Appendix V

Initial Regulatory Flexibility Act Analysis and Regulatory Impact Review for Amendment 18 to the Fishery Management Plan for

Pelagic Fisheries of the Western Pacific Region

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I. Introduction

To meet the requirements of Executive Order (EO) 12866, "Regulatory Planning and Review," the National Marine Fisheries Service (NMFS) requires that a Regulatory Impact Review (RIR) be prepared for all regulatory actions that are of public interest. The review provides an overview of the problem, policy objectives, and anticipated impacts of the action, and ensures that management alternatives are systematically and comprehensively evaluated so 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. 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 Hawaii-based shallow-set longline fishery under the Fishery Management Plan for Pelagic Fisheries of the Western Pacific Region. It also contains an analysis of the economic impacts of this action on affected small businesses and other small organizations.

In accordance with EO 12866, the following is set forth: (1) this rule is not likely to have an annual effect on the economy of more $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.

II. Objective and Need for Action

The Hawaii-based shallow-set longline fishery currently operates on a limited basis under a suite of regulations (adopted in 2004) designed to test the use of gear and bait technologies proven successful in the Atlantic at reducing sea turtle interaction rates and the severity of remaining interactions in experiments. Based on the successful results demonstrated between 2004-present, the purpose of this action is to provide increased opportunities for the Hawaii-based shallow-set longline fishery to sustainably harvest swordfish and other fish species, while continuing to

avoid jeopardizing the continued existence of threatened and endangered sea turtles as well as other protected species. The proposed modifications to the shallow-set fishery management are intended to further the purposes of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) by encouraging optimum yield from the shallow-set longline fishery, while minimizing bycatch and bycatch mortality to the extent practicable.

III. Description of the Alternatives Considered

A wide range of management alternatives was identified during the development and scoping process for this action. Under all alternatives, current regulations requiring circle hooks and mackerel bait, 100 percent observer coverage, and the use of annual loggerhead and leatherback sea turtle interaction hard caps, in addition to other measures, would remain in place. Due to the complexity of issues considered, they were divided into three topic areas, each with its own range of alternatives.

Topic 1: Shallow-set Longline Fishing Effort Limits

The fishery is currently limited to a maximum of 2,120 shallow-sets per year which is half the fishery's average annual fishing effort during 1994-1999. The existing annual sea turtle interaction hard caps of 17 loggerhead turtles and 16 leatherback turtles were determined based on experimental (Atlantic Ocean) interaction rates multiplied by the 2,120 set limit. Under Alternatives 1A-1E below the annual sea turtle interaction hard caps for the fishery were similarly predicted using observed Pacific Ocean sea turtle interaction rates multiplied by each alternative's effort limit. In the case of Alternative 1F (Remove Effort Limit), the sea turtle interaction hard caps were recommended by the Council taking into account the potential for reasonable increases in fishing effort as well as a range of interaction hard caps and their likely impacts on sea turtle populations.

Alternative 1A: No Action: Continue Current Annual Set Limit
Under this alternative, the maximum annual limit on the number of shallow-sets would remain at 2,120.

Alternative 1B: Allow up to 3,000 Sets per Year
Under this alternative, the maximum annual limit on the number of shallow-sets would be 3,000. This effort limit was chosen as a middle-ground effort alternative between the current set limit and the average annual effort between 1994 and 1999 (approximately 4,240 sets).

Alternative 1C: Allow up to 4,240 Sets per Year
Under this alternative, the maximum annual limit on the number of shallow-sets would be 4,240, which represents the average number of annual sets between 1994 and 1999 or double the current set limit of 2,120 (see Figure 26).

Alternative 1D: Allow up to 5,500 Sets per Year
Under this alternative, the maximum annual limit on the number of shallow-sets would be 5,500 which is nearly the maximum annual number sets for any one year between 1994-1999.

Alternative 1E: Set effort level commensurate with current condition of North Pacific Swordfish Stock (~9,925 sets per year)
Under this alternative, the effort level for swordfish would be established based on the condition of the swordfish stock in the North Pacific and the Maximum Sustainable Yield (MSY) for this stock. Establishment of this effort limit would take into account catches by other longline fleets and the portion of the total swordfish catch already made by the Hawaii fleet. Current (domestic and foreign) swordfish landings in the North Pacific amount to about 14,500 mt, which, according to a recent stock assessment, amounts to about 60% of an estimated MSY of 22,284 mt (Kleiber and Yokowa 2004, Bigelow, PIFSC, pers. comm. January 2008)1. Given an MSY of about 22,284 mt for North Pacific swordfish, and a current swordfish catch by the Hawaii-based fishery of between 850-1,637 mt, (1,861,391-3,602,339 lbs) the amount of effort to catch the remaining available 7,784 mt of additional swordfish would be about 9,925 sets per year. Based on the best available information regarding the status of the North Pacific swordfish stock, the effort limit under this alternative would be adjusted over time as appropriate.

Alternative 1F: Remove Effort Limit (Preferred)
Under this alternative, the annual shallow-set effort limit would be removed and the fishery would not be managed using annual set limits. Instead, fishing effort would be indirectly restricted by modifying the annual sea turtle interaction hard caps to 46 interactions with loggerhead sea turtles and 19 interactions with leatherback sea turtles. This would allow direct control of sea turtle interactions.

Topic 2: Fishery Participation

The annual effort limit is currently allocated among interested Hawaii-based longline fishery permittees and tracked using a set certificate program, i.e. participants must acquire and attach a set certificate to each daily fishing log. The set certificate program is administered by NMFS which in November of each year, provides notices to Hawaii longline fishery permit holders that set certificates are available. Set certificates may be sold, traded or otherwise exchanged with other permit holders in the Hawaii-based longline fleet.

Alternative 2A: No Action: Continue Set Certificate Program
Under this alternative, shallow-set certificates would continue to be made available and issued to all interested Hawaii longline permit holders. For each shallow-set made north of the equator, vessel operators would continue to be required to possess and submit one valid shallow-set certificate for each shallow-set made.

Alternative 2B: Discontinue Set Certificate Program (Preferred)
Under this alternative, shallow-set certificates would no longer be issued or required and the annual set-certificate solicitation of interested parties would end. Under alternatives which include effort limits, sets would be cumulatively accounted for on a fleetwide basis and the fishery would close for the remainder of the year if and when the annual set limit was reached.

1 The Klieber and Yokawa (2004) assessment contains caveats dealing with a truncated data set (historical catches from Hawaii and Japanese longline fisheries) and model results indicating relative high levels of natural mortality.

Fishery participants would continue to be required to notify NMFS at least 72 hrs before making a shallow-set trip.

Topic 3: Time-Area Closures

Time-area closures are being considered as a way to increase annual fishery profits through potential reductions in the number of sea turtle interactions that may occur in the first quarter of each year. Interaction rates for loggerhead turtles highest during the first quarter of the year, and it has been hypothesized that reducing fishing effort in areas where swordfish and loggerhead turtle habitats may overlap could increase fishery profits by reducing the risk of exceeding a turtle hard cap very early in the year when there are still many more shallow-sets allowed to be made.

Alternative 3A: No Action: Do Not Implement Time-Area Closures (Preferred)
Under this alternative, the fishery would continue to operate without time-area closures.

Alternative 3B: Implement January Time-Area Closure
Under Alternative 3B, an area closure would be implemented during January of each calendar year. The area closure would be located between 175° W and 145° W longitude and encompass the sea surface temperature band of 17.5°-18.5° C. The latitudinal location of this temperature band varies inter-and intra-annually; however, in January it is generally located near 31°-32° N latitude. Research has suggested that the area between sea surface temperatures of 17.5-18.5 C may be a loggerhead sea turtle "hotspot" based on historical and contemporary distribution and foraging studies as well as location data for observed loggerhead sea turtle interactions with the fishery (Howell, PIFSC, pers. comm., December 2008). The month of January was selected because it may be that the number of loggerhead interactions during January is pivotal to whether or not the fishery will reach its annual sea turtle interaction hard cap before all allowable sets are used. For example, in 2006, the fishery interacted with eight loggerheads in January and the fishery reached the cap of 17 on March 17, 2006. In 2007, the fishery did not interact with any loggerheads during January, but ended the first quarter with 15 loggerhead interactions and did not reach the sea turtle cap.

Alternative 3C: Implement In-season Time-area Closure
Under Alternative 3C, the sea surface temperature-based area closure described for Alternative 3B would be implemented in those years for which 75 percent of the annual loggerhead turtle cap was reached and the closure would remain in effect for the remainder of the first quarter. As with Alternative 3B, this alternative is being considered as a way to increase annual fishery profits through reductions in the number of turtle interactions that occur in the first quarter of each year. This alternative differs from 3B in that its implementation is contingent on high numbers of interactions during the first quarter.

IV. Environmental and Economic Background

U.S. swordfish landings
North Pacific swordfish are targeted by U.S. vessels based out of California and Hawaii. Provisional 2006 data for all U.S. longline fisheries operating in the Western and Central Pacific

Ocean (WCPO) out of both Hawaii and California show the bulk of the swordfish were harvested from north Pacific waters and a small amount from south Pacific waters (Table 1). Other U.S. fisheries such as the drift gillnet fishery operating in the Eastern Pacific Ocean (EPO) also harvest North Pacific swordfish.

Table 1: **U.S. landings of Pacific swordfish, 2003 - 2006**

Year	North Pacific (mt)	South Pacific (mt)	Total (mt)
2003	1,957	7	1,964
2004	1,072	4	1,076
2005	1,451	3	1,454
2006	1,131	30	1,161

Source: NMFS 2007 unpublished data

The spatial distribution of the swordfish catch in the WCPO by the U.S. longline fleet is centered around 160° W and 30-35° N. Most of the fishing effort and swordfish harvest is from Hawaii permitted longline vessels, however other domestic fisheries do catch small amounts as described below. None of the alternatives considered here are expected to increase Hawaii-based swordfish catches to the point of affecting the harvests or profits of other domestic fisheries.

