**APPENDIX III**
**Regulatory Impact Review and Initial Regulatory Flexibility Analysis**

**Additional Measures to Reduce the Incidental Catch of Seabirds in the Hawaii-Based Longline Fishery**

**A Regulatory Amendment to the Fishery Management Plan for the Pelagic Fisheries of the Western Pacific Region**

**April 6, 2005**

## I. INTRODUCTION

In order to meet the requirements of Executive Order 12866 (EO 12866) the National Marine Fisheries Service (NMFS) requires that a Regulatory Impact Review (RIR) be prepared for all regulatory actions that are of public interest. This review provides an overview of the problem, policy objectives, and anticipated impacts of regulatory actions, and ensures that management alternatives are systematically and comprehensively evaluated such that the public welfare can be enhanced in the most efficient and cost effective way. In addition, the Regulatory Flexibility Act, 5 U.S.C. 601 et seq. (RFA) requires government agencies to assess the impact of their regulatory actions on small businesses and other small organizations via the preparation of Regulatory Flexibility Analyses.

This document examines the costs and benefits of regulatory actions proposed for the domestic pelagic fisheries under the Fishery Management Plan for the Pelagic Fisheries of the Western Pacific Region (FMP). It also contains analyses of the economic impacts of this action on affected small businesses and other small organizations.

## II. OBJECTIVE AND NEED FOR ACTION

The primary objective of the proposed action is the cost-effective further reduction of the potentially harmful effects of fishing by Hawaii-bsed longline vessels on the short-tailed albatross, but the overarching goal is to reduce the potentially harmful effects of fishing by Hawaii-based longline vessels on all seabirds. Hawaii-based pelagic longline fishing vessels inadvertently hook, entangle and kill black-footed albatrosses (*Phoebastria nigripes*) and Laysan albatrosses (*Phoebastria immutabilis*) that nest in the Northwestern Hawaiian Islands (NWHI). On rare occasions Wedge-tailed and sooty shearwaters are also incidentally caught by these vessels. However, there are no observations or reports of interactions between the fishery and the endangered short-tailed albatross (*Phoebastria albatrus*). Fishery interactions may impact individual seabirds and, if large enough, in turn impact seabird populations so as to alter their trajectory (e.g. from positive to negative).

In October 1999, the Western Pacific Fishery Management Council (Council) recommended three measures to mitigate the harmful effects of fishing by vessels registered for use under Hawaii longline limited access permits (Hawaii-based longline vessels) on seabirds. The first measure required vessel operators fishing with longline gear north of 25 degrees N. latitude to employ two or more of the following seabird deterrent techniques: 1) maintain adequate quantities of blue dye on board and use only completely thawed, blue-dyed bait; 2) discard offal while setting and hauling the line in a manner that distracts seabirds from hooks; 3) tow a NMFS-approved deterrent (such as a tori line or a buoy) while setting and hauling the line; 4) deploy line with line-setting machine so that the line is set faster than the vessel's speed; 5) attach weights equal to or greater than 45 grams to branch lines within one meter of each hook; 6) begin setting the longline at least one hour after sunset and complete the setting process at least one hour before sunrise, using only the minimum vessel's lights necessary for safety. The second measure directed vessel operators to make every reasonable effort to ensure that birds brought onboard alive are handled and released in a manner that maximizes the probability of their long-term survival as directed by seabird handling guidelines. The final measure required all vessel owners and operators to annually complete a protected species educational workshop conducted by NMFS.

On July 5, 2000, NMFS published a proposed rule for the Hawaii-based longline fishery based on the Council's recommended measures. However, the agency did not proceed with the publication of a final rule, as the USFWS had indicated it was developing a Biological Opinion (BiOp) for the fishery action under section 7 of the Endangered Species Act (ESA) for the short-tail albatross. This endangered species has been documented in small numbers in the NWHI, and the USFWS BiOp, published on November 28, 2000, concluded that the Hawaii-based longline fishery as proposed was not likely to jeopardize the continued existence of the short-tailed albatross. Nevertheless, it included several non-discretionary measures to be employed by the Hawaii-based longline fishery and implemented by NMFS. In contrast to the Council's recommendation requiring the use of any two of the six approved deterrents when fishing north of 25 degrees N., the 2000 USFWS BiOp required that all Hawaii-based vessels operating with longline gear north of 23 degrees N. latitude use thawed blue-dyed bait and discard offal strategically to distract birds during setting and hauling of longline gear. In addition, when making deep sets (targeting tuna) north of 23 degrees N. latitude, Hawaii-based vessel operators were required to employ a line-setting machine with weighted branch lines (minimum weight = 45 g). All longline vessel operators and crew were also required to follow certain handling techniques to ensure that all seabirds would be handled and released in a manner that maximizes the probability of their long-term survival, and vessel operators were required to annually complete a protected species educational workshop conducted by NMFS. Optional mitigation measures include towed deterrents, or the use of weighted branch lines without a line-setting machine (in the case of swordfish or mixed target sets). In addition, operators of Hawaii-based vessels making shallow sets (targeting swordfish) north of 23 degrees N. were required to begin the setting process at least one hour after sunset and complete the setting process by sunrise.

Emergency and final regulations implementing seabird mitigation measures for the Hawaii-based longline fishery were promulgated on June 12, 2001 and May 14, 2002, respectively. However, the requirements regarding shallow-set longlining north of 23 degrees N. latitude were not implemented by NMFS as, for the purpose of minimizing effects of the fishery on threatened and endangered sea turtle species, on March 31, 2001, by order of the court NMFS prohibited all shallow-set pelagic longline fishing for swordfish north of the equator by Hawaii-based vessels.

The March, 2001 closure of the shallow set longline component of the fishery led NMFS to reinitiate consultation with the USFWS to examine the impacts of the reduced fishery on short-tailed albatrosses. The subsequent USFWS 2002 BiOp was released November 18, 2002, and again concluded that the Hawaii-based longline fishery was not likely to jeopardize the continued existence of the short-tailed albatross.

In 2003 new information, experimental results and technological advances in longline gear design that concern interactions between the fishery and sea turtles prompted the Council recommend new measures for the Hawaii-based fishery. As a result current regulations allow a limited amount (2,120 sets annually) of shallow-set longline effort by Hawaii-based swordfish vessels using circle hooks with mackerel-type bait. Because this action allowed limited shallow-setting, it also implemented the USFWS 2000 BiOp requirement that any shallow-setting occurring north of 23 degrees N. latitude be done at night. Final regulations implementing these recommendations were promulgated on April 2, 2004

Based on NMFS' extrapolations from observer data during 1999 the fleet is estimated to have brought onboard 2,320 hooked or entangled albatrosses (1,301 black-footed and 1,019 Laysan), while in 2002 the fleet is estimated to have brought onboard 113 hooked or entangled albatrosses (65 black-footed and 51 Laysan), and 257 albatrosses (111 black-footed and 146 Laysan) in 2003.Although vessel and observer records indicate that some birds are released alive it is unknown how long they actually survive and a worst-case scenario would assume that all albatrosses brought onboard represent mortalities. The increase between 2002 and 2003 may be indicative of the increase in nesting populations of black-footed and Laysan albatrosses in the Northwestern Hawaiian Islands (NWHI) (a 7.2% increase in active black-footed albatross nests on Midway Atoll as compared to 2001 and a 53.9% increase in Laysan albatrosses on Midway breeding pairs as compared to 2001). Similarly, the USFWS has reported that worldwide populations of short-tailed albatrosses are increasing at more than 7% per year. The most recent information indicates that NWHI nesting numbers for both species have remained stable since 1991.

A series of cooperative research trials with new mitigation methods were conducted between 2002 and 2003 on Hawaii-based longline vessels. The trials found that underwater setting chutes (which deploy baited hooks underwater and out of the reach of seabirds) and side setting (which deploys the longline laterally from amidships, rather than directly over the stern), were both effective in reducing interactions with seabirds. This action examines a range of alternatives that would allow or require the use of one or more of these techniques to cost-effectively further reduce seabird interactions with the Hawaii-based fishery. Also examined is the use of tori lines (also known as streamer or bird scaring lines) which have been found to be effective in reducing seabird interactions in the Alaska demersal longline fishery.

## III. DESCRIPTION OF THE POTENTIALLY AFFECTED FISHERIES

The Hawaii-based pelagic longline fleet (defined as those vessels registered to Hawaii limited access longline permits) is the largest fishery managed by the FMP. The longline fleet has historically operated in two distinct modes based on gear deployment: deep-setting by vessels that target primarily tuna and shallow-setting by those that target swordfish or have mixed target trips. Swordfish and mixed target sets are buoyed to the surface, have few hooks between floats, and are relatively shallow. These sets use a large number of lightsticks since swordfish are primarily targeted at night. Tuna sets use a different type of float placed much further apart, have more hooks per foot between the floats and the hooks are set much deeper in the water column. These sets must be placed by use of a line shooter to provide slack in the line which allows it to sink.

The longline fishery accounted for the majority of Hawaii's commercial pelagic landings (17.3 million lb) in 2003 (Table 1). The fleet includes a few wood and fiberglass vessels, and many newer steel longliners that were previously engaged in fisheries off the U.S. mainland. There is a maximum vessel length of 101 ft in length and the total number is limited to 164 vessels by a limited entry program.

**Table 1 Hawaii-based longline fishery landings 1999-2003** (WPRFMC, 2004b)

| Item | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|
| Area Fished | EEZ and high seas | EEZ and high seas | EEZ and high seas | EEZ and high seas | EEZ and high seas |
| Total Landings (million lbs) | 28.3 | 23.8 | 15.6 | 17.5 | 17.4 |
| Catch Composition* | | | | | |
| Tuna | 41% | 41% | 52% | 52% | 65% |
| Swordfish | 9% | 9% | 1% | 1% | 2% |
| Miscellaneous | 32% | 32% | 36% | 37% | 31% |
| Sharks | 18% | 18% | 11% | 10% | 2% |
| Season | All year | All year | All year | All year | All year |
| Active Vessels | 119 | 125 | 101 | 100 | 110 |
| Total Permits | 164 | 164 | 164 | 164 | 164 |
| Total Trips | 1,138 | 1,103 | 1,034 | 1,165 | 1,215 |
| Total Ex-vessel Value (adjusted) ($millions) | $50.5 | $52.5 | $34.1 | $38.4 | $38.6 |

* Number of fish

A survey conducted by O'Malley and Pooley (2003) provides estimates of average income for various vessel classes in the Hawaii-based longline fleet in 2000 (Table 2). Only vessels that were interviewed in the survey were included in the final income statements, which include fixed costs, variable costs, labor costs, and gross and net revenue. These tables were calculated by including zero costs in the calculated averages for each vessel target and classification. Swordfish and tuna vessels earned a net return of $27,484 and $55,058, respectively. Among the tuna vessels, the small vessels were the most profitable. These vessels had higher gross revenues and, consequently, higher labor costs but lower fixed and variable costs. On average swordfish vessels were larger than tuna vessels and had higher levels of capitalization and greater operating expenses (NMFS 2001a).[18] Large swordfish vessels were generally more profitable than smaller swordfish vessels due to higher gross revenues.

