and increasing the risk of interactions. This combination of methods is evaluated as part of current deterrent methods in all variations of all alternatives except SB7C, SB9, SB11 and SB12. Alternative SB11 specifically considers eliminating these two methods for shallow-setting operations.

Combination 2: *Blue-dyed and thawed bait with line-shooter and weighted branchlines (minimum 45g)*

The methods are independent, and would tend to be additive in their deterrent effects. However, line-shooters previously have not been required for shallow-setting in the Hawaii longline fishery, and blue dye is not as effective with the mackerel-type bait now required for shallow-sets as it was with the squid formerly used as bait. This combination is included as part of currently required measures for deep-sets in all alternatives except SB7C, SB9, SB11 and SB12.

Combination 3: *Blue-dyed and thawed bait with towed deterrent*

Towed deterrents were included in the 2000 BiOp as an optional measure for both deep and shallow-sets. There is anecdotal evidence that some Hawaii-based longline vessels employ towed deterrents in some circumstances, although this measure may have reduced effectiveness in the rough waters fished by this fleet. These two methods are independent, and would tend to be additive in their deterrent effects, however, blue dye is not as effective with the mackerel-type bait now required for shallow-sets as it was with the squid formerly used as bait, and towed deterrents present a risk of entanglement with the main line or the propellor. This combination is not specifically contained in any alternative, but is optional within current measures in all alternatives except SB7C, SB9, SB11 (shallow) and SB12.

Combination 4: *Blue-dyed and thawed bait with night setting*

The methods are independent of each other, and would tend to be additive in their deterrent effects, although blue bait may be unnecessary during darker moon phases or periods of high cloud cover, and blue dye is not as effective with the mackerel-type bait now required for shallow-sets as it was with the squid formerly used as bait. This combination of methods is included under current measures for shallow-sets in all alternatives except SB7C, SB9, SB11 and SB12.

Combination 5: *Blue-dyed and thawed bait with setting chute*

The methods are independent of each other, and would tend to be additive in their deterrent effects. Blue dye is not as effective with the mackerel-type bait now required for shallow-sets as it was with the squid formerly used as bait. The setting chute, as tested to date, has design deficiencies that make it operationally problematic. This combination is not specifically included in any of the alternatives, although use of a setting chute is an option under Alternatives SB3, SB5, SB6, SB7, SB11 and SB12.

Combination 6: *Blue-dyed and thawed bait with side setting*

The methods are independent of each other, and would tend to be additive in their deterrent effects. Blue dye is not as effective with the mackerel-type bait now required for shallow-sets as it was with the squid formerly used as bait. This combination is not specifically included in any of the alternatives, however, side-setting is an option under Alternatives SB2, SB5, SB6, SB7 and SB12; is required unless technically infeasible under Alternatives SB10 and SB11; and is required under Alternatives SB8 and SB9.

Combination 7: *Strategic offal discard with line shooter*

The methods are independent of each other, and would tend to be additive in their deterrent effects. Strategic offal discard is effective in luring birds away from the baits, but as noted above, may condition birds to approach longline vessels. This combination of methods is included under current measures for deep-sets in all alternatives except SB9 and SB12.

<u>Combination 8:</u> Strategic offal discard with towed deterrent

There is anecdotal evidence that some Hawaii-based longline vessels employ towed deterrents in some circumstances. The methods are independent of each other, and would tend to be additive in their deterrent effects. Strategic offal discard is effective in luring birds away from the baits, but as noted above, may condition birds to approach longline vessels, and towed deterrents present a risk of entanglement with the main line or the propellor. This combination remains part of the current measures, which is an option in all alternatives except SB9, SB11 (shallow) and SB12.

<u>Combination 9:</u> Strategic offal discard with night setting

The methods are independent of each other, and would tend to be additive in their deterrent effects. However, to the extent birds discontinue feeding at night, strategic offal discard would presumably be less effective (although albatrosses have a well developed sense of smell) and, as noted above, may condition birds to approach longline vessels. This combination of methods is included under current measures for shallow-sets in all alternatives except SB9, SB11 and SB12.

<u>Combination 10:</u> Strategic offal discard with setting chute

The methods are independent of each other, and would tend to be additive in their deterrent effects. Strategic offal discard is effective in luring birds away from the baits, but as noted above, may condition birds to approach longline vessels. The setting chute, as tested to date, has design deficiencies that make it operationally problematic. This combination is not specifically included in any of the alternatives, although use of a setting chute is an option under Alternatives SB3, SB5, SB6, SB7C, SB11 and SB12.

<u>Combination 11:</u> Strategic offal discard with side setting

The measures are independent of each other, and would tend to be additive in their deterrent effects. Strategic offal discard is effective in luring birds away from the baits, but as noted above, may condition birds to approach longline vessels. This combination is not specifically included in any of the alternatives, however, side-setting is an option under Alternatives SB2, SB5, SB6, SB7 and SB12; is required unless technically infeasible under Alternatives SB10 and SB11; and is required under Alternatives SB8 and SB9.