Hawaii-based swordfish fisheries

In the Hawaii-based pelagic fisheries, swordfish landings peaked in 1993 and subsequently decreased (Table 2). The trend in swordfish landings reflected both an increase in the number of vessels in the longline fishery and widespread targeting of swordfish by the fishery. Landings remained relatively steady up to 2000 but dropped dramatically with the prohibition on targeting swordfish by the longline fishery. Although the longline fishery for swordfish was reopened under a new set of regulations in April 2004, landings have remained substantially lower than historical levels. Swordfish landings are primarily from the longline fishery with some small amounts by the main Hawaiian Islands (MHI) commercial troll and handline fisheries (Table 2). Provisional data indicate that approximately 3.7 million pounds (16,444 mt) of swordfish was caught by the Hawaii shallow-set fishery in 2007 (WPRFMC 2008; Table 3).

Table 2: Swordfish Landings from the Hawaii-based Pelagic Fisheries 1987 - 2007

	Swordfish Landings (1000 Pounds)			
Year	Longline	MHI Troll	MHI Handline	All Gear
1988	52	2	11	65
1989	619	2	14	635
1990	5,372	1	10	5,383
1991	9,939	1	13	9,953
1992	12,566	0	3	12,569
1993	13,027	0	9	13,036
1994	7,002	1	7	7,010
1995	5,981	1	12	5,994
1996	5,517	1	11	5,529
1997	6,352	1	15	6,368
1998	7,193	1	14	7,208
1999	6,835	1	19	6,855
2000	6,205	5	193	6,404
2001	519	4	39	562
2002	681	3	19	703
2003	300	2	19	324
2004	549	0	16	598
2005	3,527	1	11	3,539
2006	2,573	1	9	2,583
2007	3,781	2	12	3,796
Average	**4,930**	**1**	**23**	**4,956**
Std. Dev.	**3,851**	**1**	**40**	**3,848**

Source: 2007 WPRFMC Pelagics Annual Report

Hawaii charter fisheries are considered commercial fisheries by the State of Hawaii and are included in the table above with the MHI Troll category. There are anecdotal reports of charter swordfish fishing off Kona, HI; however, the amount of catch is likely small and encapsulated in the MHI Troll statistics listed above. Hawaii pelagic handline fisheries primarily target bigeye and yellowfin tuna as well as monchong, and commercial landings of swordfish from MHI handline fisheries have been relatively stable over time; however, in 2000, 193,000 lbs of swordfish was reported to be landed from the handline fishery. Although information in lacking on recreational swordfish fisheries in Hawaii, landings are likely very small and likely below the statistics associated with MHI troll fisheries (see Section 3.2.12 for more information Hawaii recreational pelagic fisheries). Approximately 90 percent of catches by Hawaii's shallow-setting longline vessels is swordfish however other species are caught and retained for sale (Table 3),

Table 3: 2007 catches of major species by the Hawaii shallow-set longline fishery

Number of sets made:1,497			
Species	**Number caught**	**Number kept**	**Pounds kept**
Swordfish	20,843	18,769	3,115,654
Bigeye Tuna	1,350	1,167	101,529
Albacore	1,391	853	43,503
Oilfishes	2,392	1,890	32,130
Mahimahi	1,916	1,727	24,178
Striped Marlin	318	279	18,972
Mako Shark	832	104	18,408
Blue Marlin	51	48	7,824
Yellowfin Tuna	129	118	7,552
Moonfish	54	40	3,320
Wahoo	87	81	2,430
Shortbill Spearfish	71	61	1,891
Thresher Sharks	52	7	1,386
Pomfret	141	114	1,482
Blue Shark	15,475	9	900
Skipjack Tuna	35	27	432

Source: PIFSC 2008; NMFS PIFSC 4th Quarter Longline Report

U.S. West coast commercial and recreational swordfish fisheries

The following information was taken from the *Status of the U.S. West Coast Fisheries for Highly Migratory Species through 2005* (PFMC 2006).

Commercial harpoon fishery

California's harpoon fishery for swordfish developed in the early 1990s. Prior to 1980, harpoon and hook-and-line gears were the only methods of take authorized to commercially harvest swordfish. At that time, harpoon gear accounted for the majority of swordfish landings in California ports. In the early 1980s, a limited entry drift gill net fishery was authorized by the State Legislature and soon afterward drift gillnets replaced harpoons as the primary method for catching swordfish, and the number of harpoon permits decreased from a high of 1,223 in 1979 to a low of 23 in 2001. Fishing effort typically occurs in the Southern California Bight (SCB) from May to December, peaking in August, depending on weather conditions and the availability of fish in coastal waters. Some vessel operators work in conjunction with a spotter airplane to increase the search area and to locate swordfish difficult to see from the vessel. This practice tends to increase the catch-per-unit-effort compared to vessels that do not use a spotter plan. To participate in the harpoon fishery a permit and logbook are required in addition to a general resident or non-resident commercial fishing license and a current California Department of Fish and Game vessel registration. Additionally, the HMS FMP requires a federal permit with a harpoon gear endorsement for all U.S. vessels that fish for HMS within the West Coast EEZ and to U.S. vessels that pursue HMS on the high seas (seaward of the EEZ) and land their catch in California, Oregon, and Washington. In 2004, the annual harpoon swordfish catch was 69 mt from 28 vessels, and in 2005 it was 74 mt from 24 vessels participating in the fishery. Fishing

effort was concentrated in coastal waters off San Diego and Orange Counties in the SCB and landings occurred May through December, peaking in August.

The ex-vessel revenue for 2005 was $782,920 compared to $669,955 in 2004. Because harpoon vessels spend less time on the water and are a low-volume fishery, their catch is often fresher than drift-gillnet-caught fish, so markets tend to pay more for harpooned fish. The average ex-vessel price-per-pound for harpooned fish was $7.84 compared to $3.41 for drift gillnet caught fish in 2005.

Commercial drift gillnet

California's swordfish fishery transformed from primarily a harpoon fishery to a drift gillnet fishery in the early 1980's and landings soared to a historical high of 2,371 mt by 1985. The drift gillnet fishery is a limited entry program, managed with gear, seasons, and area closures. The limited entry program was established in 1980 and about 150 permits were initially issued. The permit is transferable under very limited conditions and it is linked to an individual fisherman, not a vessel; thus the value of the vessel does not become artificially inflated, allowing permittees to buy new vessels as needed. Since 1984, the number of permits has declined from a high of 251 in 1986 to a low of 90 in 2005; however, only 38 vessels participated in the swordfish fishery in 2005. Annual fishing effort has also decreased from a high of 11,243 sets in the 1986 fishing season to 1,043 sets in 2005. Industry representatives attribute the decline in vessel participation and annual effort to regulations implemented to protect threatened and endangered marine mammals, sea turtles, and sea birds. To keep a permit active, current permittees are required to purchase a permit from one consecutive year to the next; however, they are not required to make landings using drift gillnet gear. In addition, a general resident or non-resident commercial fishing license and a current vessel registration are required to catch and land fish caught in drift gillnet gear. A logbook is also required. The HMS FMP requires a federal permit with a drift gillnet gear endorsement for all U.S. vessels that fish for HMS within the West Coast EEZ and to U.S. vessels that pursue HMS on the high seas (seaward of the EEZ) and land their catch in California, Oregon, and Washington. Historically, the California drift gillnet fleet has operated within EEZ waters adjacent to the state and as far north as the Columbia River, Oregon, during El Niño years. Fishing activity is highly dependent on seasonal oceanographic conditions that create temperature fronts that concentrate feed for swordfish. Because of the seasonal migratory pattern of swordfish and seasonal fishing restrictions, over 90 percent of the fishing effort occurs August 15 through January 31.

In 2001, NMFS implemented two Pacific sea turtle conservation areas on the West Coast with seasonal drift gillnet restrictions to protect endangered leatherback and loggerhead turtles. The larger of the two closures spans the EPO north of Point Conception, California (34°27' N. latitude) to mid-Oregon (45° N. latitude) and west to 129° W. longitude. Drift gillnet fishing is prohibited annually within this conservation area from August 15 to November 15 to protect leatherback sea turtles. A smaller closure was implemented to protect Pacific loggerhead turtles from drift gillnet gear during a forecasted or occurring El Niño event, and is located south of Point Conception, California and west of 120° W. longitude from January 1 through January 31, and from August 15 to August 31. Since 2000, the number of vessels participating in the swordfish fishery has decreased from 69 in 2001 to 38 in 2005. In 2005, 38 drift gillnet vessels landed 220 mt of swordfish compared to 35 vessels that landed 182 mt in 2004. Landings occurred at ports from San Diego to Monterey and the majority occurred from October to

December. Over 85 percent of the reported effort occurred in the SCB. The ex-vessel revenue was $1.2 million in 2005 compared to $1.0 million in 2004. Most of the swordfish landed in California supports domestic seafood restaurant businesses.

High seas longline fishery

California prohibits pelagic longline fishing within the EEZ and the retention of striped marlin. Under regulations for the Pacific Highly Migratory Species FMP, West Coast based longline vessels are prohibited from making shallow sets to fish for swordfish in the EEZ as well as on the high seas. Vessels operating outside of the EEZ can land fish in California ports if the operator has a general resident or nonresident commercial fishing license and a current CDFG vessel registration. The operator must comply with the High Seas Fishing Compliance Act, which requires U.S. vessel operators to maintain logbooks if they fish beyond the EEZ. Additionally, the HMS FMP requires a federal permit with a pelagic longline gear endorsement for all U.S. vessels that pursue HMS on the high seas (seaward of the EEZ) and land their catch in California, Oregon, and Washington. In recent years, federal regulations promulgated to protect endangered sea turtles east and west of 150° W longitude and north of the equator have impacted the number of landings of swordfish in California ports. In 2005, two longline vessels operating with Hawaii permits made swordfish landings compared to 20 vessels that landed 898 mt in 2004.

Recreational fishery

The following on West Coast recreational swordfish catches has been freely adapted from the Billfish Newsletter (1996) Recreational anglers consider swordfish one of the finest of all trophy game fishes because of their size and strength. However, swordfish are rarely tempted to strike baits or lures. Swordfish typically feed at night in the surface waters on small pelagic fishes, hake and squid. They are also known to feed at depths of at least 300 meters. Most angling is done during the daytime from private boats targeting striped marlin. Drifting at night with chemical light-sticks and squid bait has been conducted more recently but has been more popular on the East Coast. The California recreational fishery for swordfish and striped marlin developed about the turn of the century. Recreational catch records of swordfish are kept by the various sport-fishing clubs in California. The Balboa Angling Club, San Diego Marlin Club and the Tuna Club (Avalon) are three of the major clubs where anglers have their swordfish catches recorded and weighed. The number of swordfish weighed in at these clubs averaged 3 to 4 fish per year. During the period between 1969 and 1980, an average of 30.5 fish per year were caught, with a peak in 1978 of 127 swordfish reported (Figure 7). The increased catches during that period correspond to a similar increase in commercial landings. A generally higher abundance of their prey was also reported during the same period. There is some evidence that swordfish abundance may increase in the years following EI Nino events.