**Table 2 Reported Average Annual Revenue and Costs for the Hawaii-based Longline Fleet, 2000.[1]** (Source: O'Malley and Pooley 2003)

| Category | Swordfish average | Tuna average | Small tuna average | Medium tuna average | Large tuna average | Medium swordfish average | Large swordfish average |
|---|---|---|---|---|---|---|---|
| Gross revenue ($) | 490,301 | 495,456 | 502,740 | 496,578 | 485,286 | 459,465 | 526,277 |
| Fixed costs total ($) | 93,207 | 90,597 | 66,409 | 93,056 | 84,433 | 81,520 | 105,633 |
| Variable costs total ($) | 230,232 | 184,986 | 147,503 | 182,868 | 239,749 | 239,928 | 221,449 |
| Labor costs ($) | 139,379 | 164,815 | 187,685 | 167,378 | 142,896 | 114,422 | 160,619 |
| Total costs ($) | 462,818 | 440,398 | 401,597 | 443,302 | 467,078 | 435,870 | 487,701 |
| Net revenue ($) | 27,483 | 55,058 | 101,143 | 53,276 | 18,208 | 23,595 | 385,776 |

[1]Vessels are classified by size (small <56 ft, medium 56.1 ft to 73.9 ft, large >74 ft) and target (tuna or swordfish)

## IV. DESCRIPTION OF THE ALTERNATIVES

A series of strategies available to achieve the seabird action objective were evaluated alone and in combination to arrive at 24 alternatives considered for the fishery (See Section 8 of the main body of this document for a full discussion of these strategies and combinations). These are discussed below.

[18] Swordfish vessels were typically larger than tuna vessels because they generally operated in the rougher sea and weather conditions of more northerly waters (NMFS, 2001). In addition, the fishing grounds for swordfish are more distant. Between 1991 and1998, the average distance traveled to first set by swordfish vessels was 570 miles, whereas the average distance traveled by tuna vessels was 275 miles.

The "no action" alternative means maintaining the current suite of measures implemented by current regulations. The action alternatives consist of a range of combinations of seabird deterrent measures as discussed above, and all alternatives would maintain the current requirements for Hawaii-based longline vessel owners and operators to follow seabird handling regulations and to annually attend a NMFS protected species workshop.

***<u>Alternative 1 No Action:</u> Use current mitigation measures when fishing north of 23 °N.***

The current measures appear in Section 660 of Title 50 of the Code of Federal Regulations as follows:

(a) Seabird mitigation techniques. Owners and operators of vessels registered for use under a Hawaii longline limited access permit must ensure that the following actions are taken when fishing north of 23° N. lat.:

(1) Employ a line setting machine or line shooter to set the main longline when making deep sets using monofilament main longline;

(2) Attach a weight of at least 45 g to each branch line within 1 m of the hook when making deep sets using monofilament main longline;

(3) When using basket-style longline gear, ensure that the main longline is deployed slack to maximize its sink rate;

(4) Use completely thawed bait that has been dyed blue to an intensity level specified by a color quality control card issued by NMFS;

(5) Maintain a minimum of two cans (each sold as 0.45 kg or 1 lb size) containing blue dye on board the vessel;

(6) Discharge fish, fish parts (offal), or spent bait while setting or hauling longline gear, on the opposite side of the vessel from where the longline gear is being set or hauled;

(7) Retain sufficient quantities of fish, fish parts, or spent bait, between the setting of longline gear for the purpose of strategically discharging it in accordance with paragraph (a)(6) of this section;

(8) Remove all hooks from fish, fish parts, or spent bait prior to its discharge in accordance with paragraph (a)(6) of this section; and

(9) Remove the bill and liver of any swordfish that is caught, sever its head from the trunk and cut it in half vertically, and periodically discharge the butchered heads and livers in accordance with paragraph (a)(6) of this section.

(10) When shallow-setting north of 23° N. lat., begin the deployment of longline gear at least one hour after local sunset and complete the deployment no later than local sunrise, using only the minimum vessel lights necessary for safety.

(b) *Short-tailed albatross handling techniques.* If a short-tailed albatross is hooked or entangled by a vessel registered for use under a Hawaii longline limited access permit, owners and operators must ensure that the following actions are taken:

(1) Stop the vessel to reduce the tension on the line and bring the bird on board the vessel using a dip net;

(2) Cover the bird with a towel to protect its feathers from oils or damage while being handled;

(3) Remove any entangled lines from the bird;

(4) Determine if the bird is alive or dead.

(i) If dead, freeze the bird immediately with an identification tag attached directly to the specimen listing the species, location and date of mortality, and band number if the bird has a leg band. Attach a duplicate identification tag to the bag or container holding the bird. Any leg bands present must remain on the bird. Contact NMFS, the Coast Guard, or the U.S. Fish and Wildlife Service at the numbers listed on the Short-tailed Albatross Handling Placard distributed at the NMFS protected species workshop, inform them that you have a dead short-tailed albatross on board, and submit the bird to NMFS within 72 hours following completion of the fishing trip.

(ii) If alive, handle the bird in accordance with paragraphs (b)(5) through (b)(10) of this section.

(5) Place the bird in a safe enclosed place;

(6) Immediately contact NMFS, the Coast Guard, or the U.S. Fish and Wildlife Service at the numbers listed on the Short-tailed Albatross Handling Placard distributed at the NMFS protected species workshop and request veterinary guidance;

(7) Follow the veterinary guidance regarding the handling and release of the bird.

(8) Complete the short-tailed albatross recovery data form issued by NMFS.

(9) If the bird is externally hooked and no veterinary guidance is received within 24–48 hours, handle the bird in accordance with paragraphs (c)(4) and (c)(5) of this section, and release the bird only if it meets the following criteria:

(i) Able to hold its head erect and respond to noise and motion stimuli;

(ii) Able to breathe without noise;

(iii) Capable of flapping and retracting both wings to normal folded position on its back;

(iv) Able to stand on both feet with toes pointed forward; and

(v) Feathers are dry.

(10) If released under paragraph (a)(8) of this section or under the guidance of a veterinarian, all released birds must be placed on the sea surface.

(11) If the hook has been ingested or is inaccessible, keep the bird in a safe, enclosed place and submit it to NMFS immediately upon the vessel's return to port. Do not give the bird food or water.

(12) Complete the short-tailed albatross recovery data form issued by NMFS.

(c) *Non-short-tailed albatross seabird handling techniques.* If a seabird other than a short-tailed albatross is hooked or entangled by a vessel registered for use under a Hawaii longline limited access permit owners and operators must ensure that the following actions are taken:

(1) Stop the vessel to reduce the tension on the line and bring the seabird on board the vessel using a dip net;

(2) Cover the seabird with a towel to protect its feathers from oils or damage while being handled;

(3) Remove any entangled lines from the seabird;

(4) Remove any external hooks by cutting the line as close as possible to the hook, pushing the hook barb out point first, cutting off the hook barb using bolt cutters, and then removing the hook shank;

(5) Cut the fishing line as close as possible to ingested or inaccessible hooks;

(6) Leave the bird in a safe enclosed space to recover until its feathers are dry; and

(7) After recovered, release seabirds by placing them on the sea surface.

In addition all Hawaii-based longline vessel owners and operators must attend an annual NMFS protected species workshop.

***Alternative 2A**: **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.

For the purposes of this document and analysis, when side setting vessel operators would be required to comply with the following specifications:

- Side set as far forward from the stern as possible
- Deploy a bird curtain between the setting position and the stern
- Throw baited hooks forward as close to the vessel hull as possible
- Clip deployed branchlines to the mainline the moment that the vessel passes the baited hook to minimize tension in the branch line, which could cause the baited hook to be pulled towards the sea surface

***Alternative 2B**: **Use current mitigation measures <u>or</u> use side setting, in all areas.***

Under this alternative, operators of Hawaii-based 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.

***Alternative 3A:** **Use current mitigation measures <u>or</u> use an underwater setting chute, when fishing north of 23 °N.***

Under this alternative, operators of Hawaii-based 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 3B:** **Use current mitigation measures <u>or</u> use an underwater setting chute, in all areas.***

Under this alternative, operators of Hawaii-based 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 4A:** **Use current mitigation measures <u>or</u> use a tori line, when fishing north of 23 °N.***

Under this alternative, operators of Hawaii-based 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 general design used by McNamara et al. (1999) and Boggs (2001), when fishing north of 23 °N. Boggs (2001) and McNamara et al (1999) both provided specifications for single tori lines that were effective in reducing interactions with seabirds in their studies. In the study conducted by Boggs, a 150 m tori line comprised a 10 m attachment made of 6 mm yellow twisted polypropylene; a 40 m aerial streamer segment made of the same material with seven forked branch streamers, an 85 m x 3 mm red twisted nylon trailing segment with 8 small streamers on the first 40 m and a 15 m x 12 mm yellow twisted polypropylene drogue segment. The streamer line was flown from a commercially manufactured fiberglass pole mounted 4 m forward of the stern, extending 10 m above the water and 2 m outboard. The streamer line was about 8 m high at the stern and the ends of the first forked streamer dangled just above the water, 10 m behind the stern, about 5 m directly aft of the bait entry point. It is important to note, however, that Boggs' study was conducted aboard a NMFS research vessel, thus the mounting of the tori line is higher would be possible onboard a commercial longline vessel.

In McNamara et al.'s (1999) study, the tori line varied from 140 -175 m in length depending on the zone of opportunity established for individual vessels. The line consisted of ¼ inch three strand polypropylene line, and six detachable aerial streamers. The aerial streamers were made of flexible material that moved just above the water's surface. The portion of the tori line that trailed in the water had short (10-25 cm) plastic streamers. The tori line that trailed in the water had short (10-25 cm) plastic streamers. The tori line incorporated a ½ inch hollow braid polypropylene drogue section at the terminal end. The tori line was positioned directly above the area where baited hooks were deployed. The height of the attachment point, length of the tori line, and weight of the aerial streamers determined the distance that the aerial streamer portion of the line remained aloft behind the vessel. A tori line of similar length specifications (140 -175m) was also deployed with a buoy at the end of the line, and with 1 m long plastic aerial streamers, and 10 inch water streamers.

Both Boggs (2001) and McNamara et al (1999) based the design of the tori lines used in their respective studies on tori lines used aboard pelagic longliners in the southern bluefin tuna fishery (Brothers et al (1994).

***Alternative 4B:* Use current mitigation measures *or* use a tori, in all areas.**

Under this alternative, operators of Hawaii-based 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 general design used by McNamara et al. (1999) and Boggs (2001), in all areas.

***Alternative 5A:* 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-based 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 5B:* Use current mitigation measures *or* use side setting *or* use an underwater setting chute, in all areas.**

Under this alternative, operators of Hawaii-based 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 6A:* Use current mitigation measures *or* use side setting *or* use an underwater setting chute *or* use a tori line, when fishing north of 23 °N.**

Under this alternative, operators of Hawaii-based 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 general design used by McNamara et al. (1999) and Boggs (2001), when fishing north of 23 °N.

***Alternative 6B:* Use current mitigation measures *or* use side setting *or* use an underwater setting chute *or* use a tori line, in all areas.**

Under this alternative, operators of Hawaii-based 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 general design used by McNamara et al. (1999) and Boggs (2001), in all areas.

***Alternative 7A:* Use current measures or use side setting or use a tori line, 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 7B:* Use current measures or use side setting or use a tori line, in all areas.**

Under this alternative, operators of Hawaii-based 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 general design used by McNamara et al. (1999) and Boggs (2001), in all areas.

***Alternative 7C:*** ***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, 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 in conjunction with a line shooter and weighted branch lines, when fishing north of 23 °N.***

Under this alternative operators of Hawaii-based 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 general 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 general design used by McNamara et al. (1999) and Boggs (2001), when fishing north of 23 °N.

***Alternative 7D:.*** ***All deep setting Hawaii-based longline vessels must either side-set, or use a tori line plus the currently required measures (line shooter with weighted branch lines, blue dyed thawed bait and strategic offal discards) when fishing north of 23 ° - with the requirement to use strategic offal discards modified to require that vessel operators use them only when seabirds are present. All shallow setting Hawaii-based longline vessels must either side-set, or use a tori line plus the currently required measures (night-setting, blue dyed thawed bait and strategic offal discards) wherever they fish - with the requirement to use strategic offal discards modified to require that vessel operators use them only when seabirds are present.***

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

Operators of Hawaii longline vessels targeting tuna (deep-setting) could elect to (a) use the modified current measures as described above with the addition of one or more tori bird-scaring lines according to the general design used by McNamara et al. (1999) and Boggs (2001), or (b) employ side setting with 60g swivels within 1m of the hook, when fishing north of 23 °N.