<u>Combination 12:</u> Line-shooter with towed deterrent

The methods are independent of each other, and would tend to be additive in their deterrent effects. The slack put into the main line by the line shooter increases the risk of it tangling with the tori line under rough or windy conditions. This combination remains part of current measures, which are an option for deep-sets in all alternatives except SB9 and SB12.

<u>Combination 13:</u> Line-shooter with night setting

The methods are independent of each other, and would tend to be additive in their deterrent effects. Operationally however, line-shooters are used for deep, tuna sets, which are done during daylight hours, and night setting is done for shallow, swordfish sets. The combination is not a practical one for either sector of the fleet, and does not appear as an option in any of the alternatives.

<u>Combination 14:</u> Line-shooter with setting chute

The methods would not be independent, as the main line would be shot through the chute. Preliminary tests of the setting chute were performed using a line shooter, but the chute has design deficiencies that make it operationally problematic. This combination is not specifically included in any of the alternatives, although use of a setting chute is an option under Alternatives SB3, SB5, SB6, SB7, SB11 and SB12.

<u>Combination 15:</u> Line-shooter with side setting

The methods would not be independent, as the line-shooter would deploy line from the side of the vessel. This is how the line shooter was tested by Gilman, et al. (2003), and it worked very well. This combination is not specifically included in any of the alternatives, however, side-setting is an option under Alternatives SB2, SB5, SB6, SB7; is required unless technically infeasible under Alternatives SB10 and SB11; and is required under Alternatives SB8 and SB9.

<u>Combination 16:</u> Towed deterrent with night setting

The methods are independent of each other, and would tend to be additive in their deterrent effects. Towing a deterrent at night when visibility is limited, however, would exacerbate the problems associated with keeping it clear of the main line or fouling with the propellor. The incremental improvement in deterrence over night setting alone is likely to be small. This combination is not specifically included in any of the alternatives, however, use of a towed deterrent is an option under all alternatives except Alternative SB9. Presumably a towed deterrent could be voluntarily used under that alternative, if desired.

<u>Combination 17:</u> Towed deterrent with setting chute

The methods are independent of each other, and would tend to be additive in their deterrent effects. However, the setting chute, as tested to date, has design deficiencies that make it operationally problematic. This combination is not specifically included in any of the alternatives, although use of a setting chute is an option under Alternatives SB3, SB5, SB6, SB7C, SB11 and SB12.

<u>Combination 18:</u> Towed deterrent with side setting

The methods are independent of each other, but it’s unclear that they would be additive in their deterrent effects. Presumably the towed deterrent would extend from the stern of the vessel, while the main line would extend from one side. If the towed deterrent is not over the baits, it would have little deterrent effect. This combination is not specifically included in any of the alternatives, however, side-setting is an option under Alternatives SB2, SB5, SB6, SB7 and SB12; is required unless technically infeasible under Alternatives SB10 and SB11; and is required under Alternatives SB8 and SB9.

Combination 19: *Night setting with setting chute*

The methods are independent of each other, and would tend to be additive in their deterrent effects. The setting chute, as tested to date, has design deficiencies that make it operationally problematic. This combination is not specifically included in any of the alternatives, although use of a setting chute is an option under Alternatives SB3, SB5, SB6, SB7C, SB11 and SB12. Night setting is included under current measures for shallow-sets in all alternatives except SB9 and SB12.

Combination 20: *Night setting with side setting*

The methods are independent of each other, and would tend to be additive in their deterrent effects. This combination is not specifically included in any of the alternatives, however, side-setting is an option under Alternatives SB2, SB5, SB6, and SB7; is required unless technically infeasible under Alternatives SB10 and SB11; and is required under Alternatives SB8 and SB9. Night setting is included under current measures for shallow-sets in all alternatives except SB9 and SB12.

Combination 21: *Setting chute with side setting*

In combination, these methods would not be independent, and this is an unlikely combination operationally. The chute would have to be exceptionally strong and well braced to withstand the lateral forces as it moves sideways through the water. Limited testing of chutes in the Hawaii fishery have resulted in structural failures when deployed off the stern, where lateral forces are minimal. It is unknown how the chute would function if aligned at a right angle to the deployed main line. There could be a tendency to rip the bait from the hooks. This combination is not specifically included in any of the alternatives, however, either side-setting or use of a setting chute are included in all alternatives except Alternatives SB1and SB4.

Summary

Considering the above assessments, an attempt was made to rank the combinations relative to one another. Combination 21 (setting chute with side setting) was discarded as mechanically unworkable. Combination 18 (towed deterrent with side setting) was discarded as not providing added deterrence over side setting alone. In general, combinations involving side setting faired best, but every combination had liabilities of one sort or another. Specifically, combinations employing blue bait suffered from the decreased performance of the dye on fish as compared with squid. Strategic offal discards may ultimately serve to attract more birds to the vicinity of the longline vessels. Line shooters work well for deep-sets, but are inappropriate for shallow-sets. Towed deterrents can be problematic operationally. Night setting is appropriate for shallow-sets but not for deep-sets. For the setting chute to be a reliable, convenient method, additional design development is required to resolve the difficulties encountered in testing of the prototypes.