More recently (Billfish Newsletter 2006) recreational landings of swordfish recorded at southern Californian swordfish clubs amounted to about six swordfish taken per year. The Commercial Passenger Fishing Vessel fleet submits logbooks on all fish caught. Reported catch is shown in the Pacific Council's HMS SAFE document (PFMC 2007) indicate that 3 swordfish were caught by the fleet in 2006) recreational catches. A query of the Pacific States Marine Fisheries Commission recreational database (RecFIN) found that since 1980, only one swordfish has been counted and that was caught in Oregon (Suzanne Kohin, NMFS SWFSC pers. comm. May 2008).

Non-U.S. swordfish catches in the North Pacific

In the North Pacific, there are directed swordfish fisheries that operate out of Japan and Taiwan. However, it is likely that most of the swordfish catch in the North Pacific is caught incidentally in tuna longline fisheries (*e.g.* bigeye, albacore) by countries such as Japan, Korea, China, and Taiwan. In recent years, Spanish longline vessels have caught swordfish in the North Pacific.

Hawaii's Regional Economy

Hawaii's economy is dominated by tourism and defense, with tourism by far the leading industry in terms of employment and expenditures. The two represent approximately one quarter of Gross State Product without consideration of ancillary services and also comprise the largest shares of "export" earnings (Tables 4 and 5).

Table 4: Hawaii's gross state product

Year	Gross State Product (billion $)	Per Capita State Product ($)	Resident Population
2004	50.7	40,325	1,259,299
2005	53.7	42,119	1,275,194
2006	58.3	38,083	1,285,498
2007	n/a	n/a	1,283,388

Source: DBEDT 2007
http://hawaii.gov/dbedt/info/economic/library/facts/state

Table 5: Hawaii's "export" industries

Year	Sugar (million $)	Pineapple (million $)	U.S. Military (million $)	Tourism (million $)
2004	94.1	123.2	4,772.	10,862
2005	92.4	113.4	n/a	11,904
2006	n/a	n/a	n/a	12,381

Source: DBEDT 2007

Natural resource production remains important in Hawaii, although nothing compared to the period of the sugar and pineapple plantations from throughout the first 60 or 70 years of the 20th century. Crop and livestock sales were $574.4 million in 2005, with the primary diversified agriculture crops being flower and nursery products, $100.6 million; pineapples, $79.2 million; seed crops, $70.4 million, vegetables and melons, $67.7 million; sugar, $58.8.million; macadamia nuts, $44.4 million; coffee, $37.3 million; cattle, $22.7 million; milk, $18.3 million (DBEDT 2007). Aquaculture production was $28.4 million in 2005 (DBEDT 2006), although much of aquaculture's value to Hawaii comes from development of technology.

Hawaii's commercial economy was particularly vibrant between 2000 and 2005, with a 7.5% growth in Gross State Product in 2005 and an average of 5.8% annual growth rate since 2000. Figure 1 indicates the long-term trend in Gross State Product (1970-2005), with the inflation-adjusted figures clearly showing the downturns in the early 1980s and the mid-1990s, followed by sustained growth recently.

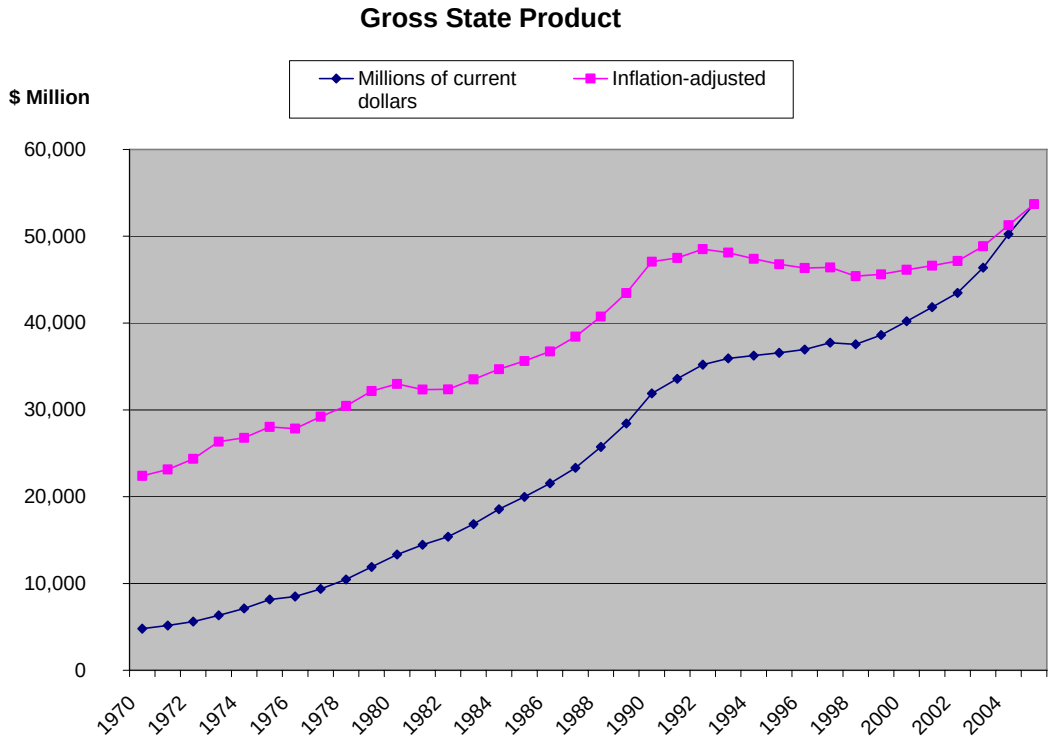

Figure 1: Gross State Product, 1970-2005
Source: DBEDT 2006

The 2006 unemployment rate (see Table 6) of 2.6% (DBEDT 2007) was the lowest in the United States by far, and close to half the U.S. average rate. This marks a major turn-around from the 1990s when Asian economies declined, the U.S. military down-sized due to the end of the Cold War, and Hawaii plantation agriculture was battered by the cost effects of global trade. Construction, manufacturing and agriculture account for only 9% of wage and salary jobs. About 30% of civilian workers are professional or managerial. Federal, state and local government accounts for 20% of wage and salary jobs (DBEDT 2007).

Table 6: Hawaii employment statistics

	2006
Civilian labor force	651,850
Employed	635,100
Unemployment rate	2.6%
Payroll jobs	624,650
Real personal income ($ million)	46,766

Source: DBEDT 2007

Tourism arrivals increased almost monotonically from 1970-1990, but growth was slower in the 1990s until the past three years. There were 7.56 million tourists in Hawaii in 2006. This represents a daily rate of 185,445 tourists, 13% of the "de facto" population (resident, tourist, and military combined), indicating the weight of tourism in many sectors of Hawaii's economy

and society (DBEDT 2007). Tourism arrivals have become more evenly distributed across source locations, with the continental U.S. and Japan being the mainstays, but with arrivals increasing from Europe and China. Nonetheless, Hawaii's tourism economy remains subject to national and international economic factors such as the recent spikes in oil prices which are believed to be hurting tourism markets such as Hawaii.

Total federal expenditures were $12.2 billion in 2004, with 85,900 military personnel and dependents and 31,300 federal civilian workers (not all of whom work on military bases, DBEDT 2007). Research and development spending by the federal government (2003) was $349.6 million representing the importance of the University of Hawaii and a number of other public and private research entities in particular.

Despite these successes, at some individual and community levels Hawaii's commercial economy has been less successful. For example, per capita disposable income in Hawaii ($29,174) has fallen to below the national average due to a cost of living that nearly doubles the national average (Table 7).

Table 7: Hawaii cost of living comparison

Cost of Living Analysis: Ratio of Honolulu living costs compared to U.S. Average at four income levels				
	Income level 1	Income level 2	Income level 3	Income level 4
Honolulu cost of living indexed to U.S. average	192.9	171.6	161.9	155.1
Rent, utilities	241.4	235.4	230.3	229.0

Source: DBEDT 2007

Hawaii per capita income has fallen from 122.5% of the U.S. average in 1970 to 99% in 2005 (Figure 2). Much of this is attributable to housing costs, with the average single family house selling for $744,174 in 2005, with the median being $590,000, the latter discrepancy also indicating the uneven nature of the housing industry in Hawaii over the past several years.