***Alternative 8A*: Use current mitigation measures *plus* side setting, when fishing north of 23 °N.**

Under this alternative, operators of Hawaii-based 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 8B*: Use current mitigation measures *plus* side setting, in all areas.**

Under this alternative, operators of Hawaii-based 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 9A*: Use side setting when fishing north of 23 °N.**

Under this alternative, operators of Hawaii-based 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 9B*: Use side setting in all areas.**

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

***Alternative 10A:* Use side setting *unless* technically infeasible[1], in which case use current mitigation measures, when fishing north of 23 °N.**

Under this alternative, operators of Hawaii-based 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.

***Alternative 10B:* Use side setting *unless* technically infeasible, in which case use current mitigation measures, in all areas.**

Under this alternative, operators of Hawaii-based 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 11A:* Use side setting *unless* technically infeasible, in which case either use current mitigation measures without blue bait or strategic offal discards (shallow-setting**

[1] The criteria for side setting infeasibility would be formulated by NMFS, in consultation with the Council and fishing industry during the rulemaking process.

***vessels set at night, deep-setting vessels use line shooters with weighted branch lines), <u>or</u> an underwater setting chute <u>or</u> 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 general 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 general design used by McNamara et al. (1999) and Boggs (2001), when setting north of 23 °N.

***<u>Alternative 11B:</u> Use side setting <u>unless</u> technically infeasible, in which case: swordfish (shallow-setting) vessels set at night, <u>or</u> use an underwater setting chute, <u>or</u> use a tori line, and tuna (deep-setting) vessels use current measures, <u>or</u> use an underwater setting chute, <u>or</u> use 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 general 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 general design used by McNamara et al. (1999) and Boggs (2001), in all areas.

***<u>Alternative 12:</u> Voluntarily use side setting, an underwater setting chute, a tori line, 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 general 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 summary of these alternatives is provided in Table 3.

**Table 3 Seabird mitigation measures included in each alternative. (Current requirements for annual protected species workshop attendance and seabird handling protocols would remain in place under all under all alternatives.)**

| Alt. | Description |
|---|---|
| 1 | CURRENT MEASURES<br>**All Hawaii-based longline vessels** fishing north of 23° N. must:<br>Discharge offal and spent bait on the opposite side from setting or hauling<br>Use blue-dyed, thawed bait, and have a minimum of 2 cans of dye onboard<br><br>**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]<br><br>**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 |
| 2A | Use current mitigation measures **OR** use side setting, when fishing north of 23° N. |
| 2B | Use current mitigation measures **OR** use side setting, in all areas |
| 3A | Use current mitigation measures **OR** use an underwater setting chute, when fishing north of 23° N. |
| 3B | Use current mitigation measures **OR** use an underwater setting chute, in all areas |
| 4A | Use current mitigation measures **OR** use a tori line (e.g. paired streamer lines), when fishing north of 23° N. |
| 4B | Use current mitigation measures **OR** use a tori line (e.g. paired streamer lines), in all areas |
| 5A | Use current mitigation measures **OR** use side setting **OR** use an underwater setting chute, when fishing north of 23° N. |
| 5B | Use current mitigation measures **OR** use side setting **OR** use an underwater setting chute, in all areas |
| 6A | 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. |

| | |
|---|---|
| 6B | 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 |
| 7A | Use current mitigation measures **OR** use side setting **OR** use a tori line (e.g. paired streamer lines), when fishing north of 23° N. |
| 7B | Use current mitigation measures **OR** use a tori line (e.g. paired streamer lines), in all areas |
| 7C | a. In all areas, shallow setting boats use current mitigation measures, excluding the requirement to use blue-dyed bait, **OR** use side setting **OR** use an underwater setting chute **OR** use a tori line (e.g. paired streamer lines).<br><br>b. North of 23° N. Lat., deep setting boats use current mitigation measures, excluding the requirement to use blue-dyed bait, **OR** use side setting **OR** use an underwater setting chute **OR** use a tori line (e.g. paired streamer lines), in conjunction with a line shooter and weighted branchlines. |
| 7D | a. All deep setting Hawaii-based longline vessels must either side-set, or use a tori line plus the currently required measures (line shooter with weighted branch lines, blue dyed thawed bait and strategic offal discards) when fishing north of 23° - with the requirement to use strategic offal discards modified to require that vessel operators use them only when seabirds are present;<br><br>b. All shallow setting Hawaii-based longline vessels must either side-set, or use a tori line plus the currently required measures (night-setting, blue dyed thawed bait and strategic offal discards) wherever they fish - with the requirement to use strategic offal discards modified to require that vessel operators use them only when seabirds are present. |
| 8A | Use current mitigation measures **PLUS** side setting, when fishing north of 23° N. |
| 8B | Use current mitigation measures **PLUS** side setting, in all areas |
| 9A | Use side setting when fishing north of 23° N. |
| 9B | Use side setting in all areas |
| 10A | Use side setting **UNLESS** technically infeasible in which case use current mitigation measures, when fishing north of 23° N. |
| 10B | Use side setting **UNLESS** technically infeasible in which case use current mitigation measures, in all areas |

| | |
|---|---|
| 11A | Use side setting **UNLESS** technically infeasible, in which case use an underwater setting chute **OR** a tori line **OR** 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), when fishing north of 23° N. |
| 11B | Use side setting **UNLESS** technically infeasible, in which case use an underwater setting chute **OR** a tori line **OR** 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), in all areas |
| 12 | Voluntarily use side setting, **OR** night-setting, **OR** an underwater setting chute, **OR** a tori line, **OR** a line shooter with weighted branch lines, when fishing 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

## V. SKILLS NECESSARY TO MEET COMPLIANCE REQUIREMENTS

No special skills would be required to comply with the proposed requirements. To the extent that side setting or using a tori line is unfamiliar to some participants NMFS may provide additional training at their protected species workshops.

## VI. IDENTIFICATION OF DUPLICATING, OVERLAPPING, AND CONFLICTING FEDERAL RULES

To the extent practicable, it has been determined that there are no Federal rules that may duplicate, overlap, or conflict with this proposed rule.

## VIII. DESCRIPTION OF SMALL BUSINESSES TO WHICH THE RULE WOULD APPLY

The preferred alternative applies only to the Hawaii-based longline fishery, which has operated since the early 1990s has operated under a limited entry program, with a total 164 permits. The majority of commercial fishing vessels are owner operated however some individuals hold permits for more than one vessel, or own more than one vessel. Maximum fleet (vessel) percentage ownership by any one individual or entity is believed to be less than 10%. All these fishing operations are believed to be small businesses; that is, they have gross revenues of less than $3.5 million annually, they are independently owned and operated, and they are not dominant in their field.

## IX. ECONOMIC IMPACTS OF THE ALTERNATIVES ON SMALL BUSINESSES

As shown in Table 4, the percentage of active vessels fishing north of 23° N ranged from 76% to 99% between 1998 and 2003. Since 2001, the percentage of vessels fishing above this latitude has been around 91%. The reasons for the percentage changes that occurred between 1998 and 2000 or the relative stability in recent years are uncertain, but they are likely related to changes in the comparative productivity of fishing grounds. In 1998, for example, the longline fleet exerted more than the usual amount of effort in the U.S. EEZ around Palmyra Atoll and Kingman Reef (south of 23° N) (pers. comm, Russell Ito, NMFS Pacific Islands Science Center, 12/06/02). More recently, there has been an increase in deep-set longline activity north of 23° N. Vessels have been catching large, high quality bigeye tuna in this area during the summer months.

**Table 4. Percentage of Active Hawaii-based Longline Vessels Fishing North of 23°N, 1998-2003.** (Source: WPRFMC 2004a and NMFS Pacific Islands Science Center)

| | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|
| Number of active vessels | 114 | 119 | 125 | 101 | 100 | 110 |
| Number of vessels fishing north of 23°N | 87 | 118 | 110 | 92 | 92 | 100 |
| Percentage of vessels fishing north of 23°N | 76% | 99% | 88% | 91% | 92% | 91% |

Table 5 shows that in 2003, there was no clear distinction between the number of vessels fishing above and below 23° N for different vessel size groups. However, fishing grounds north of 23° N accounted for 19% of the fishing effort (sets) of small vessels, 25% of the effort of medium vessels, and 30% of the effort of large vessels.

**Table 5. Distribution of Fishing Effort in the Hawaii-based Longline Fishery, 1998-2003.**[1] (Source: NMFS Pacific Islands Science Center)

| Location | Vessel size | Number of vessels | Number of deep-sets | Number of shallow-sets | Total number of sets |
|---|---|---|---|---|---|
| | | **1998** | | | |
| North of 23°N | Small | 12 | 141 | 74 | 215 |
| | Medium | 37 | 446 | 1,562 | 2,008 |
| | Large | 38 | 122 | 2,830 | 2,952 |
| | Subtotal | 87 | 709 | 4,466 | 5,175 |
| South of 23°N | Small | 19 | 1,880 | 67 | 1,947 |
| | Medium | 49 | 3,498 | 258 | 3,756 |
| | Large | 33 | 1,426 | 201 | 1,627 |
| | Subtotal | 101 | 6,804 | 526 | 7,330 |
| | | Total | 7,513 | 4,992 | 12,505 |
| | | **1999** | | | |
| North of 23°N | Small | 17 | 654 | 42 | 696 |
| | Medium | 50 | 1,136 | 1,406 | 2,542 |
| | Large | 51 | 532 | 2,335 | 2,867 |
| | Subtotal | 118 | 2,322 | 3,783 | 6,105 |
| South of 23°N | Small | 19 | 1,540 | 78 | 1,618 |
| | Medium | 49 | 3,220 | 116 | 3,336 |
| | Large | 27 | 1,635 | 111 | 1,746 |
| | Subtotal | 95 | 6,395 | 305 | 6,700 |
| | | Total | 8,717 | 4,088 | 12,805 |
| | | **2000** | | | |
| North of 23°N | Small | 14 | 249 | 81 | 330 |

| Location | Vessel size | Number of vessels | Number of deep-sets | Number of shallow-sets | Total number of sets |
|---|---|---|---|---|---|
| | Medium | 44 | 345 | 1,053 | 1,398 |
| | Large | 52 | 138 | 2,424 | 2,562 |
| | Subtotal | 110 | 732 | 3,558 | 4,290 |
| South of 23°N | Small | 19 | 1,821 | 73 | 1,894 |
| | Medium | 46 | 3,796 | 322 | 4,118 |
| | Large | 34 | 2,505 | 124 | 2,629 |
| | Subtotal | 99 | 8,122 | 519 | 8,641 |
| | | Total | 8,854 | 4,077 | 12,931 |
| | | 2001 | | | |
| North of 23°N | Small | 13 | 283 | 33 | 316 |
| | Medium | 42 | 1,162 | 189 | 1,351 |
| | Large | 37 | 954 | 316 | 1,270 |
| | Subtotal | 92 | 2,399 | 538 | 2,937 |
| South of 23°N | Small | 18 | 1,801 | 3 | 1,804 |
| | Medium | 46 | 4,602 | 75 | 4,677 |
| | Large | 36 | 2,747 | 21 | 2,768 |
| | Subtotal | 100 | 9,150 | 99 | 9,249 |
| | | Total | 11,549 | 637 | 12,186 |
| | | **2002** | | | |
| North of 23°N | Small | 11 | 356 | 0 | 356 |
| | Medium | 45 | 1,605 | 0 | 1,605 |
| | Large | 36 | 1,483 | 0 | 1483 |
| | Subtotal | 92 | 3,444 | 0 | 3,444 |
| South of 23°N | Small | 17 | 1,795 | 0 | 1,795 |
| | Medium | 47 | 5,021 | 0 | 5,021 |
| | Large | 38 | 3,625 | 0 | 3,625 |
| | Subtotal | 102 | 10,441 | 0 | 10,441 |
| | | Total | 13,885 | 0 | 13,885 |
| | | **2003** | | | |
| North of 23°N | Small | 13 | 388 | 0 | 388 |
| | Medium | 48 | 1,703 | 4 | 1,707 |
| | Large | 39 | 1,744 | 0 | 1,744 |
| | Subtotal | 100 | 3,835 | 4 | 3,839 |
| South of 23°N | Small | 15 | 1,644 | 0 | 1,644 |
| | Medium | 52 | 5,230 | 0 | 5,230 |
| | Large | 43 | 4,023 | 0 | 4,023 |
| | Subtotal | 110 | 10,897 | 0 | 10,897 |
| | | Total | 14,732 | 4 | 14736 |

[1]Vessels are classified by size (small <56 ft, medium 56.1 ft to 73.9 ft, large >74 ft)

**Alternative 1: No action**
Alternative 1 is considered the baseline case against which all other alternatives are compared. In general, the description of Alternative 1 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 6 summarizes the projected catches of the Hawaii-based longline fleet under Alternative 1 for a one-year period.