The best combination appears to be side setting at night, followed respectively by side setting with a line shooter, side setting with blue bait, side setting with strategic offal discard and night setting with a line shooter. For the reasons given above however, each of these combinations has liabilities. In developing alternatives, three conclusions emerged from this analysis:

1. Side setting appears to be the single best deterrent measure and it is not improved much by adding other deterrent methods in combination,
2. The suite of measures currently required by or optionally permitted by the 2000 USFWS BiOp and current regulations for the deep and shallow sectors of the Hawaii-based longline fishery is a good default package of deterrents for vessels unable to employ side setting; and
3. Because of operational liabilities, consideration should be given to eliminating blue-dyed bait and strategic offal discards from the default suite of measures.

In consideration of the above, a wide variety of alternatives are presented below. These alternatives are generally of the form where vessels may use the current suite of measures or one of the individual methods above, but alternatives are offered which also consider requiring side setting and dropping blue-dyed bait and strategic offal discard from the default suite of measures.

2.1.3 Alternatives for Reduction of Seabird Interactions in the Hawaii-based Longline Fishery Including a Preliminary Preferred Alternative

In this section a range of alternatives for mitigating seabird interactions in the Hawaii longline fishery are presented. The “no action” alternative means maintaining the current suite of measures implemented by current regulations based on the requirements of the US Fish and Wildlife Service’s 2000 BiOp. At its 123rd meeting (June 21-24, 2004), the Council selected Alternative SB7C as its preliminary preferred alternative. The Council expects to take final action at its 124th meeting (scheduled for October 11-14, 2004) and forward a recommendation to NMFS for implementation.

<u>Alternative SB1 No Action:</u> *Use current mitigation measures when fishing north of 23°N.*

The current measures are as follows:

Hawaii-based longline vessels deep-setting north of 23°N

1. Use a line setting machine (mainline shooter) if using a monofilament main line
2. Use minimum 45g weight within 1m of the hook if using a monofilament main line
3. If using basket-style gear, set the mainline slack
4. Use blue-dyed, thawed bait, and have a minimum of 2 cans of dye onboard
5. Discharge offal and spent bait on the opposite side from setting or hauling

Hawaii-based longline vessels shallow-setting north of 23°N

1. Begin setting 1 hour after local sunset and complete the setting process by local sunrise, using the minimum vessel lights necessary
2. Use blue-dyed, thawed bait, and have a minimum of 2 cans of dye onboard
3. Discharge offal and spent bait on the opposite side from setting or hauling

In addition all Hawaii-based longline vessels must employ prescribed seabird handling protocols wherever they fish, and vessel owners and operators must attend an annual NMFS protected species workshop. These requirements would continue to apply under all alternatives considered here.

<u>Alternative SB2A</u>: *Use current mitigation measures <u>or</u> use side setting, when fishing north of 23°N.*

Under this alternative, operators of Hawaii longline vessels could elect to either (a) continue to use the current measures described above, or (b) employ side setting with 60g swivels within 1m of the hook according to the specifications below, when fishing north of 23°N. Allowing vessel operators to choose between the current methods or side setting would increase flexibility and address safety concerns by offering the choice of current methods for those vessel operators unwilling to switch to 60 g weights. It also recognizes that not all vessels can be configured for side setting.

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
3. Throw baited hooks forward as close to the vessel hull as possible
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

<u>Alternative SB2B</u>: *Use current mitigation measures <u>or</u> use side setting, in all areas.*

Under this alternative, operators of Hawaii longline vessels could elect to either (a) continue to use the current measures described above, or (b) employ side setting with 60g swivels within 1m of the hook according to the specifications above, in all areas.

<u>Alternative SB3A:</u> *Use current mitigation measures <u>or</u> use an underwater setting chute, when fishing north of 23°N.*

Under this alternative, operators of Hawaii longline vessels could elect to either (a) continue to use the current measures described above, or (b) use an underwater setting chute that has a minimum of 2.9m of its shaft underwater, when fishing north of 23°N.

Alternative SB3B: Use current mitigation measures or use an underwater setting chute, in all areas.

Under this alternative, operators of Hawaii longline vessels could elect to either (a) continue to use the current measures described above, or (b) use an underwater setting chute that has a minimum of 2.9m of its shaft underwater, in all areas

Alternative SB4A: Use current mitigation measures or use a tori line (e.g., paired streamer lines), when fishing north of 23°N.

Under this alternative, operators of Hawaii longline vessels could elect to either (a) continue to use the current measures described above, or (b) employ one or more tori lines according to the design used by McNamara et al. (1999) and Boggs (2001), when fishing north of 23°N.

Alternative SB4B: Use current mitigation measures or use a tori line (e.g., paired streamer lines), in all areas.