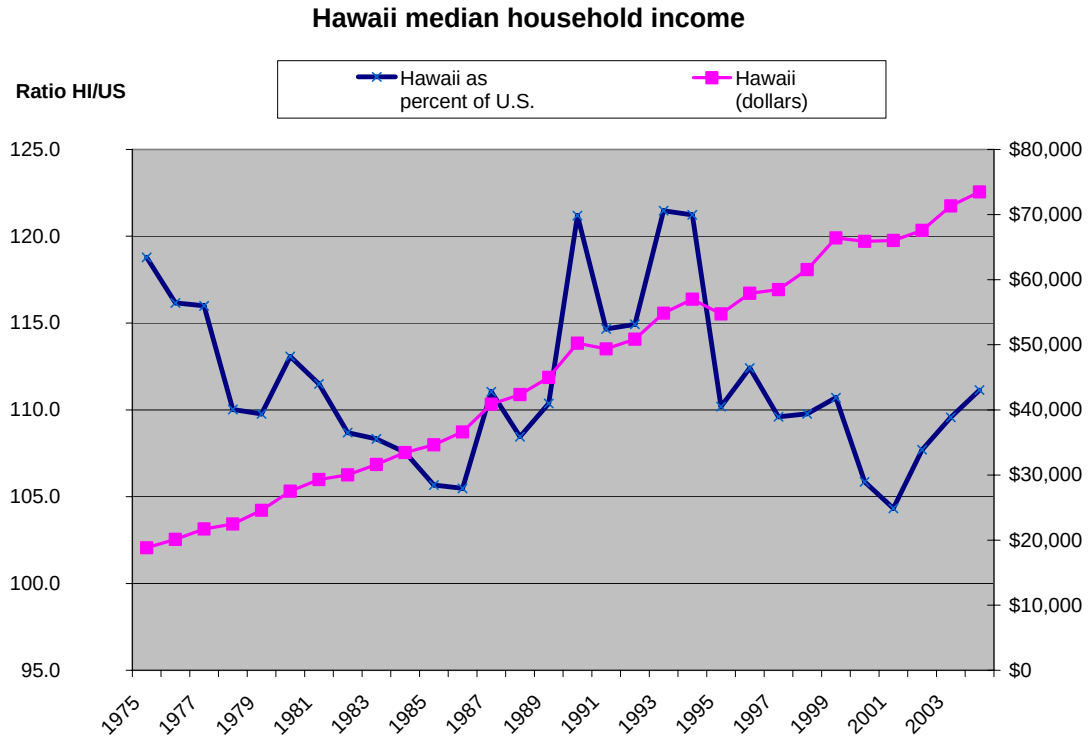

Figure 2: Hawaii median household income, 1975-2005
Source: DBEDT 2006

Tourism is a service industry, and as such, tends to have lower wage levels than manufacturing, for example. So the dominance of tourism means that many workers in Hawaii hold more than one job, with 8 percent of the workforce working more than one job (DBEDT 2007). Similarly, the benefits of the commercial economy are not spread evenly across either islands or ethnic groups in Hawaii. In 2006, 8.6% of Hawaii's population was below the poverty line (DBEDT 2007). The effect of these conditions is that the value of common use resources, such as shorelines, forests, and the ocean, is important for both subsistence and recreational reasons.

The State of Hawaii has been attempting to diversify its economy for many years. Industries encouraged are science and technology, film and television production, sports, ocean research and development, health and education tourism, diversified agriculture and floral and specialty food products. (DBEDT 2007) However, these remain a small percentage of the Hawaii commercial economy.

The most recent estimate of the ex-vessel value of fish sold by the Hawaii-based longline fishery amounts to a small percentage of Gross State Product, in fact, less than 1%. On the other hand, the seafood industry is an important component of local and tourist consumption, and recreational and subsistence fishing represent a substantial proportion of the local population (estimated at 109,000 participants, 8.6% of Hawaii's population).[2] An additional 41,000 tourists are also reported to go fishing while in Hawaii, and total fishing expenditures (resident and

2 DBEDT 2005.

tourist combined) were estimated at $125 million.

The most recent estimate of the total economic contribution of Hawaii's demersal and pelagic commercial, charter, and recreational fishing sectors to the state economy indicated that in 1992, these sectors contributed $118.79 million of output (production) and $34.29 million of household income, employing 1,469 people (Sharma et al. 1999.) These contributions accounted for 0.25 percent of total state output ($47.4 billion), 0.17 percent of household income ($20.2 billion), and 0.19 percent of employment (757,132 jobs). Recreational, subsistence and sport (*e.g.* charter) fisheries provide additional but unquantified economic benefits in terms of angler satisfaction, protein sources, and tourism revenues.

Hawaii's pelagic fisheries are responsible for the largest share of annual commercial landings and ex-vessel revenue, with 28.3 million pounds of pelagic fish landed in 2005 at an ex-vessel value of $ 70.6 million. The domestic longline fishery for tuna, swordfish, and other pelagic species is the largest component of the fishery, landing 23 million pounds in 2005 with an ex-vessel value of $58 million. Among the demersal fisheries, commercial harvests of coral reef species dominate, with MHI and NWHI bottomfish relatively close behind (Table 8). The remainder of Hawaii's commercial fisheries are relatively small, with annual fishery ex-vessel revenues of less than $150,000.

Table 8: Ex-vessel revenues from Hawaii's fisheries

	Pounds Sold	**Ex-vessel Revenue**
Pelagics (2005)	28,384,000	$70,637,000
Coral reef species (2005)	701,624	$1,796,764
MHI bottomfish (2003)	272,569	$1,460,000
NWHI bottomfish (2003)	222,000	$851,219
MHI crustaceans (2005)	10,091	$110,927
Precious corals (1997)	415	$10,394
Total	29,590,699	$74,866,304

Source: State of Hawaii fisheries statistics, unpublished data

V. Description of Small Entities to Which the Rule Would Apply

The preferred alternative would apply to all vessels registered to Hawaii longline permits that use shallow-set longline gear to target swordfish and other pelagic species.

Hawaii's longline fishery began around 1917 and was based on fishing techniques brought to Hawaii by Japanese immigrants. The early Hawaiian sampan-style flagline boats targeted large yellowfin and bigeye tuna using traditional basket gear with tarred rope mainline. This early phase of Hawaii longline fishing declined steadily into the 1970s due to low profitability and lack of investment in an ageing fleet (Boggs and Ito 1993). During the 1980s, tuna longline effort began to expand as there was increasing demand from developing domestic and export markets for high quality fresh and sashimi grade tuna. In the late 1980s and early 1990s, the nature of the fishery changed completely with the arrival of swordfish- and tuna-targeting fishermen from longline fisheries of the Atlantic and Gulf States. The influx of large, modern longline vessels

promoted a revitalization of the fishery, and the fleet quickly adopted new technology to better target bigeye tuna at depth. The near-full usage of monofilament mainline longline reels further modernized the fleet and improved profitability. Longline effort increased rapidly from 37 vessels in 1987 to 138 vessels in 1990 (Ito and Machado 2001). An emergency moratorium was placed on the rapidly expanding fishery in 1991.

Longline fishing employs a mainline that is deployed as the fishing vessel moves across the water. The mainline is suspended horizontally below the surface by evenly spaced float lines that are clipped along the mainline's length. Branch lines that terminate with baited fishhooks are clipped to and suspended below the mainline. Longline deployment is typically referred to as "setting", and the gear, once it is deployed, is typically referred to as a "set". Longline sets are normally left to drift for several hours before they are hauled back aboard along with any catch. Mainlines typically consist of a single strand of monofilament line with a test strength of 450 to 680 kg (1000 to 1500 lb). Mainlines are stored on large horizontal reels, and may exceed 74 km (40 nm) in length. Float lines most frequently consist of braided, multi-stand lines with a quick release clip on one end and a large float on the other. Float lines are typically 10 to 30 meters (m) long. Branch lines typically consist of 20 to 30 m of 227 kg (500 lb) test monofilament line with a quick release clip on one end and a fishhook on the other. Depending on the fishery, branch lines may, or may not, have some form of weight attached above the hook.

The longline fleet is composed mostly of steel-hulled vessels and a few wood and fiberglass vessels. The longline fleet has historically operated in two distinct modes based on gear deployment: deep-set longline to target primarily tuna and shallow-set longline used to target swordfish or mixed species including bigeye, albacore and yellowfin tuna. Presently, Hawaii-based longline fishermen must declare themselves as shallow- or deep-set trips 72 hours in advance of their planned departure. Mixed trips are prohibited. Shallow-set fishermen must use of float lines 20 m or less, 10 to 20 m float lines are standard. A typical shallow-set branch line is 15 to 20 m long, with a 45 to 85 gram lead weight in middle, and an 18/0 offset circle hook at end. About 840 hooks are deployed per shallow-set, with 4 to 5 hooks set between each float. Since swordfish are targeted at night, lightsticks are typically attached to every other branch line. Lightsticks are prohibited onboard vessels on deep-set declared trips. Since swordfish are targeted at night, lightsticks attached to the longline gear are used to attract swordfish. 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.

To further manage the rapidly expanding fishery, longline fishing was also prohibited within 50 nm of the main Hawaiian Islands to reduce gear conflicts between small troll and handline boats and longline vessels. Another area closure was established prohibiting longline fishing within a 50 nm radius of the Northwestern Hawaiian Islands to prevent interactions with endangered Hawaiian monk seals. A limited access program was established in 1994 allowing for a maximum of 164 transferable longline permits for vessels ≤101 feet in overall length that is administered by NMFS. During the same year, the Hawaii Longline Observer Program was initiated, primarily to monitor interactions with protected species.

In 1985, the longline fishery surpassed landings of the skipjack pole-and-line fleet and has remained the largest Hawaii-based fishery to date. Swordfish landings rose rapidly from 600,000

lbs in 1989 to 13.1 million pounds in 1993 (WPRFMC 2003). The Hawaii-based limited access longline fishery is the largest of all the pelagics fisheries under Council jurisdiction. This fishery accounted for the majority of Hawaii's commercial pelagic landings with an average of 9,672 t or 19.3 million lb for the years 2000 – 2005. The relative importance of swordfish to the fishery declined during the mid 1990s following a 47 percent decrease in landings in 1994. The latter part of 1994 saw a stabilization of swordfish landings at close to 6.5 million pounds/year, a significant increase in shark take, primarily blue shark fins, and a gradual increase in tuna fishing effort and landings. Effort continued to shift away from swordfish and back to tuna targeted trips throughout the latter 1990s (WPRFMC 2004).

During the mid to late 1990's, the fishery was often described as consisting of three components; a core tuna group, a swordfish targeting sector and vessels that were classified as "mixed"; switching between swordfish and tuna throughout the year or even within a single trip. Generally speaking, tuna vessels set deep gear with more than 15 hooks between floats in the morning, began hauling gear in the late afternoon or dusk, usually used a line shooter to deepen the set, preferred saury or sardine bait and made relatively short trips within 500 miles of home port. Swordfish boats were generally larger than tuna boats, set shallow gear at dusk with an average of 4 hooks between floats, used chemical light sticks, hauled gear at dawn, never used a line shooter, preferred large squid bait and made much longer trips beyond 700 miles from port. The swordfish grounds are generally north of Hawaii, between 145° and 175° W and 20° and 40° N, centered around the sub-tropical convergence zone. In the late 1990s, the fishery supplied 37 to 47 percent of the total U.S. domestic swordfish consumption.

Regulations imposed from 2001-2004 prohibited swordfish targeted longline fishing for Hawaii-based vessels due to concerns about interactions with protected sea turtles. As a result of restrictions on swordfish-targeted longline fishing by Hawaii-based boats, a number of vessels temporarily left Hawaii to exploit the same swordfish stocks from bases in California. Other swordfish boats converted gear to remain in Hawaii and target bigeye tuna.