**Table 6 Predicted Annual Catch of the Hawaii-based Longline Fleet Under Alternative 1.**
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 calendar 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 utilize 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.

The current requirements for seabird mitigation 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. 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 $150 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.

Based on a projection of the number of sets that will occur north of 23°N, the costs of continuing to use current mitigation methods can be estimated for the Hawaii-based longline fleet (Table 7). Current mitigation methods do not entail any installation or set-up costs. Moreover, the costs of a line-shooter, weighted branch lines, and equipment required for handling of hooked seabirds should not be considered compliance costs, as these costs are routinely incurred by all Hawaii longline vessels targeting tuna. However, current mitigation methods do involve some annual costs. The fleet-wide annual cost of using blue-dyed bait is anticipated to be about $68,992, assuming a cost of $14 per set. This estimate likely overstates bait-related compliance costs because, as noted above, a number of vessels routinely dye a portion of their bait blue in order to increase its allure to target fish species.

**Table 7. Predicted Fishery Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative 1** (Source: NMFS 2005)

| Vessel Type | Area Where Mitigation Method Applies | Mitigation Method | Percentage of Vessels Choosing Mitigation Method | Predicted No. of Affected Vessels | Predicted No. of Affected Sets | Predicted Installation/ Set-up Costs | Predicted Annual Costs |
|---|---|---|---|---|---|---|---|
| Tuna | North of 23 °N | Current Methods | 100 | 111 | 3,090 | $0 | $59,910 |
| Swordfish | North of 23 °N | Current Methods | 100 | 21 | 184 | $0 | $28,882 |
| | | | | | **Total** | $0 | $88,792 |

Based on the total number of predicted sets (14,285), the total number of active longline vessels is expected to be about 143, assuming a typical longline vessel makes 100 sets per year. Further, based on the number of predicted deep-sets (12,165) and shallow-sets (2,120), the number of tuna vessels and swordfish vessels is expected to be 121 and 21, respectively.

However, not all of these vessels may fish north of 23 °N. Based on the information above, this analysis assumed that all 21 swordfish vessels fish north of 23 °N at least once a year, but only 111 (91%) of the 121 tuna boats fish above this latitude. The analysis further assumed that from year to year it will be same vessels that restrict their fishing effort to grounds south of 23 °N. All vessels that fish north of 23 °N at least once would incur the costs of buying containers to store offal for discarding under Alternative 1. Assuming an annual cost of $150 per vessel for containers, the cost for all affected vessels is estimated to be about $19,800.

As shown in Table 7, the total annual compliance costs for the Hawaii-based longline fleet is estimated to be $88,792 under Alternative 1. The cost-earnings study by O'Malley and Pooley (2003) reports that the average annual total costs of operating a swordfish vessel and tuna vessel are about $462,000 and $441,000, respectively. Assuming a future affected fleet size of 111 tuna boats and 21 swordfish boats, the total annual costs of the fleet would be $59 million.

As noted above, the compliance costs of current measures to mitigate seabird interactions are not evenly distributed across the fleet. In 2003, fishing grounds north of 23 °N accounted for 19% of the fishing effort of small vessels (<56 ft), 25% of the effort of medium vessels (56.1 ft-73.9 ft), and 30% of the effort of large vessels (>74 ft).Consequently, small vessels are expected to bear the lowest proportion of the predicted fleet-wide compliance costs under Alternative 1, and large vessels are anticipated to bear the highest share.

**Alternative 2A: Use either current methods or side setting north of 23 N**

In comparison to Alternative 1, 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. Allowing vessel operators to choose between the current measures or side setting would increase flexibility and address safety concerns by offering the choice of current measures for those vessel operators unwilling to switch to 60 g weights. It also allows for the possibility that not all vessels can be configured for side setting.

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 1 (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) (WPRFMC 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.

The estimated economic effects of side setting are summarized in Table 8. All boats that choose side setting would be required to employ a bird curtain, which Gilman et al.(2003) estimated to cost about $50. The bird curtain prevents birds from establishing a flight path along the side of the boat where baited hooks are deployed. In addition, all vessels would need to switch from 45 g to 60 g weighted swivels. The higher swivel weight is recommended by Gilman et al. to increase the bait sink rate. The cost of new swivels and crimps is about $2,500 (WPRFMC 2004c). It is estimated that about 70% of the longline vessels currently fishing in Hawaii already use 60 g weighted swivels (WPRFMC 2004c), with the remaining vessels using the required 45 g weight when deep set fishing north of 23 °N.

Converting to side setting would also generally require some adjustment of the deck design. According to WPRFMC (2004c), a typical vessel in the Hawaii longline fleet would have to spend about $1,500 to alter its deck design for side setting. Gilman et al. (2003) noted that 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 from the vessel stern, the more effective side setting is at avoiding seabird interactions (also, the further forward the setting position, the easier it is to contend with tote tangles and inadvertently badly thrown baits). According to Gilman et al., a vessel needs a minimum of 0.5 m from the stern corner to allow space to mount a bird curtain aft of the line-shooter. 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.

Gilman et al. (2003) concluded that it is likely that side setting can be employed on all vessels in the Hawaii-based longline fleet; however, the researchers noted that a small number of vessels in the fleet may have limited options to mount line-shooters for side setting from a position far forward from the stern. Industry representatives indicated that some boat owners may need to reconfigure the entire deck of their vessels before they could employ side setting, including moving the mainline spool (pers. comm., Karla Gore, NMFS Pacific Islands Fisheries Regional Office). Such a reconfiguration could entail substantial expenses for labor and materials as well as lost fishing time. Smaller vessels, in particular, may find it costly to convert to side setting because of structural limitations (pers. comm., Karla Gore, NMFS Pacific Islands Fisheries Regional Office, WPRFMC 2004c). Because reconfiguring some vessels for side setting may be expensive, the WPFMC has recommended that NMFS provide low-interest loans or State of Hawaii Fisheries Disaster Relief Program funds to fishermen to reduce these costs (WPFMC, 123rd Meeting, June 21-24, 2004).[2]

Gilman et al. (2003) noted 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 catch rates.

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 to starboard and hard to 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. 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.

Based on a projection of the number of sets that will occur north of 23 °N and an estimate of the percentage of vessels that would employ each of the available mitigation method options, the costs of Alternative 2A can be estimated for the Hawaii-based longline fleet (Table 8). The number of affected vessels and costs of current methods were estimated as in Alternative 1. The installation/set-up costs of side setting is estimated to be about $4,000 for a typical vessel, including deck reconfiguration and new swivels and crimps (WPRFMC 2004c). (Many vessels will not need to purchase new swivels and crimps because they already use 60 g weighted swivels; on the other hand, the estimated reconfiguration costs do not include possible lost fishing time as a result of extra time spent in port during deck modifications.) In addition, each

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

vessel employing side setting would incur an annual cost of $50 to replace its bird curtain. As shown in Table 8, the predicted compliance costs for the longline fleet under Alternative 2A include $476,000 for installation/set-up costs and $14,802 for annual costs. In comparison to Alternative 1, this represents a $476,000 increase in installation/set-up costs and a $73,990 decrease in annual costs.

**Table 8. Predicted Fishery Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative 2A.** (Source: NMFS 2005)

| Vessel Type | Area Where Mitigation Method Applies | Mitigation Method | Percentage of Vessels Choosing Mitigation Method | Predicted No. of Affected Vessels | Predicted No. of Affected Sets | Predicted Installation/ Set-up Costs | Predicted Annual Costs |
|---|---|---|---|---|---|---|---|
| Tuna | | Current Methods | 10 | 11 | 309 | $0 | $5,976 |
| | North of 23°N | Side Setting | 90 | 100 | 2,781 | $400,000 | $5,000 |
| Swordfish | | Current Methods | 10 | 2 | 184 | $0 | $2,876 |
| | North of 23°N | Side Setting | 90 | 19 | 1,654 | $76,000 | $950 |
| | | | | | **Total** | $476,000 | $14,802 |

**Alternative 2B: Use either current methods or side setting in all areas**

The economic effects of this alternative would be similar to those described under Alternative 2A; the primary differences would be that some vessels that choose to use current methods will incur additional costs and those vessels that fish exclusively south of 23°N would be affected by the regulations. As a result of these differences, the predicted compliance costs for the Hawaii-based longline fleet under Alternative 2B include $516,000 for installation/set-up costs and $28,556 for annual costs (Table 9). In comparison to Alternative 1, this represents a $516,000 increase in installation/set-up costs and a $60,236 decrease in annual costs.

**Table 9. Predicted Fishery Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative 2B.** (Source: NMFS 2005)

| Vessel Type | Area Where Mitigation Method Applies | Mitigation Method | Percentage of Vessels Choosing Mitigation Method | Projected No. of Affected Vessels | Projected No. of Affected Sets | Projected Installation/ Set-up Costs | Projected Annual Costs |
|---|---|---|---|---|---|---|---|
| Tuna | | Current Methods | 10 | 12 | 1,217 | $0 | $18,838 |
| | All | Side Setting | 90 | 110 | 10,948 | $440,000 | $5,500 |
| Swordfish | | Current Methods | 10 | 2 | 212 | $0 | $3,268 |
| | All | Side Setting | 90 | 19 | 1,908 | $76,000 | $950 |
| | | | | | **Total** | $516,000 | $28,556 |

**Alternative 3A: Use either current methods or underwater chute north of 23°N**
In comparison to Alternative 1, 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 1 (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 estimated economic effects of employing an underwater setting chute are summarized in Table 10. 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. However, the underwater setting chute manufactured by Albi Save for use by pelagic longliners is about $2,500 (pers. comm., Eric Gilman, Blue Ocean Institute, 6/13/04). 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 (Gilman et al. 2003). 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. (2003) 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.

Based on a projection of the number of sets that will occur north of 23 °N and an estimate of the percentage of vessels that would employ each of the available mitigation method options, the costs of Alternative 3A can be estimated for the Hawaii-based longline fleet (Table 10). The number of affected vessels and costs of current methods were estimated as in Alternative 1. To be conservative (i.e., more likely to overstate impacts than understate them), this analysis assumed that the cost of an underwater setting funnel is $5,000. The life expectancy of an underwater setting chute is about 20 years (pers. comm., Eric Gilman, Blue Ocean Institute, 6/13/04). Based on a straight-line method of calculating depreciation, the annual cost for the chute is estimated to be about $250. The installation/set-up costs for an underwater chute are estimated to be about $1,000 for a typical vessel. As shown in Table10, the predicted compliance costs for the Hawaii-based longline fleet under Alternative 3A include $119,000 for installation/set-up costs and $38,602 for annual costs. In comparison to Alternative 1, this represents a $119,000 increase in installation/set-up costs and a $50,190 decrease in annual costs.