Under this alternative, operators of Hawaii longline vessels could elect to either (a) continue to use the current measures described above, or (b) employ one or more tori lines according to the design used by McNamara et al. (1999) and Boggs (2001), in all areas.

Alternative SB5A: Use current mitigation measures or use side setting or use an underwater setting chute, when fishing north of 23°N.

Under this alternative, operators of Hawaii longline vessels could elect to either (a) continue to use the current measures described above, or (b) employ side setting with 60g swivels within 1m of the hook according to the specifications above, or (c) employ an underwater setting chute that has a minimum of 2.9m of its shaft underwater, when fishing north of 23°N.

Alternative SB5B: Use current mitigation measures or use side setting or use an underwater setting chute, in all areas.

Under this alternative, operators of Hawaii longline vessels could elect to either (a) continue to use the current measures described above, or (b) employ side setting with 60g swivels within 1m of the hook according to the specifications above, or (c) employ an underwater setting chute that has a minimum of 2.9m of its shaft underwater, in all areas.

Alternative SB6A: Use current mitigation measures or use side setting or use an underwater setting chute or use a tori line (e.g., paired streamer lines), when fishing north of 23°N.

Under this alternative, operators of Hawaii longline vessels could elect to either (a) continue to use the current measures described above, or (b) employ side setting with 60g swivels within 1m of the hook according to the specifications above, or (c) employ an underwater setting chute that has a minimum of 2.9m of its shaft underwater, or (d) employ one or more tori lines according to the design used by McNamara et al. (1999) and Boggs (2001), when fishing north of 23°N.

Alternative SB6B: Use current mitigation measures or use side setting or use an underwater setting chute or use a tori line (e.g., paired streamer lines), in all areas.

Under this alternative, operators of Hawaii longline vessels could elect to either (a) continue to use the current measures described above, or (b) employ side setting with 60g swivels within 1m of the hook according to the specifications above, or (c) employ an underwater setting chute that has a minimum of 2.9m of its shaft underwater, or (d) employ one or more tori lines according to the design used by McNamara et al. (1999) and Boggs (2001), in all areas.

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

Under this alternative, operators of Hawaii longline vessels could elect to (a) continue to use the current measures described above, or (b) employ side setting with 60g swivels within 1m of the hook according to the specifications above, or (c) employ one or more tori bird-scaring lines according to the design used by McNamara et al. (1999) and Boggs (2001), when fishing north of 23°N.

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

Under this alternative, operators of Hawaii longline vessels could elect to (a) continue to use the current measures described above, or (b) employ side setting with 60g swivels within 1m of the hook according to the specifications above, or (c) employ one or more tori bird-scaring lines according to the design used by McNamara et al. (1999) and Boggs (2001), in all areas.

Alternative SB7C: Swordfish (shallow-setting) vessels use "current" mitigation measures except thawed blue-dyed bait, or use side setting, or use an underwater setting chute that has a minimum of 2.9m of its shaft underwater, or use a tori line (e.g., paired streamer lines), in all areas. Tuna (deep-setting) vessels use "current" mitigation measures except thawed blue-dyed bait, or use side setting in conjunction with a line shooter and weighted branch lines, or use an underwater setting chute that has a minimum of 2.9m of its shaft underwater, or use a tori line (e.g., paired streamer lines) in conjunction with a line shooter and weighted branch lines, when fishing north of 23°N.

This is the Council's preliminary preferred alternative. Under this alternative operators of Hawaii longline vessels targeting swordfish (shallow-setting) could elect to (a) use the measures currently required for vessels fishing north of 23°N as described above except the requirement to use thawed blue-dyed bait, or (b) employ side setting with 60g swivels within 1m of the hook according to the specifications, below, or (c) use an underwater setting chute that has a minimum of 2.9m of its shaft underwater, or (d) employ one or more tori bird-scaring lines according to the design used by McNamara et al. (1999) and Boggs (2001), in all areas.

Operators of Hawaii longline vessels targeting tuna (deep-setting) could elect to (a) use the measures currently required for vessels fishing north of 23°N as described above except the requirement to use thawed blue-dyed bait, or (b) employ side setting with 60g swivels within 1m of the hook according to the specifications above in conjunction with a line shooter with weights of at least 45 g placed within one meter of each hook, or (c) use an underwater setting chute that has a minimum of 2.9m of its shaft underwater, or (d) employ one or more tori bird-scaring lines according to the design used by McNamara et al. (1999) and Boggs (2001), when fishing north of 23°N.

Alternative SB8A: *Use current mitigation measures plus side setting, when fishing north of 23°N.*

Under this alternative, operators of Hawaii longline vessels would be required to continue to use the current measures described above as well as to employ side setting with 60g swivels within 1m of the hook as described above, when fishing north of 23°N.

Alternative SB8B: *Use current mitigation measures plus side setting, in all areas.*

Under this alternative, operators of Hawaii longline vessels would be required to continue to use the current measures described above as well as to employ side setting with 60g swivels within 1m of the hook as described above, in all areas.