Regulatory Amendment 3, effective April 2, 2004, re-opened the Hawaii-based shallow-set swordfish fishery by allowing 2,120 shallow-sets to be made annually (69 FR 17329, April 2, 2004). In order to reduce3 and mitigate interactions with sea turtles, use of 18/0 (or larger) circle hooks with 10˚ maximum offset and blue-dyed mackerel-type bait instead of squid were required, along with other mitigation measures and a maximum annual limit on the number of interactions with sea turtles is set at 16 leatherbacks and 17 loggerheads. Integral to this program has been the requirement for 100 percent observer coverage. Most of the swordfish boats that had moved to California have now returned to Hawaii; however, tuna directed effort remains higher than for swordfish.

Presently, Hawaii-based longline fishermen must declare themselves as shallow- or deep-set trips 72 hours in advance of their planned departure. Mixed trips are prohibited. Shallow-set fishermen must use of float lines 20 m or less, 10 to 20 m float lines are standard. A typical shallow-set branch line is 15 to 20 m long, with a 45 to 85 gram lead weight in middle, and an

3 In experiments conducted by NMFS with longline vessels in the Atlantic, the use of circle hooks and mackerel-type bait significantly reduced sea turtle interaction rates. The mean reduction rate for loggerhead turtles was 92%, with a 67% reduction in leatherback interactions.

18/0 offset circle hook at end. About 840 hooks are deployed per shallow-set, with 4 to 5 hooks set between each float. Since swordfish are targeted at night, lightsticks are typically attached to every other branch line. Lightsticks are prohibited onboard vessels on deep-set declared trips

Regulatory Amendment 4, effective December 15, 2005 further reduced and mitigated interactions between turtles and longline gear by requiring that: (1) owners and operators of vessels registered for use under longline general permits attend protected species workshops annually, (2) owners and operators of vessels registered for use under longline general permits carry and use dip nets, line clippers, and bolt cutters, and follow handling, resuscitation, and release requirements for incidentally hooked or entangled sea turtles, and (3) operators of non-longline vessels using hooks to target pelagic management unit species follow sea turtle handling, resuscitation, and release requirements, as well as remove the maximum amount of gear possible from incidentally hooked or entangled sea turtles (70 FR 69282). In addition this rule extended the requirement to use circle hooks, mackerel-type bait and dehookers when shallow-setting north of the equator to include all longline vessels managed under the Pelagics FMP.

All longline vessels carry mandatory VMS monitored by the NMFS and must submit mandatory logsheet data at the completion of every trip. VMS are satellite-based vessel monitoring systems whereby each unit transmits a signal identifying the exact latitude and longitude of a vessel.

The limited access program allows for 164 vessels in the longline fisheries, but active vessel participation has been closer to 120 during the past decade. About 30 vessels have participated in the shallow-set fishery annually since its reopening; 33 in 2005, 37 in 2006, and 29 in 2007. Vessel sizes range up to nearly the maximum 101 foot limit, but the average size is closer to 65 – 70 ft. Most of the vessels are of steel construction and use flake ice to hold catch in fresh/chilled condition. A few older wooden boats persist in the fishery. Some of the boats have mechanical refrigeration that is used to conserve ice, but catch is not frozen in this fishery. Almost all of the Hawaii-based longline catch is sold at the United Fishing Agency auction in Honolulu. It is believed that very little of the longline catch is directly marketed to retailers or exported by the fishermen. For detailed information and annual landings data see the Council's Annual Reports. Table 9 illustrates that Hawaii's longline fleet is by far the largest commercial pelagic producer in Hawaii. Figures 3-6 provide data and trends for the Hawaii-based longline fleet and shallow-set fishery.

Table 9: Hawaii commercial pelagic landings, revenue, and average price by fishery

	2005			2006		
Fishery	**Pounds Landed (1000 lbs)**	**Ex-vessel Revenue ($1000)**	**Average Price ($/lb)**	**Pounds Landed (1000 lbs)**	**Ex-vessel Revenue ($1000)**	**Average Price ($/lb)**
Longline	23,275	$61,379	$2.76	21,478	$49,207	$2.66
MHI trolling	2,517	$5,323	$2.40	2,363	$4,713	$2.44
MHI Handline	1,193	$2,138	$1.89	645	$1,187	$2.11
Offshore Handline	313	$410	$2.05	390	$458	$2.11
Aku boat	931	$1,137	$1.23	632	$812	$1.41
Other Gear	155	$250	$2.15	286	$432	$2.41
Total	**28,384**	**$70,637**	**$2.64**	**25,794**	**$56,809**	**$2.59**

Source: 2006 WPRFMC Annual Report.

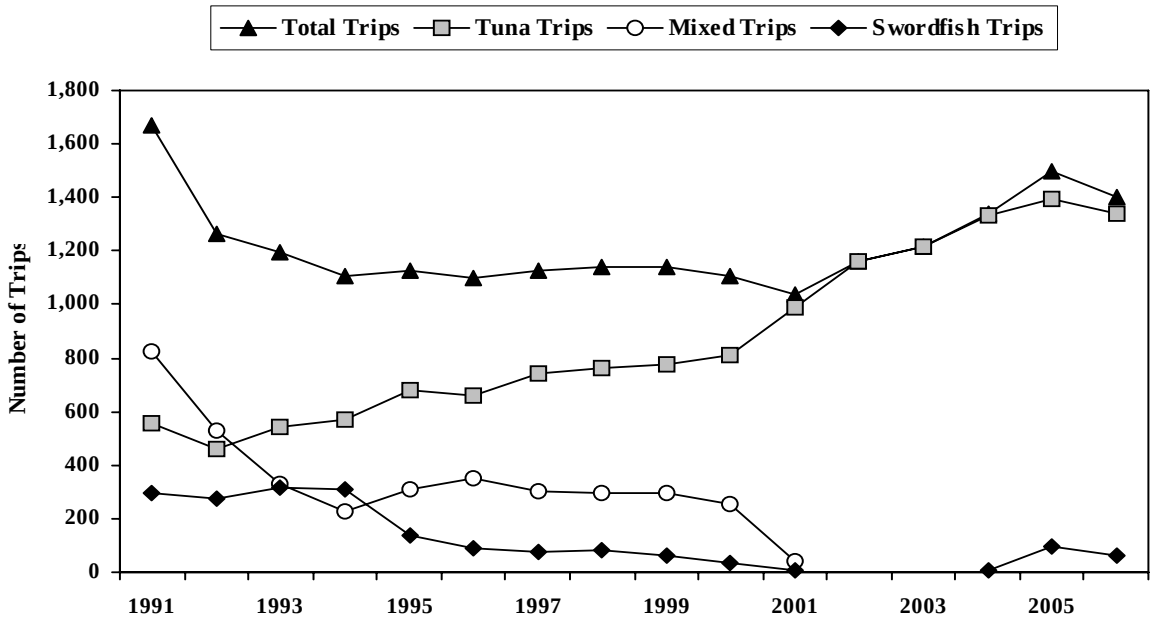

Figure 3: Annual Hawaii-based longline trips, 1991-2006
Source: 2006 WPRFMC Annual Report

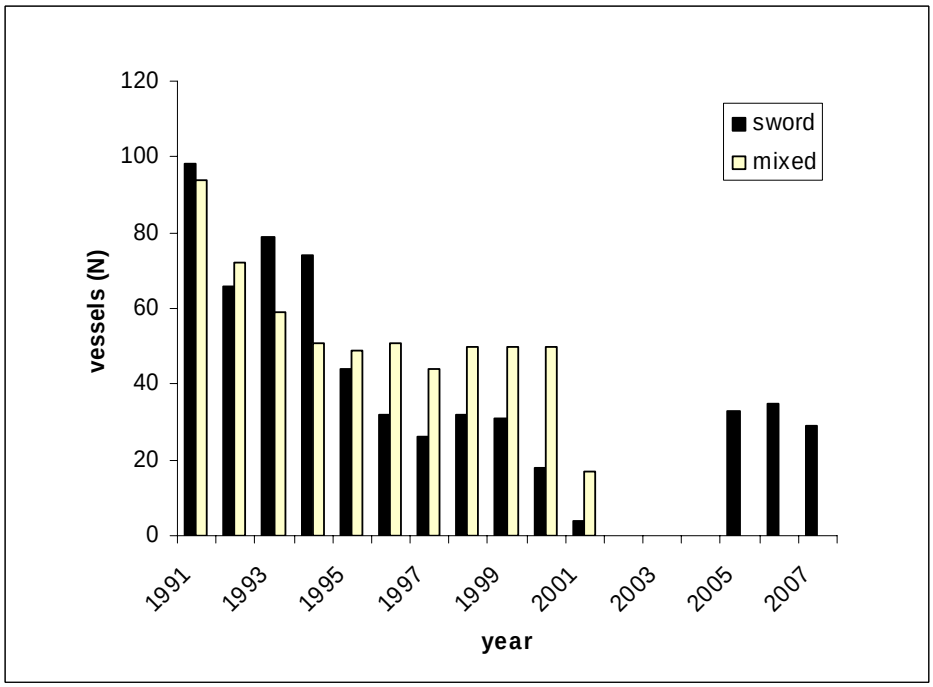

Figure 4: Number of Hawaii longline vessels targeting swordfish, 1991-2007
Source: WPRFMC Pelagics Annual Report 2006