**Table 10. Predicted Fishery Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative 3A.** (Source: NMFS 2005)

| Vessel Type | Area Where Mitigation Method Applies | Mitigation Method | Percentage of Vessels Choosing Mitigation Method | Projected No. of Affected Vessels | Projected No. of Affected Sets | Projected Installation/ Set-up Costs | Projected Annual Costs |
|---|---|---|---|---|---|---|---|
| Tuna | | Current Methods | 10 | 11 | 309 | $0 | $5,976 |
| | North of 23 °N | Underwater Chute | 90 | 100 | 2,781 | $100,000 | $25,000 |
| Swordfish | | Current Methods | 10 | 2 | 184 | $0 | $2,876 |
| | North of 23 °N | Underwater Chute | 90 | 19 | 1,654 | $19,000 | $4,750 |
| | | | | | Total | $119,000 | $38,602 |

**Alternative 3B: Use either current methods or underwater chute in all areas**

The economic effects of this alternative would be similar to those described under Alternative 3A; the primary differences would be that some vessels that choose to use current methods will incur additional costs and those vessels that fish exclusively south of 23 °N would be affected by the regulations. As a result of these differences, the predicted compliance costs for the Hawaii-based longline fleet under Alternative 3B include $129,000 for installation/set-up costs and $54,356 for annual costs (Table 11). In comparison to Alternative 1, this represents a $129,000 increase in installation/set-up costs and a $34,436 decrease in annual costs.

**Table 11. Predicted Fishery Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative 3B.** (Source: NMFS 2005)

| Vessel Type | Area Where Mitigation Method Applies | Mitigation Method | Percentage of Vessels Choosing Mitigation Method | Projected No. of Affected Vessels | Projected No. of Affected Sets | Projected Installation/ Set-up Costs | Projected Annual Costs |
|---|---|---|---|---|---|---|---|
| Tuna | | Current Methods | 10 | 12 | 1,217 | $0 | $18,838 |
| | All | Underwater Chute | 90 | 110 | 10,948 | $110,000 | $27,500 |
| Swordfish | | Current Methods | 10 | 2 | 212 | $0 | $3,268 |
| | All | Underwater Chute | 90 | 19 | 1,908 | $19,000 | $4,750 |
| | | | | | Total | $129,000 | $54,356 |

**Alternative 4A: Use either current methods or tori line (e.g., paired streamer lines) north of 23°N**

In comparison to Alternative 1, 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 1 (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 WPRFMC (2004c), the cost of a tori line is about $2,000 for the fiberglass pole and $300 for the streamer line. However, McNamara et al. (1999) state that several on-board replacements may be required because of the high 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 deterrent 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.

The estimated economic effects of employing a tori line are summarized in Table 12. 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 is particularly acute at night because of reduced visibility and during the haul back because of frequent changes in the vessel's direction. The slack put into the main line by a line shooter increases the risk of it tangling with the tori line under rough or windy conditions. 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.

Based on a projection of the number of sets that will occur north of 23°N and an estimate of the percentage of vessels that would employ each of the available mitigation method options, the costs of Alternative 4A can be estimated for the Hawaii-based longline fleet (Table 12). The number of affected vessels and costs of current methods were estimated as in Alternative 1. The cost of a fiberglass pole with a streamer line was assumed to be $2,300. Because vessels may need to replace the pole due to breakage, the total annual costs were estimated to be $4,600. Installation of a mount for the tori line is expected to cost $1,000 (WPRFMC 2004c). As shown in Table 12, the predicted compliance costs for the Hawaii-based longline fleet under Alternative 4A include $119,000 for installation/set-up costs and $556,252 for annual costs. In comparison to Alternative 1, this represents an $119,000 increase in installation/set-up costs and a $467,460 increase in annual costs.

**Table 12. Predicted Fishery Costs Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative 4A.** (Source NMFS 2005)

| Vessel Type | Area Where Mitigation Method Applies | Mitigation Method | Percentage of Vessels Choosing Mitigation Method | Projected No. of Affected Vessels | Projected No. of Affected Sets | Projected Installation/ Set-up Costs | Projected Annual Costs |
|---|---|---|---|---|---|---|---|
| Tuna | North of 23 °N | Current Methods | 10 | 11 | 309 | $0 | $5,976 |
| | | Tori Line | 90 | 100 | 2,781 | $100,000 | $460,000 |
| Swordfish | North of 23 °N | Current Methods | 10 | 2 | 184 | $0 | $2,876 |
| | | Tori Line | 90 | 19 | 1,654 | $19,000 | $87,400 |
| | | | | | **Total** | $119,000 | $556,252 |

**Alternative 4B: Use either current methods or tori line (e.g., paired streamer lines) in all**
The economic effects of this alternative would be similar to those described under Alternative 3A; the primary differences would be that some vessels that choose to use current methods will incur additional costs and those vessels that fish exclusively south of 23 °N would be affected by the regulations. As a result of these differences, the predicted compliance costs for the Hawaii-based longline fleet under Alternative 4B include $129,000 for installation/set-up costs and $615,506 for annual costs (Table 13). In comparison to Alternative 1, this represents a $129,000 increase in installation/set-up costs and a $526,714 increase in annual costs.

**Table 13. Predicted Fishery Costs Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative 4B.** (Source: NMFS 2005)

| Vessel Type | Area Where Mitigation Method Applies | Mitigation Method | Percentage of Vessels Choosing Mitigation Method | Projected No. of Affected Vessels | Projected No. of Affected Sets | Projected Installation/ Set-up Costs | Projected Annual Costs |
|---|---|---|---|---|---|---|---|
| Tuna | All | Current Methods | 10 | 12 | 1,217 | $0 | $18,838 |
| | | Tori Line | 90 | 110 | 10,948 | $110,000 | $506,000 |
| Swordfish | All | Current Methods | 10 | 2 | 212 | $0 | $3,268 |
| | | Tori Line | 90 | 19 | 1,908 | $19,000 | $87,400 |
| | | | | | **Total** | $129,000 | $615,506 |

**Alternative 5A: Use either current methods or side setting or underwater chute north of 23°N**

The economic effects of this alternative would be similar to those described for Alternatives 2A and 3A; the primary difference would be 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). The predicted compliance costs for the Hawaii-based longline fleet under Alternative 5A include $437,000 for installation/set-up costs and $17,402 for annual costs (Table 14). In comparison to Alternative 1, this represents a $437,000 increase in installation/set-up costs and a $71,390 decrease in annual costs.

**Table 14. Predicted Fishery Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative 5A.** (Source: NMFS 2005)

| Vessel Type | Area Where Mitigation Method Applies | Mitigation Method | Percentage of Vessels Choosing Mitigation Method | Projected No. of Affected Vessels | Projected No. of Affected Sets | Projected Installation/ Set-up Costs | Projected Annual Costs |
|---|---|---|---|---|---|---|---|
| Tuna | North of 23°N | Current Methods | 10 | 11 | 309 | $0 | $5,976 |
| | | Side Setting | 80 | 89 | 2,472 | $356,000 | $4,450 |
| | | Underwater Chute | 10 | 11 | 309 | $11,000 | $2,750 |
| Swordfish | North of 23°N | Current Methods | 10 | 2 | 184 | $0 | $2,876 |
| | | Side Setting | 80 | 17 | 1,470 | $68,000 | $850 |
| | | Underwater Chute | 10 | 2 | 184 | $2,000 | $500 |
| | | | | | Total | $437,000 | $17,402 |

**Alternative 5B: Use either current methods or side setting or underwater chute in all areas**
The economic effects of this alternative would be similar to those described under Alternative 3A; the primary differences would be that some vessels that choose to use current methods will incur additional costs and those vessels that fish exclusively south of 23 °N would be affected by the regulations. As a result of these differences, the predicted compliance costs for the Hawaii-based longline fleet under Alternative 5B include $474,000 for installation/set-up costs and $31,356 for annual costs (Table 15). In comparison to Alternative 1, this represents a $474,000 increase in installation/set-up costs and a $57,436 decrease in annual costs.

**Table 15. Predicted Fishery Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative 5B.** (Source: NMFS 2005)

| Vessel Type | Area Where Mitigation Method Applies | Mitigation Method | Percentage of Vessels Choosing Mitigation Method | Projected No. of Affected Vessels | Projected No. of Affected Sets | Projected Installation/ Set-up Costs | Projected Annual Costs |
|---|---|---|---|---|---|---|---|
| Tuna | All | Current Methods | 10 | 12 | 1,217 | $0 | $18,838 |
| | | Side Setting | 80 | 98 | 9,731 | $392,000 | $4,900 |
| | | Underwater Chute | 10 | 12 | 1,217 | $12,000 | $3,000 |
| Swordfish | All | Current Methods | 10 | 2 | 212 | $0 | $3,268 |
| | | Side Setting | 80 | 17 | 1,696 | $68,000 | $850 |
| | | Underwater Chute | 10 | 2 | 212 | $2,000 | $500 |
| | | | | | **Total** | $474,000 | $31,356 |

**Alternative 6A: Use either current methods or side setting or underwater chute or tori line (e.g., paired streamer lines) north of 23°N**

The economic effects would be similar to those described for Alternative 5A; the primary difference would be 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). The predicted compliance costs for the Hawaii-based longline fleet under Alternative 6A include $398,000 for installation/set-up costs and $76,552 for annual costs (Table 16). In comparison to Alternative 1, this represents a $398,000 increase in installation/set-up costs and a $12,240 decrease in annual costs.

**Table 16. Predicted Fishery Costs Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative 6A.** (Source: NMFS 2005)

| Vessel Type | Area Where Mitigation Method Applies | Mitigation Method | Percentage of Vessels Choosing Mitigation Method | Projected No. of Affected Vessels | Projected No. of Affected Sets | Projected Installation/ Set-up Costs | Projected Annual Costs |
|---|---|---|---|---|---|---|---|
| Tuna | North of 23°N | Current Methods | 10 | 11 | 309 | $0 | $5,976 |
| | | Side Setting | 70 | 78 | 2,162 | $312,000 | $3,900 |
| | | Underwater Chute | 10 | 11 | 309 | $11,000 | $2,750 |
| | | Tori Line | 10 | 11 | 309 | $11,000 | $50,600 |
| Swordfish | North of 2 °N | Current Methods | 10 | 2 | 184 | $0 | $2,876 |
| | | Side Setting | 70 | 15 | 1,287 | $60,000 | $750 |
| | | Underwater Chute | 10 | 2 | 184 | $2,000 | $500 |
| | | Tori Line | 10 | 2 | 184 | $2,000 | $9,200 |
| | | | | | **Total** | $398,000 | $76,552 |

**Alternative 6B: Use either current methods or side setting or underwater chute or tori line (e.g., paired streamer lines) in all areas**

The economic effects of this alternative would be similar to those described under Alternative 6A; the primary differences would be that some vessels that choose to use current methods will incur additional costs and those vessels that fish exclusively south of 23 °N would be affected by the regulations. As a result of these differences, the predicted compliance costs for the Hawaii-based longline fleet under Alternative 6B include $428,000 for installation/set-up costs and $95,006 for annual costs (Table 17). In comparison to Alternative 1, this represents a $428,000 increase in installation/set-up costs and a $6,214 increase in annual costs.