Alternative SB9A: *Use side setting when fishing north of 23°N.*

Under this alternative, operators of Hawaii longline vessels would be required to employ side setting with 60g swivels within 1m of the hook as described above, when fishing north of 23°N.

Alternative SB9B: *Use side setting in all areas.*

Under this alternative, operators of Hawaii longline vessels would be required to employ side setting with 60g swivels within 1m of the hook as described above, in all areas.

Alternative SB10A: Use side setting ***UNLESS*** *technically infeasible, in which case use current mitigation measures, when fishing north of 23°N.*

Under this alternative, operators of Hawaii longline vessels would be required to employ side setting with 60g swivels within 1m of the hook as described above unless technically infeasible in which case they would be required to use the current measures described above, when fishing north of 23°N. Note that the Council, in formulating alternatives, did not define criteria for infeasibility. Presumably any vessel could be reconfigured, cost notwithstanding. The Council did recommend that NMFS investigate the possibility of NMFS providing low interest loans for such reconfigurations.

Alternative SB10B: Use side setting ***UNLESS*** *technically infeasible, in which case use current mitigation measures, in all areas.*

Under this alternative, operators of Hawaii longline vessels would be required to employ side setting with 60g swivels within 1m of the hook as described above unless technically infeasible in which case they would be required to use the current measures described above, in all areas.

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

Under this alternative operators of Hawaii-based longline vessels would be required to use side-setting with 60g swivels within 1m of the hook as described above unless technically infeasible, in which case shallow-setting vessels would be required to either (a) begin the setting process at least one hour after local sunset and complete the setting process by local sunrise, or (b) employ an underwater setting chute that has a minimum of 2.9m of its shaft underwater, or (c) employ one or more tori lines according to the design used by McNamara et al. (1999) and Boggs (2001), when fishing north of 23°N. Deep-setting vessels unable to side-set would be required to either (a) use the measures currently required for vessels fishing north of 23°N, as described above, or (b) employ an underwater setting chute that has a minimum of 2.9m of its shaft underwater, or (c) employ one or more tori lines according to the design used by McNamara et al. (19990 and Boggs (2001), when setting north of 23°N.

*Alternative SB11B: Use side setting **UNLESS** technically infeasible, in which case: swordfish (shallow-setting) vessels set at night, **OR** use an underwater setting chute, **OR** use a tori line (e.g., paired streamer lines), and tuna (deep-setting) vessels use current measures, **OR** use an underwater setting chute, **OR** use a tori line (e.g., paired streamer lines), when fishing north of 23°N.*

Under this alternative operators of Hawaii-based longline vessels would be required to use side-setting with 60g swivels within 1m of the hook as described above unless technically infeasible, in which case shallow-setting vessels would be required to either (a) begin the setting process at least one hour after local sunset and complete the setting process by local sunrise, or (b) employ an underwater setting chute that has a minimum of 2.9m of its shaft underwater, or (c) employ one or more tori lines according to the design used by McNamara et al. (1999) and Boggs (2001), in all areas. Deep-setting vessels unable to side-set would be required to either (a) use the measures currently required for vessels fishing north of 23°N, as described above, or (b) employ an underwater setting chute that has a minimum of 2.9m of its shaft underwater, or (c) employ one or more tori lines according to the design used by McNamara et al. (19990 and Boggs (2001), in all areas.

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

Under this alternative, operators of Hawaii longline vessels would be asked to voluntarily either (a) use side-setting with 60g swivels within 1m of the hook as described above, or (b) employ an underwater setting chute that has a minimum of 2.9m of its shaft underwater, or (c) employ one or more tori lines according to the design used by McNamara et al. (1999) and Boggs (2001), or (d) begin the setting process at least one hour after local sunset and complete the setting process by local sunrise, or (e) use a line shooter with weights of at least 45 g placed within one meter of each hook, when fishing south of 23°N.

A narrative summary of these alternatives is given in Table 2.1-4. Table 2.1-5 graphically presents a matrix of mitigation measures by alternative for the seabird interaction mitigation methods.

Table 2.1-4 Seabird mitigation measures included in each alternative. (Note that all alternatives would continue current requirements for annual protected species workshop attendance and seabird handling protocols.)