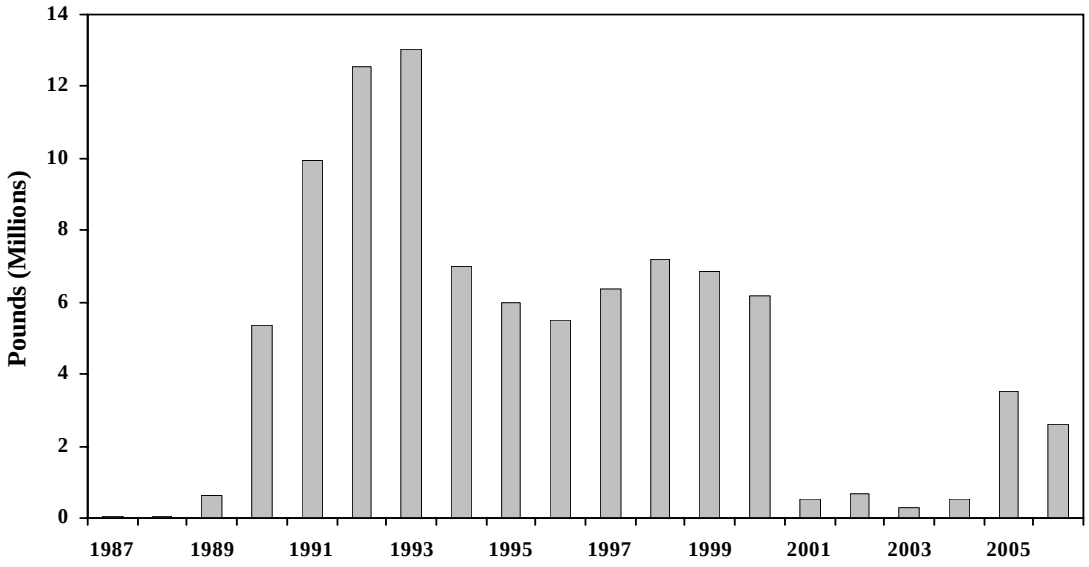

Figure 5: Hawaii Swordfish Landings, 1987-2006
Source: 2006 WPRFMC Annual Report

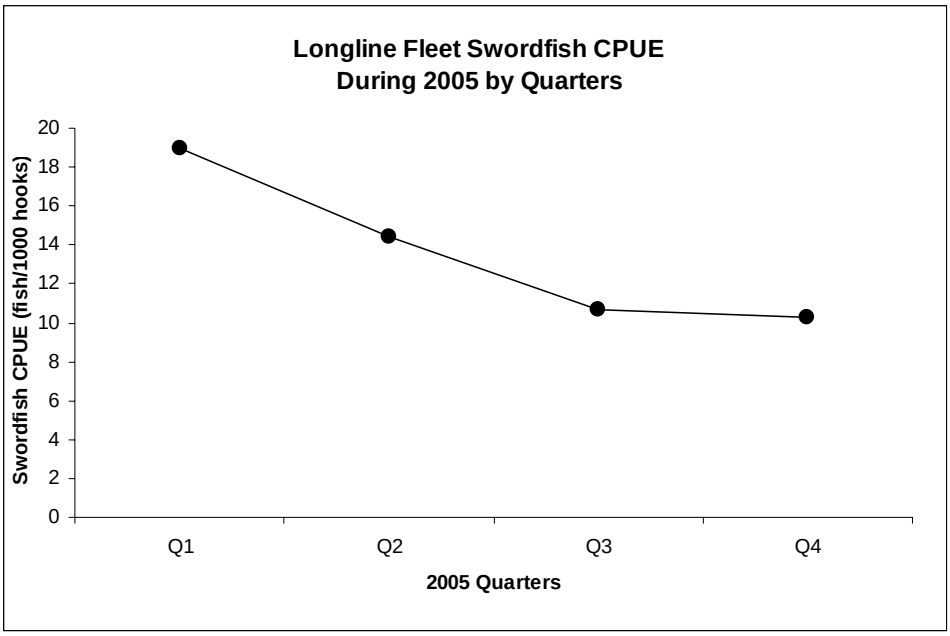

Figure 6: 2005 Hawaii longline swordfish quarterly catch rates
Source: 2006 WPRFMC Annual Report
As seen Figure 6, swordfish catch per unit effort (catch per set or CPUE) is highest in the first quarter of the year with the second quarter also yielding high CPUE levels. Since the reopening of the shallow-set fishery in 2004, effort in the fishery has been highest in the first quarter. However, prior to 2004, effort in the fishery was highest in the second quarter. A plausible explanation for higher first quarter effort since 2004 is linked to possibility that the annual sea turtle hard caps are driving effort in the first quarter, *i.e.* a race to the fish before a potential fishery closure due to reaching the turtle cap.

According to unpublished information from NMFS, about 30 vessels have participated in the shallow-set fishery annually since its reopening; 33 in 2005, 37 in 2006, and 29 in 2007.

Assuming that 100 percent of the swordfish caught by Hawaii permitted longline vessels is caught on shallow-set longline gear and that these vessels only 2005-2007 harvest swordfish, annual participation, trips, and using then 2004-2007 average annual swordfish price of $2.32 per pound, harvests and ex-vessel [gross] revenues are as shown in Table 10. The assumptions regarding catches and prices are necessary as currently available fishery reports do not provide gear specific (i.e. shallow-set vs. deep-set) historical catch or revenue information. The assumption that 100 percent of the longline fishery's swordfish catch can be attributed to shallow-set fishing is likely an overstatement, but only a small one, as deep-setting vessels are prohibited from retaining or landing more than 10 swordfish per trip. On the other hand, the assumption that swordfish is the only species caught by shallow-set gear is an understatement as swordfish has been shown to comprise between 90 and 91 percent of catches by this gear. However given that the primary purpose of Table 10 is to demonstrate that these operations are believed to have annual gross revenues of less than $4.5 million, these shortcomings do not appear unreasonable.

Table 10: Summary of operating information for Hawaii-based longline vessels

Year	Number of active vessels	Number of trips	Pounds of swordfish landed	Total shallow-set fishery ex-vessel revenue	Average shallow-set ex-vessel revenue per vessel
2005	33	99	3,257,000	$7,556,240	$228,978
2006	37	60	2,573,000	$5,969,360	$161,334
2007	29	82	3,781,000	$8,771,920	$302,480
Average	33	80	3,204	$7,432,507	$225,227

Source: 2006 and 2007 WPRFMC Annual Reports

Given an annual average of 33 active shallow-setting vessels between 2005-2007 with an annual average fleet-wide adjusted revenue of $7,432,507 (Table 10), it is estimated that each vessel realized an average of $225,227 in annual ex-vessel revenues from shallow-set longline fishing operations. In addition it is believed that the vast majority of participants are also active in the deep-set longline fishery during the course of a year, thus their shallow-set revenues represent one portion of their total revenue. In 2007 the overall average (combined deep-set and shallow-set longline fisheries) ex-vessel revenue was $62,699,000 realized by a total of 129 active vessels (2007 WPRFMC Annual Report). On a per vessel basis, this yields an average ex-vessel revenue of $486,039 per vessel, still far below the $4.5 million threshold. Although single permit holders may own more than one vessel, none are believed to own more than five active shallow-setting vessels and none are believed to be dominant in their field – making them small businesses under the Regulatory Flexibility Act. Impacts to shoreside businesses would likely be neutral to positive under all alternatives as none would reduce fishing effort and most would increase it, along with associated purchases of fishing gear and supplies and associated sales of swordfish.

VI. Economic Impacts of the Alternatives on Small Businesses

Table 11: Summary of alternatives considered

Topic	Alternative	Description
1. Effort Limit	1A	No action (allow 2,120 shallow-sets per year)
	1B	Allow 3,000 shallow-sets per year
	1C	Allow 4,240 shallow-sets per year
	1D	Allow 5,000 shallow-sets per year
	1E	Allow effort appropriate to swordfish stock status (~9,925 shallow-sets per year)
	1F Preferred	Remove effort limit (rely on turtle hard caps)
2. Fishery Participation	2A	No action
	2B Preferred	Discontinue set certificate program
3. Time Area Closures	3A Preferred	No action
	3B	Implement January time-area closure
	3C	Implement in-season time-area closure

Analytical Methodology
Data used in this analysis were provided by NMFS. Quarter 1 (Q1) comprises January – March of each year, Quarter 2 is April-June, Quarter 3 is July-September, and Quarter 4 is October-December.

Predicted fish catch rates (number of fish caught per set) are based on quarterly logbook data provided by NMFS (PIFSC 2008) for Hawaii-based longline swordfish trips since the 2004 implementation of regulatory requirements to use circle hooks and mackerel-type bait, which may have affected catch rates for swordfish and other species. These 2004-2007 average quarterly rates (Table 12) were applied to the respective quarterly swordfish effort levels (number of sets) anticipated under each alternative to yield fish catches for each alternative.

Table 12: 2004-2007 Hawaii longline average catches (number of fish) per set by quarter

Species	Q1	Q2	Q3	Q4
Swordfish	15.15	12.22	8.89	9.78
Striped marlin	0.11	1.24	0.63	0.11
Blue marlin	0.01	0.34	0.19	0.01
Bigeye tuna	1.51	0.58	1.01	0.49
Albacore tuna	1.04	0.03	0.01	2.14
Yellowfin tuna	0.11	0.13	0.06	0.01
Blue shark	12.41	5.04	8.09	10.04
Mahimahi	0.55	5.08	5.74	0.27
Opah	0.05	0.01	0.02	0.22
Ono	0.02	0.14	0.06	0.00
Pomfret	0.14	0.05	0.02	0.14
Mako shark	0.70	0.40	0.33	1.21
Oceanic whitetip shark	0.00	0.24	0.19	0.00
Oilfishes	0.73	2.29	3.01	0.56
Other pelagics	0.04	0.17	0.02	1.09
Other sharks	0.03	0.06	0.01	0.07
Other tuna	0.01	0.00	0.29	0.18
Shortbilled spearfish	0.03	0.18	0.04	0.01
Skipjack tuna	0.04	0.03	0.01	0.01
Thresher sharks	0.02	0.05	0.10	0.02

Source: PIFSC 2008

These catches were converted from numbers of fish to pounds using 2005-2006 average weight recorded per fish for each species (WPRFMC 2006, Table 13). In some cases average weights are not available. This is either because virtually all catches of certain species are discarded (*e.g.* oceanic whitetip sharks) or because related species caught in small numbers have been aggregated into groups (*e.g.* other pelagics, sharks, and tunas).

Table 10: 2005-2006 average weight per fish

Species	2005-2006 average weight per fish (lbs)
Albacore Tuna	51
Bigeye Tuna	87
Blue Marlin	163
Blue Shark	100
Mahimahi	14
Mako Shark	177
Oceanic Whitetip Shark	n/a
Oilfishes	17
Ono	30
Opah	83
Other Pelagics	n/a
Other Sharks	n/a
Other Tunas	n/a
Pomfret	13
Shortbilled Spearfish	31
Skipjack Tuna	16
Striped Marlin	68
Swordfish	166
Thresher Sharks	198
Yellowfin Tuna	64

Source: WPRFMC 2006
n/a = not available

The catch data presented for each alternative begins with the pounds of fish predicted to be caught ("pounds caught") then reduces this number by the discard rates recorded by federal observers for that species to arrive at "pounds kept". The next column indicates the pounds of fish discarded dead (again from NMFS observer data). Total species impacts ("total mortality) can be regarded as the sum of the pounds kept plus the pounds, plus some portion of those discarded alive that subsequently perish due to their experience.