**Table 17. Predicted Fishery Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative 6B.**

| Vessel Type | Area Where Mitigation Method Applies | Mitigation Method | Percentage of Vessels Choosing Mitigation Method | Projected No. of Affected Vessels | Projected No. of Affected Sets | Projected Installation/ Set-up Costs | Projected Annual Costs |
|---|---|---|---|---|---|---|---|
| Tuna | All | Current Methods | 10 | 12 | 1,217 | $0 | $18,838 |
| | | Side Setting | 70 | 85 | 8,514 | $340,000 | $4,250 |
| | | Underwater Chute | 10 | 12 | 1,217 | $12,000 | $3,000 |
| | | Tori Line | 10 | 12 | 1,217 | $12,000 | $55,200 |
| Swordfish | All | Current Methods | 10 | 2 | 212 | $0 | $3,268 |
| | | Side Setting | 70 | 15 | 1,484 | $60,000 | $750 |
| | | Underwater Chute | 10 | 2 | 212 | $2,000 | $500 |
| | | Tori Line | 10 | 2 | 212 | $2,000 | $9,200 |
| | | | | | **Total** | $428,000 | $95,006 |

**Alternative 7A: Use either current methods or side setting or tori north of 23°N**
The economic effects would be similar to those described for Alternatives 2A and 4A; the primary difference would be 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). The predicted compliance costs for the Hawaii-based longline fleet under Alternative 7A include $437,000 for installation/set-up costs and $73,952 for annual costs (Table 18). In comparison to Alternative 1, this represents a $437,000 increase in installation/set-up costs and a $14,842 decrease in annual costs.

**Table 18. Predicted Fishery Costs Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative 7A.** (Source NMFS 2005)

| Vessel Type | Area Where Mitigation Method Applies | Mitigation Method | Percentage of Vessels Choosing Mitigation Method | Projected No. of Affected Vessels | Projected No. of Affected Sets | Projected Installation/ Set-up Costs | Projected Annual Costs |
|---|---|---|---|---|---|---|---|
| Tuna | North of 23°N | Current Methods | 10 | 11 | 309 | $0 | $5,976 |
| | | Side Setting | 80 | 89 | 2,472 | $356,000 | $4,450 |
| | | Tori Line | 10 | 11 | 309 | $11,000 | $50,600 |
| Swordfish | North of 23°N | Current Methods | 10 | 2 | 184 | $0 | $2,876 |
| | | Side Setting | 80 | 17 | 1,470 | $68,000 | $850 |
| | | Tori Line | 10 | 2 | 184 | $2,000 | $9,200 |
| | | | | | **Total** | $437,000 | $73,952 |

**Alternative 7B: Use either current methods or side setting or tori line in all areas**
The economic effects of this alternative would be similar to those described under Alternative 7A; the primary differences would be that some vessels that choose to use current methods will incur additional costs and those vessels that fish exclusively south of 23 °N would be affected by the regulations. As a result of these differences, the predicted compliance costs for the Hawaii-based longline fleet under Alternative 7B include $474,000 for installation/set-up costs and $92,256 for annual costs (Table 19). In comparison to Alternative 1, this represents a $474,000 increase in installation/set-up costs and a $3,464 increase in annual costs.

**Table 19. Predicted Fishery Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative 7B.** (Source: NMFS 2005)

| Vessel Type | Area Where Mitigation Method Applies | Mitigation Method | Percentage of Vessels Choosing Mitigation Method | Projected No. of Affected Vessels | Projected No. of Affected Sets | Projected Installation/ Set-up Costs | Projected Annual Costs |
|---|---|---|---|---|---|---|---|
| Tuna | All | Current Methods | 10 | 12 | 1,217 | $0 | $18,838 |
| | | Side Setting | 80 | 98 | 9,731 | $392,000 | $4,900 |
| | | Tori Line | 10 | 12 | 1,217 | $12,000 | $55,200 |
| Swordfish | All | Current Methods | 10 | 2 | 212 | $0 | $3,268 |
| | | Side Setting | 80 | 17 | 1,696 | $68,000 | $850 |
| | | Tori Line | 10 | 2 | 212 | $2,000 | $9,200 |
| | | | | | **Total** | $474,000 | $92,256 |

**Alternative 7C: For shallow-sets: use either current methods (without blue-dyed bait) or underwater chute or side setting or tori line in all areas. For deep-sets: use either current methods (without blue-dyed bait) or underwater chute or side setting or tori line north of 23°N**

The economic effects of this alternative would be similar to those described for Alternative 6A; the primary difference would be that those fishermen that choose to use the current mitigation methods would not incur the costs and operational difficulties of using blue-dyed bait. The predicted compliance costs for the Hawaii-based longline fleet under Alternative 7C include $398,000 for installation/set-up costs and $69,650 for annual costs (Table 20). In comparison to Alternative 1, this represents a $398,000 increase in installation/set-up costs and a $19,142 decrease in annual costs.

**Table 20. Predicted Fishery Costs Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative 7C.** (Source: NMFS 2005)

| Vessel Type | Area Where Mitigation Method Applies | Mitigation Method | Percentage of Vessels Choosing Mitigation Method | Projected No. of Affected Vessels | Projected No. of Affected Sets | Projected Installation/ Set-up Costs | Projected Annual Costs |
|---|---|---|---|---|---|---|---|
| Tuna | North of 23°N | Current Methods wo/BDB | 10 | 11 | 309 | $0 | $1,650 |
| | | Side Setting | 70 | 78 | 2,163 | $312,000 | $3,900 |
| | | Underwater Chute | 10 | 11 | 309 | $11,000 | $2,750 |
| | | Tori Line | 10 | 11 | 309 | $11,000 | $50,600 |
| Swordfish | All | Current Methods wo/BDB | 10 | 2 | 212 | $0 | $300 |
| | | Side Setting | 70 | 15 | 1,484 | $60,000 | $750 |
| | | Underwater Chute | 10 | 2 | 212 | $2,000 | $500 |
| | | Tori Line | 10 | 2 | 212 | $2,000 | $9,200 |
| | | | | | **Total** | $398,000 | $69,650 |

**Alternative 7D: For shallow-sets: use either side setting or current methods and tori lines in all areas. For deep-sets: use either side setting or current methods and tori lines north of 23°N**

For vessels targeting swordfish (shallow-setting) the economic effects of this alternative would be similar to those described under Alternative 2B; the primary difference would be that those vessels that do not choose side setting would incur the costs of both current methods and tori lines. For vessels targeting tuna (deep-setting) the economic effects of this alternative would be similar to those described under Alternative 2A; as with swordfish vessels, the primary difference would be that those tuna vessels that do not choose side setting would incur the costs of both current methods and tori lines. The predicted compliance costs for the Hawaii-based longline fleet under Alternative 7D include $507,000 for installation/set-up costs and $43,154 for annual costs (Table 21). In comparison to Alternative 1, this represents a $507,000 increase in installation/set-up costs and a $45,638 decrease in annual costs.

**Table 21. Predicted Fishery Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative 7D.** (Source: NMFS 2005)

| Vessel Type | Area Where Mitigation Method Applies | Mitigation Method | Percentage of Vessels Choosing Mitigation Method | Projected No. of Affected Vessels | Projected No. of Affected Sets | Projected Installation/ Set-up Costs | Projected Annual Costs |
|---|---|---|---|---|---|---|---|
| Tuna | North of 23°N | Current Methods and Tori Line | 5 | 6 | 155 | $,000 | $30,670 |
| | | Side Setting | 95 | 105 | 2,937 | $420,000 | $5,250 |
| Swordfish | North of 23°N | Current Methods and Tori Line | 5 | 1 | 106 | $1,000 | $6,234 |
| | | Side Setting | 95 | 20 | 2,014 | $80,000 | $1,000 |
| | | | | | **Total** | $507,000 | $43,154 |

**Alternative 8A: Use current mitigation methods plus side setting north of 23°**
In comparison to Alternative 1, 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. As noted above, however, reconfiguring some vessels for side setting may be costly, although it is likely that side setting can be feasibly employed on all vessels in the Hawaii-based longline fleet. Smaller vessels, in particular, may find it costly to convert to side setting because of structural limitations. The WPFMC has recommended that NMFS provide low-interest loans or State of Hawaii Fisheries Disaster Relief Program funds to fishermen to reduce these costs (WPFMC, 123rd Meeting, June 21-24, 2004). If implemented, this financial assistance would mitigate the unusually high costs that some vessels may incur when converting to side setting.

Assuming that side setting is feasible for all vessels in the longline fleet and given the possibility of financial assistance to mitigate conversion costs, this analysis assumed that a requirement to side set would not restrict fishing opportunities for any vessel north of 23°N. Under this scenario, the predicted compliance costs for the Hawaii-based longline fleet under Alternative 8A include $528,000 for installation/set-up costs and $95,392 for annual costs (Table 22). In comparison to Alternative 1, this represents a $528,000 increase in installation/set-up costs and a $6,600 increase in annual costs. The negative economic impacts of this alternative would be higher if the requirement to side set eliminates pelagic longlining opportunities north of 23°N for vessels that can not be readily reconfigured for side setting.

**Table 22. Predicted Fishery Costs Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative 8A.** (Source: NMFS 2005)

| **Vessel Type** | **Area Where Mitigation Method Applies** | **Mitigation Method** | **Percentage of Vessels Choosing Mitigation Method** | **Projected No. of Affected Vessels** | **Projected No. of Affected Sets** | **Projected Installation/ Set-up Costs** | **Projected Annual Costs** |
|---|---|---|---|---|---|---|---|
| Tuna | North of 23°N | Current Methods and Side Setting | 100 | 111 | 3,090 | $444,000 | $65,460 |
| Swordfish | North of 23°N | Current Methods and Side Setting | 100 | 21 | 1,838 | $84,000 | $29,932 |
| | | | | | **Total** | $528,000 | $95,392 |

**Alternative 8B: Use current mitigation methods plus side setting in all areas**
The economic effects of this alternative would be similar to those described for Alternative 8A; the primary difference would be that those vessels that fish exclusively south of 23 °N would be affected by the regulations.

Assuming that side setting is feasible for all vessels in the longline fleet and given the possibility of financial assistance to mitigate conversion costs, this analysis assumed that a requirement to side set would not restrict fishing opportunities for any vessel. Under this scenario the predicted compliance costs for the Hawaii-based longline fleet under Alternative 8B include $572,000 for installation/set-up costs and $228,590 for annual costs (Table 23). In comparison to Alternative 1, this represents a $572,000 increase in installation/set-up costs and a $139,798 increase in annual costs. The negative economic impacts of this alternative would be higher if the requirement to side set eliminates pelagic longlining opportunities for vessels that can not be readily reconfigured for side setting.

**Table 23. Predicted Fishery Costs Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative 8B.** (Source: NMFS 2005)

| Vessel Type | Area Where Mitigation Method Applies | Mitigation Method | Percentage of Vessels Choosing Mitigation Method | Projected No. of Affected Vessels | Projected No. of Affected Sets | Projected Installation/ Set-up Costs | Projected Annual Costs |
|---|---|---|---|---|---|---|---|
| Tuna | All | Current Methods and Side Setting | 100 | 122 | 12,165 | $488,000 | $194,710 |
| Swordfish | All | Current Methods and Side Setting | 100 | 21 | 2,120 | $84,000 | $33,880 |
| | | | | | Total | $572,000 | $228,590 |

**Alternative 9A: Use side setting north of 23°N**

Assuming that side setting is feasible for all vessels in the longline fleet and given the possibility of financial assistance to mitigate conversion costs, this analysis assumed that a requirement to side set would not restrict fishing opportunities for any vessel. Under this scenario the economic effects of this alternative would be similar to those described for Alternative 8A; the primary difference would be that fishermen would not incur the costs and operational difficulties of using the current mitigation methods. The predicted compliance costs for the Hawaii-based longline fleet under Alternative 9A include $528,000 for installation/set-up costs and $6,600 for annual costs (Table 24). In comparison to Alternative 1, this represents a $528,000 increase in installation/set-up costs and a $82,192 decrease in annual costs.