Alt.	Description
SB1	**CURRENT MEASURES** **All Hawaii-based longline vessels** fishing north of 23°N must: Discharge offal and spent bait on the opposite side from setting or hauling Use blue-dyed, thawed bait, and have a minimum of 2 cans of dye onboard **Vessels deep-setting** north of 23°N must use a line setting machine (line shooter) and use minimum 45g weights within 1m of each hook, if using a monofilament main line[1] **Vessels shallow-setting** north of 23°N must begin setting at least 1 hour after local sunset and complete the setting process by local sunrise, using the minimum vessel lights necessary
SB2A	Use current mitigation measures **OR** use side setting, when fishing north of 23°N
SB2B	Use current mitigation measures **OR** use side setting, in all areas
SB3A	Use current mitigation measures **OR** use an underwater setting chute, when fishing north of 23°N
SB3B	Use current mitigation measures **OR** use an underwater setting chute, in all areas
SB4A	Use current mitigation measures **OR** use a tori line (e.g., paired streamer lines), when fishing north of 23°N
SB4B	Use current mitigation measures **OR** use a tori line (e.g., paired streamer lines), in all areas
SB5A	Use current mitigation measures **OR** use side setting **OR** use an underwater setting chute, when fishing north of 23°N
SB5B	Use current mitigation measures **OR** use side setting **OR** use an underwater setting chute, in all areas
SB6A	Use current mitigation measures **OR** use side setting **OR** use an underwater setting chute **OR** use a tori line (e.g., paired streamer lines), when fishing north of 23°N
SB6B	Use current mitigation measures **OR** use side setting **OR** use an underwater setting chute **OR** use a tori line (e.g., paired streamer lines), in all areas
SB7A	Use current mitigation measures **OR** use side setting **OR** use an underwater setting chute **OR** use a tori line (e.g., paired streamer lines), when fishing north of 23°N
SB7B	Use current mitigation measures **OR** use side setting **OR** use an underwater setting chute **OR** use a tori line (e.g., paired streamer lines), in all areas
SB7C	Swordfish (shallow-setting) vessels use current mitigation measures except thawed blue-dyed bait, or use side setting, or use an underwater setting chute that has a minimum of 2.9m of its shaft underwater, or use a tori line (e.g., paired streamer lines), in all areas. Tuna (deep-setting) vessels use "current" mitigation measures except thawed blue-dyed bait, or use side setting in conjunction with a line shooter and weighted branch lines, or use an underwater setting chute that has a minimum of 2.9m of its shaft underwater, or use a tori line (e.g., paired streamer lines) in conjunction with a line shooter and weighted branch lines, when fishing north of 23°N.

SB8A	Use current mitigation measures **PLUS** side setting, when fishing north of 23°N
SB8B	Use current mitigation measures **PLUS** side setting, in all areas
SB9A	Use side setting when fishing north of 23°N
SB9B	Use side setting in all areas
SB10A	Use side setting **UNLESS** technically infeasible in which case use current measures, when fishing north of 23°N
SB10B	Use side setting **UNLESS** technically infeasible in which case use current measures, in all areas
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
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
SB12	Voluntarily use night setting, **OR** an underwater setting chute, **OR** a tori line, **OR** a line shooter with weighted branch lines, south of 23°N.
1. Basket gear may also be used if deep-set longline fishing above 23°N, with a requirement that the mainline be set slack to maximize the sinking of baited hooks.	

Table 2.1-5 Matrix of Seabird Alternatives by Mitigation Measure

Alternative	Mitigation Measure						
	Current Measures				New Measures		
	Strategic Offal Discard	Line Shooter with 45g Weight	Night Setting	Blue-dyed, Thawed Bait	Side-setting	Underwater Setting Chute	Tori Line
Highest Capture Deterrence (%)	**53**	**--**	**98**	**95**	**100**	**88**	**88**
SB1 No Action	brick	brick	brick	brick			
SB2A CM or SS above 23°N	horizontal	horizontal	horizontal	horizontal	horizontal		
SB2B CM or SS All Areas	vertical	vertical	vertical	vertical	vertical		
SB3A CM or USC above 23°N	horizontal	horizontal	horizontal	horizontal		horizontal	
SB3B CM or USC All Areas	vertical	vertical	vertical	vertical		vertical	
SB4A CM or TL above 23°N	horizontal	horizontal	horizontal	horizontal			horizontal
SB4B CM or TL All Areas	vertical	vertical	vertical	vertical			vertical
SB5A CM, SS or USC above 23°N	horizontal	horizontal	horizontal	horizontal	horizontal	horizontal	
SB5B CM, SS or USC All Areas	vertical	vertical	vertical	vertical	vertical	vertical	
SB6A CM or SS or USC or TL above 23°N	horizontal	horizontal	horizontal	horizontal	horizontal	horizontal	horizontal
SB6B CM or SS or USC or TL All Areas	vertical	vertical	vertical	vertical	vertical	vertical	vertical
SB7A CM or SS or TL above 23°N	horizontal	horizontal	horizontal	horizontal	horizontal		horizontal
SB7B CM or SS or TL All Areas	vertical	vertical	vertical	vertical	vertical		vertical
Council's Preliminary Preferred Alternative							
SB7C Shallow CM-BB or SS or USC or TL All Areas	vertical		vertical		vertical	vertical	vertical
SB7C Deep CM-BB or SS or USC or TL above 23°N	horizontal	horizontal			horizontal	horizontal	horizontal
SB8A CM + SS above 23°N	brick	brick	brick	brick	brick		
SB8B CM + SS All Areas	checkered	checkered	checkered	checkered	checkered		
SB9A SS above 23°N					brick		
SB9B SS All Areas					checkered		
SB10A SS if feasible or CM above 23°N	horizontal	horizontal	horizontal	horizontal	diagonal		
SB10B SS if feasible or CM All Areas	vertical	vertical	vertical	vertical	diagonal		