Average annual ex-vessel species specific prices received by Hawaii-based swordfish longline vessels between 2004-2007 (PIFSC 2008) were applied to "pounds kept" to calculate predicted ex-vessel revenues. The one exception to this is swordfish which is the fishery's target species and accounts for approximately 90 percent of its revenue. Because swordfish prices are known to vary within years, swordfish ex-vessel revenues are based on recent quarterly average prices (2004-2007, PIFSC 2008) rather than a single annual average price (Table 14). This provides explicit consideration of temporal swordfish price effects under each alternative.

Table 14: 2004-2007 Hawaii longline average swordfish ex-vessel prices

	Q1	Q2	Q3	Q4
Price per pound	$2.38	$2.11	$2.59	$2.21

Source: PIFSC 2008

Predicted quarterly effort levels for each alternative utilize three temporal effort distributions. The first is that observed in the current "tightly constrained" regulatory environment which restricts annual effort to 2,120 sets (approximately 50 percent of the 1994-1999 average). Swordfish effort data from NMFS (PIFSC 2008) for 2004-2007 revealed that Hawaii-based vessels made the majority of their annual sets in the first quarter, with another third made in the second quarter and smaller amounts in the last two quarters (Table 15). At the other extreme the fishery can be considered to be "unconstrained "prior to 2001 when there was no limitation on the number of annual sets allowed or sea turtle hard caps. In the prior regulatory environment (before 2001), Hawaii-based swordfish vessels made the majority of their sets in the second quarter. By comparison, the current regulatory environment ("tightly constrained") exhibits signs of a "race to the fish" as participants likely seek to complete trips before either the effort limit or turtle cap is reached. Because the effort limit of 2,120 sets has not been reached in any calendar year since 2004, it appears the sea turtle hard caps of 17 loggerheads and 16 leatherbacks are driving the observed increase in percentage of first quarter effort relative to the historical fishery prior to 2001.

Quarterly shallow-set effort data from 2005-2007 were used to estimate quarterly effort distributions under differing regulatory regimes. In calculating effort distributions in response to varying regulatory restrictions under the alternatives for Topic 1, first quarter 2006 effort data was used while recognizing that the second, third, and fourth quarters of 2006 did not experience effort because the fishery was closed from reaching loggerhead turtle cap. By entering first quarter 2006 effort data as 100 % annual effort for that year skews the predicted effort distributions towards the first quarter for Alternatives 1A, 1B, and 1C. This allows the analysis to present "worst-case" scenarios in terms of sea turtle impacts as interactions are highest in the first quarter of the year. As first quarter catch rates for swordfish are also highest in the first quarter, predicted catches of swordfish similarly presented as well as predicted economic impacts. A strictly objective statistical approach was not possible because data only exists for two full years of fishing effort at the time of conducting this analysis.

Table 11: Hawaii shallow-set fishery quarterly effort (sets) distribution, 2004-2008

Year	Q1	Q2	Q3	Q4	Annual Total
2004	0	5	3	127	135
2005	539	871	54	181	1,645
2006	850	0	0	0	850
2007	948	465	83	27	1,497

Source: NMFS 2008

Due to their relatively restrictive natures, Alternatives 1A and 1B (allow 2,120 and 3,000 sets respectively) are analyzed under the "tightly constrained" temporal effort distribution (Table 16). Alternative 3 (allow 4,240 sets) is analyzed under a "moderately constrained" distribution which lies halfway between the two extremes described above (Table 16). Under this scenario vessels again make the majority of their sets in the first quarter; however, it is a smaller majority than that shown in the "tightly constrained" scenario. Alternatives 1D and 1E (allow 5,500 and 9,925 sets respectively) would allow swordfish fishing levels around the fishery's historical maximum and are therefore analyzed under the "unconstrained" distribution shown below in Table 16.

Table 12: Swordfish effort distributions for each effort limit alternative

Alternative: scenario	Percent of annual swordfish effort per quarter			
	Q1	Q2	Q3	Q4
Alternatives 1A and 1B: tightly constrained	57%	32%	3%	7%
Alternative 1C: moderately constrained	43%	34%	11%	12%
Alternatives 1D, 1E: unconstrained	29%	36%	19%	17%

Note: Alternative 1F is predicted to lie between 1C and 1D in terms of regulatory constraints.

As the number of allowable sets increase under the alternatives, the predicted protected species interactions must be increasingly regarded as "worst case" scenarios as the Hawaii-based longline fleet has not made 8,500 sets in any one year since 1991 and in fact the average between 1991 and 2000 was 5,600 annual swordfish sets. More recently, since the 2004 implementation of the set certificate program and 2,120 set limit, the fleet has averaged less than 1,400 sets per year (in 2006 the fishery closed in March after 850 sets due to the turtle cap being reached). Anecdotal information indicates that the necessity of buying set certificates under the existing program has acted as a deterrent and limited total effort as well as high demand and established market channels for bigeye tuna. The true reactions of fishery participants and their resultant effort distributions under the alternatives considered here remain uncertain and will likely include considerations of prevailing weather, oceanographic, economic and market conditions. However, resultant effort is not expected to yield higher numbers of protected species interactions than the worst case scenarios presented here which assume that all available sets are used under each alternative. For further information on the calculation of estimated catches and interactions with protected species under each alternative please see Chapter 4 of the main document. Please also see Chapter 4 or information on the expected impacts of the alternatives on other aspects of the physical environment. The following analysis focuses on the expected economic impacts of each alternative to affected fishery participants, and the regional economy of Hawaii.

Topic 1: Shallow-set Longline Fishing Effort Limits

Impacts of Alternative 1A (No action)

Under Alternative 1A, the shallow-set swordfish segment of the Hawaii longline fishery would continue to operate with a maximum effort limit of 2,120 sets and existing hard caps on sea turtle interactions (17 loggerheads or 16 leatherbacks). Based on the 2004 - 2007 fishing seasons, it is unlikely that all this effort will be expended in every year and swordfish landings (retained catches) would then be likely to remain between the 226,000 and 3.1 million pounds retained in 2004 and 2005 respectively. If the fishery was to utilize all 2,120 sets the total retained swordfish catch would be anticipated to be 4.3 million pounds, with another 349,000 pounds discarded dead for a total annual fishing mortality of 4.6 million pounds which is approximately 9.4 percent of MSY. Other (non-swordfish) species would continue to comprise a small fraction of the catch with bigeye tuna accounting for approximately four percent of total fishing mortality and striped marlin and mahimahi each comprising another one percent of fishing mortality within the shallow-set fishery. Other commercial species such as albacore, blue marlin, yellowfin tuna would contribute smaller amounts to the remainder of the retained catch. Catches of these non-swordfish target species under this and all the remaining alternatives are a negligible fraction of total Pacific-wide catches and known MSY values of these species. For example,

194,911 pounds of bigeye is estimated to be 0.00096-0.0013 percent of the WCPO bigeye MSY. Because Alternative 1A is not expected to significantly alter fishing operations, catch and discard rates of non-target species would be anticipated to remain as observed between 2004 and 2007 and these species would be expected to form between six and seven percent of the fishery's total annual catch, with the specific volume proportional to the number of sets actually made. Relative discard conditions would also be expected to remain as observed. Resultant fishing mortality to non-target species would be expected to be a very minor fraction of Pacific-wide catches, and well below known MSY levels.

Using the methodology described above and assuming that all 2,120 sets were utilized, the fleet would be anticipated to retain and sell 4.3 million pounds of swordfish for $9.7 million in ex-vessel revenues. Sales of 424,000 pounds of other species would yield an additional $1.1 million in ex-vessel revenues (Table 17). Currently, there are approximately 30 vessels participating in the fishery and under this alternative, that number is not expected to increase.

Table 13: Predicted annual ex-vessel revenues under Alternative 1A (2,120 sets made)

Species	Annual pounds kept	Annual ex-vessel revenue	Percent of annual revenue
Swordfish	4,263,648	$ 9,781,758	90.22%
Bigeye Tuna	188,900	$ 622,742	5.74%
Mahimahi	53,431	$ 119,507	1.10%
Striped Marlin	60,267	$ 98,838	0.91%
Albacore Tuna	51,531	$ 97,738	0.90%
Blue Marlin	36,501	$ 45,215	0.42%
Yellowfin Tuna	13,594	$ 36,891	0.34%
Oilfishes	4,903	$ 9,904	0.09%
Opah	5,105	$ 9,902	0.09%
Ono	3,432	$ 9,173	0.08%
Pomfret	2,249	$ 5,366	0.05%
Shortbilled Spearfish	3,211	$ 3,629	0.03%
Skipjack Tuna	990	$ 877	0.01%
All Other Pelagics*			
Annual Total	4,687,763	$ 10,841,538	100.00%
* All other pelagics account for less than two percent of total annual fish kept, detailed weight and price, information not available for all species.			

Utilizing the methodology and model presented by Leung and Pooley (2002) for the Hawaii longline fishery, the anticipated ex-vessel revenues under Alternative 1A ($10.8 million, Table 17) would generate $26.3 million in direct and indirect business sales, $11.7 million in personal and corporate income, 362 jobs, and $2 million in state and local taxes (Table 18).