**Table 24. Predicted Fishery Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative 9A.** (Source: NMFS 2005)

| Vessel Type | Area Where Mitigation Method Applies | Mitigation Method | Percentage of Vessels Choosing Mitigation Method | Projected No. of Affected Vessels | Projected No. of Affected Sets | Projected Installation/ Set-up Costs | Projected Annual Costs |
|---|---|---|---|---|---|---|---|
| Tuna | North of 23°N | Side Setting | 100 | 111 | 3,090 | $444,000 | $5,550 |
| Swordfish | North of 23°N | Side Setting | 100 | 21 | 1,838 | $84,000 | $1,050 |
| | | | | | Total | $528,000 | $6,600 |

**Alternative 9B: Use side setting in all areas**

Assuming that side setting is feasible for all vessels in the longline fleet and given the possibility of financial assistance to mitigate conversion costs, this analysis assumed that a requirement to side set would not restrict fishing opportunities for any vessel. Under this scenario the economic effects of this alternative would be similar to those described for Alternative 8B; the primary difference would be that fishermen would not incur the costs and operational difficulties of using the current mitigation methods. The predicted compliance costs for the Hawaii-based longline fleet under Alternative 9B include $572,000 for installation/set-up costs and $7,150 for annual costs (Table 25). In comparison to Alternative 1, this represents a $572,000 increase in installation/set-up costs and an $81,642 decrease in annual costs.

**Table 25. Predicted Fishery Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative 9B.** (Source: NMFS 2005)

| Vessel Type | Area Where Mitigation Method Applies | Mitigation Method | Percentage of Vessels Choosing Mitigation Method | Projected No. of Affected Vessels | Projected No. of Affected Sets | Projected Installation/ Set-up Costs | Projected Annual Costs |
|---|---|---|---|---|---|---|---|
| Tuna | All | Side Setting | 100 | 122 | 12,165 | $488,000 | $6,100 |
| Swordfish | All | Side Setting | 100 | 21 | 2,120 | $84,000 | $1,050 |
| | | | | | Total | $572,000 | $7,150 |

**Alternative 10A: Use side setting unless technically infeasible in which case use current methods north of 23°N**

As noted above, it is assumed that side setting can be employed on all vessels in the Hawaii longline fleet but reconfiguring some vessels for side setting may be especially costly. Consequently, this analysis assumed that 5% of the active longline vessels would choose to use the current methods. Under this scenario the economic effects of this alternative would be similar to those described for Alternative 2A the predicted compliance costs for the Hawaii-based longline fleet under Alternative 10A include $500,000 for installation/set-up costs and $10,758 for annual costs (Table 26). In comparison to Alternative 1, this represents a $500,000 increase in installation/set-up costs and a $78,034 decrease in annual costs.

**Table 26. Predicted Fishery Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative 10A.** (Source: NMFS 2005)

| Vessel Type | Area Where Mitigation Method Applies | Mitigation Method | Percentage of Vessels Choosing Mitigation Method | Projected No. of Affected Vessels | Projected No. of Affected Sets | Projected Installation/ Set-up Costs | Projected Annual Costs |
|---|---|---|---|---|---|---|---|
| Tuna | North of 23°N | Side Setting | 95 | 105 | 2,935 | $420,000 | $5,250 |
| | | Current Methods | 5 | 6 | 155 | $0 | $3,070 |
| Swordfish | North of 23°N | Side Setting | 95 | 20 | 1,746 | $80,000 | $1,000 |
| | | Current Methods | 5 | 1 | 92 | $0 | $1,438 |
| | | | | | **Total** | $500,000 | $10,758 |

**Alternative 10B: Use side setting unless technically infeasible in which case use current methods in all areas**

The economic effects of this alternative would be similar to those described for Alternative 2B. The predicted compliance costs for the Hawaii-based longline fleet under Alternative 10B include $544,000 for installation/set-up costs and $17,846 for annual costs (Table 27). In comparison to Alternative 1, this represents a $544,000 increase in installation/set-up costs and a $70,946 decrease in annual costs.

**Table 27. Predicted Fishery Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative 10B.** (Source: NMFS 2005)

| Vessel Type | Area Where Mitigation Method Applies | Mitigation Method | Percentage of Vessels Choosing Mitigation Method | Projected No. of Affected Vessels | Projected No. of Affected Sets | Projected Installation/ Set-up Costs | Projected Annual Costs |
|---|---|---|---|---|---|---|---|
| Tuna | | Side Setting | 95 | 116 | 11,557 | $464,000 | $5,800 |
| | All | Current Methods | 5 | 6 | 608 | $0 | $9,412 |
| Swordfish | All | Side Setting | 95 | 20 | 2,014 | $80,000 | $1,000 |
| | | Current Methods | 5 | 1 | 106 | $0 | $1,634 |
| | | | | | **Total** | $544,000 | $17,846 |

**Alternative 11A: 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 economic effects of this alternative would be similar to those described for Alternative 6A; the primary difference would be that those fishermen that choose to use the current mitigation methods would not incur the costs and operational difficulties of using blue-dyed bait and strategic offal discards. The predicted compliance costs for the Hawaii-based longline fleet under Alternative 11A include $503,000 for installation/set-up costs and $15,700 for annual costs (Table 28). In comparison to Alternative 1, this represents a $503,000 increase in installation/set-up costs and a $73,092 decrease in annual costs.

**Table 28. Predicted Fishery Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative 11A.** (Source: NMFS 2005)

| Vessel Type | Area Where Mitigation Method Applies | Mitigation Method | Percentage of Vessels Choosing Mitigation Method | Projected No. of Affected Vessels | Projected No. of Affected Sets | Projected Installation/ Set-up Costs | Projected Annual Costs |
|---|---|---|---|---|---|---|---|
| Tuna | North of 23°N | Side Setting | 95 | 105 | 2,935 | $420,000 | $5,250 |
| | | Current Methods wo/BDB&SOD | 2 | 2 | 62 | $0 | $0 |
| | | Underwater Chute | 1 | 1 | 31 | $1,000 | $250 |
| | | Tori Line | 2 | 2 | 62 | $2,000 | $9,200 |
| Swordfish | North of 23°N | Side Setting | 95 | 20 | 1,746 | $80,000 | $1,000 |
| | | Current Methods wo/BDB&SOD[1] | 2 | 0 | 37 | $0 | $0 |
| | | Underwater Chute[1] | 1 | 0 | 18 | $0 | $0 |
| | | Tori Line[1] | 2 | 0 | 37 | $0 | $0 |
| | | | | | Total | $503,000 | $15,700 |

[1]The number of vessels that choose this mitigation method is too small to calculate compliance costs.

**Alternative 11B: 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 economic effects of this alternative would be similar to those described for Alternative 6B; the primary differences would be that those fishermen that choose to use the current mitigation methods would not incur the costs and operational difficulties of using blue-dyed bait and strategic offal discards. The predicted compliance costs for the Hawaii-based longline fleet under Alternative 11B include $547,000 for installation/set-up costs and $16,250 for annual costs (Table 29). In comparison to Alternative 1, this represents a $547,000 increase in installation/set-up costs and a $72,540 decrease in annual costs.

**Table 29. Predicted Fishery Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative 11B.** (Source: NMFS 2005)

| Vessel Type | Area Where Mitigation Method Applies | Mitigation Method | Percentage of Vessels Choosing Mitigation Method | Projected No. of Affected Vessels | Projected No. of Affected Sets | Projected Installation/ Set-up Costs | Projected Annual Costs |
|---|---|---|---|---|---|---|---|
| Tuna | All | Side Setting | 95 | 116 | 11,558 | $464,000 | $5,800 |
| | | Current Methods wo/BDB&SOD | 2 | 2 | 243 | $0 | $0 |
| | | Underwater Chute | 1 | 1 | 122 | $1,000 | $250 |
| | | Tori Line | 2 | 2 | 243 | $2,000 | $9,200 |
| Swordfish | | Side Setting | 95 | 20 | 2,014 | $80,000 | $1,000 |
| | | Current Methods wo/BDB&SOD[1] | 2 | 0 | 42 | $0 | $0 |
| | | Underwater Chute[1] | 1 | 0 | 21 | $0 | $0 |
| | All | Tori Line[1] | 2 | 0 | 42 | $0 | $0 |
| | | | | | Total | $547,000 | $16,250 |

[1]The number of vessels that choose this mitigation method is too small to calculate compliance costs.

**Alternative 12: Voluntarily use night-setting or underwater chute or tori line (e.g., paired streamer lines) or line shooter with weighted branch lines south of 23°N**

The economic effects of this alternative would be similar to those described for Alternative 1. It is unlikely that any fishing enterprise that experienced significant negative economic 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, if any, vessels would voluntarily adopt these mitigation methods. Vessels that do not already use night-setting may be hesitant to adopt this fishing practice because of concerns that it would decrease catch rates of certain target species and could be dangerous if vessels are not suitably equipped. Most 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, thereby causing the mainline to sag in the middle and allowing the middle hooks to fish deeper. Vessels that do not already use a line-shooter with weighted branch lines are unlikely to voluntarily adopt this gear solely for the purpose of reducing seabird interactions because of the high costs of the gear.

Table 30 summarizes the above information for each deterrent concerning cost to fishery participants. Table 31 presents similar information but costs are presented on a fishery wide basis rather than per vessel and the projected number of fishery interactions with seabirds under each alternative are included. Given the size and stable to increasing status of potentially affected seabird populations (327,000 black-footed albatrosses, 3.4 million Laysan albatrosses, and 1,900 short-tailed albatrosses, see Section 10.5) and the low levels of anticipated captures under the alternatives (0 to 311 black-footed and Laysan albatrosses combined), it would appear that none of the alternatives would have a discernable impact on the trajectory of potentially affected seabird populations.

**Table 30. Summary of Costs Per Vessel of Deterrent Measures**

| **Seabird deterrent** | **Cost per vessel** |
|---|---|
| Thawed blue-dyed bait | $1,400 annual |
| Strategic offal discards | $150 initial plus<br>$150 annual |
| Line shooter with weighted branch lines (on tuna vessels) | already purchased<br>($5,700 initial plus $2,400 annual) |
| Tori line | $3,300 initial<br>$4,600 annual (2 lines) |
| Night setting (on swordfish vessels) | $0 |
| Underwater setting chute | $6,000 initial |
| Side setting (+ 60g swivels within 1m of the hook ) | $4,000 initial plus<br>$50 annual |