SB11A Shallow SS if feas. or NS or USC or TL above 23°N			Optional in All Areas			Mandatory N of 23°N if Feasible		Optional in All Areas		Optional in All Areas	
SB11A Deep SS if feas. or CM or USC or TL above 23°N	Optional N of 23°N	Optional N of 23°N		Optional N of 23°N		Mandatory N of 23°N if Feasible		Optional N of 23°N		Optional N of 23°N	
SB11B Shallow SS if feas. or NS or USC or TL All Areas			Optional in All Areas			Mandatory All Areas if Feasible		Optional in All Areas		Optional in All Areas	
SB11B Deep SS if feas. or CM or USC or TL All Areas	Optional N of 23°N	Optional N of 23°N		Optional N of 23°N		Mandatory All Areas if Feasible		Optional N of 23°N		Optional N of 23°N	
SB12 Voluntary SS or USC or TL below 23°N						Voluntary S of 23°N		Voluntary S of 23°N		Voluntary S of 23°N	

Fill Codes:

Mandatory N of 23°N	
Mandatory in All Areas	
Mandatory N of 23°N if Feasible	
Mandatory All Areas if Feasible	
Optional N of 23°N (Must use one, all marked CM are one option)	
Optional in All Areas (Must use one, all marked CM are one option)	
Voluntary S of 23°N	

2.1.4 Alternatives Considered but Rejected for Reduction of Seabird Interactions in the Hawaii-based Longline Fishery

It is assumed that the required seabird handling techniques and annual attendance at a NMFS protected workshop will continue to be desired by NMFS, the Council and the USFWS, and that these measures will be part of regulations implementing the selected alternative. Some possible combinations of mitigation methods did not specifically appear in any of the alternatives due to impracticality or redundancy and these were, in effect, alternatives rejected from further study.

The alternatives described here are intended to satisfy the objective of reducing seabird interactions in the Hawaii-based longline fishery. Alternatives to impose measures on General Longline Permit holders or Hawaii limited access permit holders fishing in California were rejected. The shallow-set longline fishery operating from California was closed in 2004 through regulations implementing a BiOp on the highly migratory species fishery based there. The consequent options for vessels from this fishery were either to return to Hawaii and reactivate their latent Hawaii permits, in which case they would be obliged to fish under the conditions imposed on the Hawaii fishery, or base elsewhere in the region and fish under a General Longline Permit. General permit vessels might conceivably fish with the required circle hook and mackerel-type bait unhindered by the sea turtle take or set limits, and tranship catches into Hawaii, but this has never happened in the history of the Hawaii fishery, due to the economics of running two vessels to land one vessel's catch. Relocating to other island areas in the Western Pacific Region is also an option for longline vessels displaced from the Hawaii-based fishery, but these areas also have existing (or proposed) longline fishing regulations as well as logistical problems that could render the costs of longline fishing prohibitively high. In American Samoa, for example, longline vessels harvesting tuna or swordfish for the fresh fish market would have to overcome obstacles such as limited shoreside ice and cold storage facilities and infrequent and expensive air transportation links. Moreover, vessels operating with a General Permit have the option of fishing in American Samoa until this fishery begins to operate under a limited access program, likely to be implemented in 2004.

Other seabird interaction mitigation methods have been informally tested by fishermen (weighted hooks, towed trash bags, avoidance of setting in the vessel's wake, undyed thawed bait) and at least one, the bait-setting capsule, has been developed and tested as a prototype. None of these methods, however, have been subject to formal testing in the Hawaii-based longline fishery, and so were not included among the methods considered here. Noise making, either with explosive devices or horns, has been shown to be ineffective.

Other types of hooks and baits could eventually prove useful in mitigating seabird interactions. At this time, however, the specifications of hook and bait type in this fishery are rooted in experiments conducted in the Atlantic Ocean which dramatically reduced interactions with leatherback and loggerhead sea turtles. Any other combination of hook and bait would first have to be tested for efficacy in deterring interactions with sea turtles.

Operational restrictions such as time and area closures were also considered but rejected. The Hawaii longline fleet is already subject to area closures around the NWHI and the MHI, the former especially significant in prohibiting longlining near seabird nesting areas. The effectiveness of the available mitigation methods argues against more restrictions on operating areas.

2.1.5 Seabird Interaction Mitigation Measure Effectiveness Comparison

Table 2.1.6 summarizes the expected results of implementation of the various longline-seabird interaction alternatives in terms of seabird catch.