**Table 31 Summary of Fleet-wide Quantitative Appraisals of the Alternatives**

| Alternative | Initial costs | Annual costs | Projected number of interactions |
|---|---|---|---|
| 1: all vessels set deep or at night and use blue bait and strategic offal discards (SOD), north of 23 °N – (NO ACTION: Current Measures) | $0 | $88,792 | 97 |
| 2A: all vessels side-set, or set deep or at night and use blue bait and SOD, north of 23 ° N | $476,000 | $14,802 | 11 |
| 2B: all vessels side-set, or set deep or at night and use blue bait and SOD, in all areas | $516,000 | $28,556 | 6 |
| 3A: all vessels use underwater setting chute, or set deep or at night and use blue bait and SOD, north of 23 ° N | $119,000 | $38,602 | 146 |
| 3B: all vessels use underwater setting chute, or set deep or at night and use blue bait and SOD, in all areas | $129,000 | $54,356 | 73 |
| 4A: all vessels use tori lines, or set deep or at night and use blue bait and SOD, north of 23 ° N | $119,000 | $556,252 | 311 |
| 4B: all vessels use tori lines, or set deep or at night and use blue bait and SOD, in all areas | $129,000 | $615,506 | 248 |
| 5A: all vessels side-set or use underwater setting chute or, set deep or at night and use blue bait and SOD, north of 23 ° N | $437,000 | $17,402 | 27 |
| 5B: all vessels side-set or use underwater setting chute or, set deep or at night and use blue bait and SOD, in all areas | $474,000 | $31,356 | 13 |
| 6A: all vessels side-set or use underwater setting chute or tori lines, or set deep or at night and use blue bait and SOD, north of 23 ° N | $398,000 | $76,552 | 59 |
| 6B: all vessels side-set or use underwater setting chute or tori lines, or set deep or at night and use blue bait and SOD, in all areas | $428,000 | $95,006 | 39 |
| 7A: all vessels side-set or use tori lines, or set deep or at night and use blue bait and SOD, north of 23 ° N | $437,000 | $73,952 | 46 |
| 7B: all vessels side-set or use tori lines, or set deep or at night and use blue bait and SOD, in all areas | $474,000 | $92,256 | 32 |
| 7C: shallow-set vessels side-set, or use underwater setting chute or tori lines or night set, in all areas; deep-set vessels side-set, or use underwater setting chute or tori lines, north of 23 ° N | $398,000 | $69,650 | 61 |
| 7D: shallow-set vessels side-set or set at night and use tori lines and blue bait and modified SOD, in all areas; deep-set vessels side-set, or use tori lines and | $507,000 | $43,154 | 6 |

| Alternative | Initial costs | Annual costs | Projected number of interactions |
|---|---|---|---|
| blue bait and modified SOD, north of 23° N | | | |
| 8A: all vessels side-set and set deep or at night and use blue bait and SOD, north of 23° N | $528,000 | $95,392 | 0 |
| 8B: all vessels side-set and set deep or at night and use blue bait and SOD, in all areas | $572,000 | $228,590 | 0 |
| 9A: all vessels side-set north of 23° N | $528,000 | $6,600 | 2 |
| 9B: all vessels side-set in all areas | $572,000 | $7,150 | 3 |
| 10A: all vessels side-set if feasible, otherwise set deep or at night and use blue bait and SOD, north of 23° N | $500,000 | $10,758 | 7 |
| 10B: all vessels side-set if feasible, otherwise set deep or at night and use blue bait and SOD, in all areas | $544,000 | $17,846 | 4 |
| 11A: all vessels side-set if feasible, otherwise use underwater setting chute, or tori lines, or set deep or at night, north of 23° N | $503,000 | $15,700 | 23 |
| 11B: all vessels side-set if feasible, otherwise use underwater setting chute, or tori lines, or set deep or at night, in all areas | $547,000 | $16,250 | 18 |
| 12: all vessels voluntarily night set, use underwater setting chute or tori line, or set deep south of 23° N | $0 | $88,792 | 80 |

Table 32 presents the average number of trips that fishery participants could expect to take per seabird interaction in each fishery sector and area if no seabird deterrence strategies were used (again, with the exception of line shooters with weighted branch lines which have been used on virtually all deep sets throughout the modern history of this fishery). Interaction rates for shallow sets come from the 1994-1999 time period as shallow-setting was prohibited between 2000 and 2004. Interaction rates for deep sets in the north are also from the 1994-1999 time period as regulatory changes including the imposition of mitigation measures were required in this area beginning in 2000. Operating information (average sets per trip and trips per year) for these groups is from the 1994-1998 time period as regulatory changes at the end of 1999 restricted shallow setting. Information for deep sets in the south is from the 2002-2003 time period as no mitigation measures have been imposed for the south and it is preferable to use the most recent data available. Operating information for deep sets comes from the second quarter of 2004 as this most recent information best describes current operating conditions. In all cases, operating information is not available on a geographic basis.

**Table 32 Expected Years per Interaction when no Mitigation Measures are used** (Sources: McCracken 2004; Ito & Machado 1999; PIFSC website report on the Hawaii longline fishery for the second quarter of 2004)

| Type and Area | Interactions per Set | Sets per Interaction | Average Sets per Trip | Trips per Interaction | Average Trips per Year | Years per Interaction |
|---|---|---|---|---|---|---|
| North Deep | .07016 | 14 | 11.1 | 1.28 | 12.40 | 0.10 |
| South Deep | .00799 | 125 | 11.1 | 11.28 | 12.40 | 0.91 |
| North Shallow | .54583 | 2 | 14.6 | 0.13 | 3.14 | 0.04 |
| South Shallow | .01650 | 61 | 14.6 | 4.15 | 3.14 | 1.32 |

As shown above, when no mitigation measures are used, deep setting vessels in the south are expected to have slightly more than one interaction per year, while those in the north are expected to have up to 10 per year. Similarly shallow setting vessels in the south are expected to have less than one interaction per year, while those in the north are expected to have up to 25 interactions per year. Because of the difference in the average number of trips per year between the (seasonal) shallow and deep fishery sectors (3.14 vs. 12.4), it will be longer before an interaction occurs on vessels in the south shallow fishery as compared to those in the south deep fishery.

The costs presented in Tables 30 and 31 are summarized from the analyses in Section 10.7.9 of the main body of this document. The projected numbers of interactions are summarized from Table 24 in Section 10.7.8 and qualitative evaluations of the operational characteristics and compliance criteria for the deterrent measures are presented in Table 1 of the main body of this document. In comparing the ratings of the qualitative criteria with the projections of interactions, a general correlation is seen. The deterrents rated lowest qualitatively are associated with those alternatives (3A, 3B, 4A and 4B) with the highest projected numbers of seabird interactions (range: 73-311). Deterrents with intermediate qualitative ratings are associated with alternatives (1 and 12) that had lower, but still relatively high, interaction projections (range: 80-97). Alternatives in those two categories were therefore discounted on the basis of both poor qualitative characteristics and low seabird interaction avoidance efficacy.

The remainder of the deterrents (and associated alternatives) were rated highly against the qualitative criteria, primarily because side-setting had the highest efficacy rate. Within that group of alternatives, those mandating the use of side-setting (8A, 8B, 9A, 9B) had the highest initial costs (range: $528,000-$572,000). These latter alternatives were discounted on the basis of their high initial costs, but perhaps more importantly because they mandate the use of a measure (side-setting) that has undergone only very limited testing. While results with this measure have been very promising, it is appropriate to gather more performance data under actual fleet operating conditions before mandating its universal application.

On the basis of cost-effectiveness, the "B" versions of alternatives 2, 5, 6, 7, 10, and 11 had higher initial and annual costs than the "A" versions, while offering modest reductions of projected seabird interactions, and thus they were discounted.

Several of the remaining alternatives (6A, 7A, 7C, and 7E) would permit the use of tori lines without other interaction avoidance measures. Although tori lines may be further developed to function more effectively in the Hawaii longline fishery, the available experimental efficacy value is the lowest of those measures considered here. These alternatives would have the potential to reduce interaction avoidance efficacies compared to currently required measures, and would not satisfy that aspect of the action objective. They were consequently discounted.

That leaves a short-list of three alternatives, 2A, 5A and 7D, that best meet the action objectives. Alternative 2A offers side-setting as an option to using currently required measures. This alternative recognizes the potential operational and seabird interaction reduction benefits of side-setting, while maintaining flexibility for individual vessel operators and recognizing that it may be premature to mandate the use of side-setting throughout the fleet. Alternative 5A is identical to 2A except that it offers the additional option to use underwater setting chutes. Setting chutes have shown high interaction avoidance efficacies in trials, but they have also suffered from structural failures which seriously compromised their interaction avoidance efficacies as well as their fishing efficiencies. It would seem that authorization of their use as a substitute for currently required measures in the Hawaii longline fleet is premature, and should be delayed pending further design development and testing.

That leaves Alternatives 2A and 7D as the best choices. Alternative 7D is the Preferred Alternative. Although its costs are somewhat higher than those of Alternative 2A, its projected seabird interactions are lower. Alternative 7D was designed to improve on Alternative 2A in several ways. Like Alternative 2A, it offers the option of using side-setting in place of currently required interaction avoidance measures. However, it strengthens the incentive to use side-setting by requiring mandatory use of tori lines along with currently required measures if side-setting is not used. Thus, this alternative has the potential to improve upon the efficacy of currently required measures regardless of which option is adopted by a given vessel. In addition, Alternative 7D requires all shallow-setting vessels to use interaction avoidance measures wherever they fish, not just north of 23°N, as in Alternative 2A. As this sector of the fleet will have 100% observer coverage, implementation of Alternative 7D will also provide comprehensive data on the efficacy of the measures employed in areas where seabirds are abundant or not. Alternative 7D also encourages the use of side-setting in the deep-setting sector of the fishery by requiring mandatory use of tori lines along with currently required measures if side-setting is not used at latitudes above 23°N, where seabirds and interactions are most prevalent. On the other hand, it does not impose measures on deep-setting vessels fishing south of 23° N. Cost-effectiveness of the alternative is supported because deep sets in the south are the most common type of set, and they have the lowest historical rate of seabird interactions per set. Deep-setting vessels fishing south of 23°N, a category that includes the smallest vessels in the fleet (Appendix II), would thus retain the option to fish without employing seabird interaction avoidance measures if they fished exclusively south of 23°N.

## X. IMPACTS OF THE PREFERRED ALTERNATIVE ON NATIONAL COSTS AND BENEFITS

In accordance with E.O. 12866, the following is set forth: (1) This rule is not likely to have an annual effect on the economy of more than $100 million or to adversely affect in a material way the economy, a sector of the economy, productivity, jobs, the environment, public health or safety, or state, local, or tribal governments or communities; (2) This rule is not likely to create any serious inconsistencies or otherwise interfere with any action taken or planned by another agency; (3) This rule is not likely to materially alter the budgetary impact of entitlements, grants, user fees or loan programs or the rights or obligations of recipients thereof; and (4) This rule is not likely to raise novel or policy issues arising out of legal mandates, or the principles set forth in the Executive Order.

The implementation of the preferred alternative would allow Hawaii-based longline vessels to operate in the North Pacific while according seabirds increased protection through the use of a range of mitigation measures.

The implementation of the preferred alternative would also likely to have implications beyond those on small businesses and entities participating in the affected fisheries. Non-use values, also referred to as passive-use or existence values, do not involve personal consumption of derived products nor *in situ* contact. (Bishop, 1987). Non-use values may, nevertheless, be the most important benefit derived from some endangered species, simply because such species are so few in number that many people are unlikely to have seen them or to have had very much tangible experience regarding them. The most visible manifestation of existence values is the donation of funds to private organizations that support activities to preserve protected and endangered species. However, whether people enjoy existence values of resources is not contingent upon whether they donate money to support a cause. Any impact of non-use values would be a hedonic (non-market) effect.

Particularly in the United States and western Europe, there are those who consider that certain marine species such as seabirds represent a special group of animals that should not be killed, deliberately or incidentally, under any circumstances. Certain animals are viewed symbolically as unique or majestic creatures – "charismatic megafauna" – similar to African big game. From this perspective, every incidental catch of such a species would be a severe problem.

The perceived need for conservation of such species may be independent of any impact caused by fishing or of its stock status. This perception may also influence the response of resource managers to bycatch management issues. For example, the case of three ice-entrapped gray whales in Alaska might be seen as an example of where the ecological impact is minimal but where public perception and political attractiveness may lead to disproportionate effort. Such views are strongly culture-dependent (Hall, 1998).

Numerous studies have been conducted on the value of endangered species (e.g., Loomis and White 1996) and several studies provide estimates of the value of protected species in Hawaii, including the Hawaiian monk seal (WPRFMC, 2000). Metrick and Weitzman (1996) were unable to identify a satisfactory measure of charisma in the context of endangered species but they note that eye-size or eye-body ratio have been suggested. Another possible component of existence value is the degree to which a species is considered to be a higher form of life and possibly possess (anthropomorphic) capabilities for feeling, thought and pain (Metrick and Weitzman, 1996; Kellert, 1986). There may also be existence value for the contribution of particular species to biodiversity (Metrick and Weitzman, 1996). However, no valuation studies have been conducted specifically for seabirds in the western Pacific region and for other species of interest in FMP-managed fisheries. As a result, new research would be needed to understand the non-use value of these species and how such values would be affected by the alternatives.