Table 2.1-6 Effectiveness of the Seabird Alternatives

Alternative	Predicted Seabird Catch	
	Deep Sets	Shallow Sets
SB1 No Action	500	1,300
SB2A CM or SS above 23°N	CM 500 SS 5-10	CM 1,300 SS 5-10
SB2B CM or SS All Areas		
SB3A CM or USC above 23°N	CM 500 USC 338	CM 1,300 USC 1,743
SB3B CM or USC All Areas		
SB4A CM or TL above 23°N	CM 500	CM 1,300
SB4B CM or TL All Areas		
SB5A CM, SS or USC above 23°N	CM 500 SS 5-10USC 338	CM 1,300 SS 5-10 USC 1,743

Alternative	Predicted Seabird Catch	
	Deep Sets	Shallow Sets
SB5B CM, SS or USC All Areas		
SB6A CM or SS or USC or TL above 23°N	CM 500 SS 5-10USC 338	CM 1,300 SS 5-10 USC 1,743
SB6B CM or SS or USC or TL All Areas		
SB7A CM or SS or TL above 23°N	CM 500 SS 5-10	CM 1,300 SS 5-10
SB7B CM or SS or TL All Areas		
Council's Preliminary Preferred Alternative		
SB7C Shallow CM-BB or SS or USC or TL All Areas	CM 500 SS 5-10USC 338	CM 1,300 SS 5-10 USC 1,743
SB7C Deep CM-BB or SS or USC or TL above 23°N		
SB8A CM + SS above 23°N	5-10	5-10
SB8B CM + SS All Areas		
SB9A SS above 23°N	5-10	5-10
SB9B SS All Areas		
SB10A SS if feasible or CM above 23°N	5-10 or greater	5-10 or greater
SB10B SS if feasible or CM All Areas		
SB11A Shallow SS if feas. or NS or USC or TL above 23°N		5-10 or greater
SB11A Deep SS if feas. or CM or USC or TL above 23°N	5-10 or greater	
SB11B Shallow SS if feas. or NS or USC or TL All Areas		5-10 or greater
SB11B Deep SS if feas. or CM or USC or TL All Areas	5-10 or greater	
SB12 Voluntary SS or USC or TL below 23°N	Unknown but could be as high as 500	Unknown but could be as high as 1,300

2.2 Alternatives for Management of the U.S. Pacific Squid Jigging Fishery

In consideration of jurisdictional boundaries, the objective has been divided into two sub-objectives and alternatives developed for each.

2.2.1 Alternatives for Management of the Squid Jigging Fishery under the MSA

SQA.1 No Action. Do not monitor or manage through an FMP squid fishing in areas under the Council's jurisdiction.

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. (The Council has reached a preliminary agreement with the three known domestic high seas squid jiggers to voluntarily participate in a pilot program under which they would use modified logbooks and carry federal observers, this alternative would continue these efforts.)

SQA.3 This is the Council's preliminary preferred alternative for Objective A. 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 permitted under the HSFCA to also include any EEZ fishing activities 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. Centralize this data into a database easily available to resource managers.

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. Require vessels that harvest pelagic squid solely in EEZ waters to either use this logbook or to participate in local reporting systems. Centralize this data into a database easily available to resource managers.

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.

2.2.2 Alternatives for Management of the Squid Jigging Fishery under the HSFCA

SQB.1 No Action. Continue to implement the HSFCA as it pertains to the high seas domestic squid fishery (i.e., continue to require HSFCA permits and catch reports for these vessels).

SQB.2 Cease issuing HSFCA permits for the high seas domestic squid fishery (i.e., stop issuing HSFCA permits for domestic squid vessels and do not allow un-permitted vessels to fish on the high seas).

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 Council has reached a preliminary agreement with the three known domestic high seas squid jiggers to voluntarily participate in a pilot program under which they would use modified logbooks and carry federal observers, this alternative would continue these efforts.) Centralize this data into a database easily available to resource managers.

SQB.4 This is the Council's preliminary preferred alternative for Objective B. 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).

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.

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.

At its 123rd meeting (June 21-24, 2004), the Council selected Alternative SQA3 as its preliminary preferred alternative for Objective A, and Alternative SQB4 as its preliminary alternative for Objective B. The Council expects to take final action at its 124th meeting (scheduled for October 11-14, 2004) and forward its recommendation to NMFS for implementation.

2.3.2 Alternatives Considered but Rejected for Management of the U.S. Pacific Squid Fishery

At the present time, U.S. participation in this international fishery is extremely limited, with from 0 to 4 vessels participating in the past four years. Hundreds of foreign vessels participate in this fishery. Our current knowledge of the status of the stocks, fishing mortality and bycatch in this fishery is very limited, although the stocks appear healthy and bycatch does not appear to be a problem. There do not appear to be interactions with protected species. Consequently there does not appear to be any reason at this time to propose management alternatives that would limit fishing mortality or reduce bycatch (such as time or area closures, or effort or landing limits). Also not under current consideration is the use of vessel monitoring systems. These systems monitor the location of fishing vessels and are only appropriate for fisheries that are subject to area closures. However the establishment of mechanisms to implement specific fishing management measures would allow for regulatory controls to be quickly put in place should resource concerns arise.