Table 18: Predicted regional impacts under Alternative 1A (2,120 sets made)

Variable	Impact
Predicted Ex-vessel Revenue ($ million)	10.84
Direct Effects	
Business Sales ($ million)	10.84
Income ($ million)	5.25
Employment (jobs)	151.36
State & Local Taxes ($ million)	0.88
Indirect and Induced Effect From Local Purchases of Goods & Services	
Business Sales ($ million)	7.69
Income ($ million)	3.05
Employment (jobs)	95.56
State & Local Taxes ($ million)	0.51
Indirect and Induced Effect From Direct Income of Longline Fishing	
Business Sales ($ million)	7.75
Income ($ million)	3.38
Employment (jobs)	115.57
State & Local Taxes ($ million)	0.56
Total Effect	
Business Sales ($ million)	26.28
Income ($ million)	11.68
Employment (jobs)	362.48
State & Local Taxes ($ million)	1.95

Source: Based on Leung and Pooley (2002)

Impacts of Alternative 1B (Allow 3,000 shallow-sets per year)

Under Alternative 1B and assuming that all 3,000 allowable sets were made, the Hawaii-based swordfish fishery would be expected to retain and sell 6 million pounds of swordfish for $13.8 million in ex-vessel revenues (Table 19). Sales of 600,016 pounds of other species would yield an additional $1.5 million in ex-vessel revenues. As compared to anticipated catches and revenues if all 2,120 sets were made under Alternative 1A, this represents a 41.5 percent increase in retained catch with a directly associated 41.5 percent increase in ex-vessel revenues, for individual and aggregate species. Currently, there are approximately 30 vessels participating in the fishery, and under this alternative, that number would be expected to increase by approximately 5-10 vessels.

Table 19: Predicted annual ex-vessel revenues under Alternative 1B (3,000 sets made)

Species	Annual pounds kept	Annual ex-vessel revenue	Percent of annual revenue
Swordfish	6,033,465	$ 13,842,110	90.22%
Bigeye Tuna	267,312	$ 881,239	5.74%

Species	Annual pounds kept	Annual ex-vessel revenue	Percent of annual revenue
Mahimahi	75,610	$ 169,113	1.10%
Striped Marlin	85,283	$ 139,865	0.91%
Albacore Tuna	72,922	$ 138,309	0.90%
Blue Marlin	51,652	$ 63,984	0.42%
Yellowfin Tuna	19,237	$ 52,204	0.34%
Oilfishes	6,938	$ 14,015	0.09%
Opah	7,224	$ 14,012	0.09%
Ono	4,856	$ 12,980	0.08%
Pomfret	3,183	$ 7,594	0.05%
Shortbilled Spearfish	4,544	$ 5,135	0.03%
Skipjack Tuna	1,401	$ 1,241	0.01%
All Other Pelagics*			
Annual Total	6,633,627	$ 15,341,799	100.00%
* All other pelagics account for less than two percent of total annual fish kept, detailed weight and price information not available for all species			

Utilizing the methodology and model presented by Leung and Pooley (2002) the anticipated ex-vessel revenues under Alternative 1B ($15.3 million, Table 19) would be predicted to have impacts to the regional economy as depicted in Table 20. In sum it is estimated that under Alternative 1B the Hawaii longline swordfish fishery would generate $37.2 million in direct and indirect business sales, $16.5 million in personal and corporate income, 513 jobs, and $2.8 million in state and local taxes.

Table 20: Predicted regional impacts under Alternative 1B (3,000 sets made)

Variable	Impact
Predicted Ex-vessel Revenue ($ million)	15.34
Direct Effects	
Business Sales ($ million)	15.34
Income ($ million)	7.43
Employment (jobs)	214.18
State & Local Taxes ($ million)	1.24
Indirect and Induced Effect From Local Purchases of Goods & Services	
Business Sales ($ million)	10.88
Income ($ million)	4.32
Employment (jobs)	135.23
State & Local Taxes ($ million)	0.72
Indirect and Induced Effect From Direct Income of Longline Fishing	
Business Sales ($ million)	10.97
Income ($ million)	4.78
Employment (jobs)	163.54

State & Local Taxes ($ million)	0.80
Total Effect	
Business Sales ($ million)	37.19
Income ($ million)	16.52
Employment (jobs)	512.95
State & Local Taxes ($ million)	2.76

Source: Based on Leung and Pooley 2002

Impacts of Alternative 1C (Allow 4,240 shallow-sets per year)

Under Alternative 1C and assuming that all 4,240 allowable sets were made, the Hawaii-based swordfish fishery would be expected to retain and sell 8 million pounds of swordfish for $18.4 million in ex-vessel revenues (Table 21). Sales of 856,000 pounds of other pelagics would yield an additional $2.1 million in ex-vessel revenues. As compared to anticipated catches and revenues if all 2,120 sets were made under Alternative 1A, this represents an 88 percent increase in swordfish pounds kept and a 90 percent increase in total retained catch as well as total ex-vessel revenues. Currently, there are approximately 30 vessels participating in the fishery, and under this alternative, that number would be expected to increase by approximately 20-30 vessels. This increase in vessels, however, is dependent on several factors such as swordfish and bigeye markets, fuel costs, and other operational costs.

Table 21: Predicted annual ex-vessel revenues under Alternative 1C (4,240 sets made)

Species	Annual pounds kept	Annual ex-vessel revenue	Percent of annual revenue
Swordfish	8,038,241	$ 18,408,854	89.84%
Bigeye Tuna	343,045	$ 1,130,906	5.52%
Mahimahi	129,370	$ 289,357	1.41%
Striped Marlin	134,921	$ 221,270	1.08%
Albacore Tuna	97,107	$ 184,180	0.90%
Blue Marlin	84,115	$ 104,197	0.51%
Yellowfin Tuna	25,031	$ 67,929	0.33%
Oilfishes	11,263	$ 22,751	0.11%
Opah	11,449	$ 22,207	0.11%
Ono	7,418	$ 19,829	0.10%
Pomfret	4,050	$ 9,662	0.05%
Shortbilled Spearfish	6,636	$ 7,498	0.04%
Skipjack Tuna	1,757	$ 1,556	0.01%
All Other Pelagics*			
Annual Total	8,894,403	$ 20,490,196	100.00%

* All other pelagics account for less than three percent of total annual fish kept, detailed weight and price information not available for all species.

Utilizing the methodology and model presented by Leung and Pooley (2002) the anticipated ex-vessel revenues under Alternative 1C ($20.53 million, Table 21) would be predicted to have the following impacts to the regional economy (Table 22). In sum it is estimated that under

Alternative 1C the Hawaii longline swordfish fishery would generate $49.7 million in direct and indirect business sales, $22.1 million in personal and corporate income, 685 jobs, and $3.7 million in state and local taxes.

Table 22: Predicted regional impacts under Alternative 1C (4,240 sets made)

Variable	Impact
Predicted Ex-vessel Revenue ($ million)	20.49
Direct Effects	
Business Sales ($ million)	20.49
Income ($ million)	9.92
Employment (jobs)	286.07
State & Local Taxes ($ million)	1.66
Indirect and Induced Effect From Local Purchases of Goods & Services	
Business Sales ($ million)	14.53
Income ($ million)	5.77
Employment (jobs)	180.61
State & Local Taxes ($ million)	0.96
Indirect and Induced Effect From Direct Income of Longline Fishing	
Business Sales ($ million)	14.66
Income ($ million)	6.38
Employment (jobs)	218.42
State & Local Taxes ($ million)	1.07
Total Effect	
Business Sales ($ million)	49.67
Income ($ million)	22.07
Employment (jobs)	685.11
State & Local Taxes ($ million)	3.69

Source: Based on Leung and Pooley (2002)

Impacts of Alternative 1D (Allow 5,000 shallow-sets per year)

Under Alternative 1D and assuming that all 5,500 allowable sets were made, the Hawaii-based swordfish fishery would be expected to retain and sell 9.8 million pounds of swordfish for $22.4 million in ex-vessel revenues (Table 23). Sales of1.1 million pounds of other pelagics would yield an additional $2.7 million in ex-vessel revenues. As compared to anticipated catches and revenues if all 2,120 sets were made under Alternative 1A, this represents a 130 percent increase in swordfish pounds kept and a 130 percent increase in total retained catch as well as total ex-vessel revenues. Currently, there are approximately 30 vessels participating in the fishery, and under this alternative, that number would be expected to increase by approximately 30-40 vessels. This increase in vessels, however, is dependent on several factors such as swordfish and bigeye markets, fuel costs, and other operational costs.

Table23: Predicted annual ex-vessel revenues under Alternative 1D (5,500 sets made)

Species	Annual pounds kept	Annual ex-vessel revenue	Percent of annual revenue
Swordfish	9,792,574	$ 22,381,618	89.41%
Bigeye Tuna	399,904	$ 1,318,349	5.27%
Mahimahi	197,012	$ 440,650	1.76%
Striped Marlin	193,677	$ 317,631	1.27%
Albacore Tuna	118,239	$ 224,261	0.90%
Blue Marlin	123,528	$ 153,020	0.61%
Yellowfin Tuna	29,672	$ 80,523	0.32%
Oilfishes	16,500	$ 33,329	0.13%
Opah	16,459	$ 31,923	0.13%
Ono	10,343	$ 27,645	0.11%
Pomfret	4,671	$ 11,145	0.04%
Shortbilled Spearfish	8,884	$ 10,039	0.04%
Skipjack Tuna	1,989	$ 1,762	0.01%
All Other Pelagics*			
Annual Total	10,913,452	$ 25,031,895	100.00%
* All other pelagics account for less than three percent of total annual fish kept, detailed weight and price information not available for all species.			

Utilizing the methodology and model presented by Leung and Pooley (2002) the anticipated ex-vessel revenues under Alternative 1D ($25 million, Table 23) would be predicted to have the following impacts to the regional economy (Table 24). In sum it is estimated that under Alternative 1D the Hawaii longline swordfish fishery would generate $60.7 million in direct and indirect business sales, $27 million in personal and corporate income, 837 jobs, and $4.5 million in state and local taxes.

Table 24: Predicted regional impacts under Alternative 1D (5,500 sets made)

Variable	Impact
Predicted Ex-vessel Revenue ($ million)	25.03
Direct Effects	
Business Sales ($ million)	25.03
Income ($ million)	12.12
Employment (jobs)	349.48
State & Local Taxes ($ million)	2.02
Indirect and Induced Effect From Local Purchases of Goods & Services	
Business Sales ($ million)	17.75
Income ($ million)	7.05
Employment (jobs)	220.65
State & Local Taxes ($ million)	1.18
Indirect and Induced Effect From Direct Income of Longline Fishing	
Business Sales ($ million)	17.90

Income ($ million)	7.79
Employment (jobs)	266.84
State & Local Taxes ($ million)	1.30
Total Effect	
Business Sales ($ million)	60.69
Income ($ million)	26.96
Employment (jobs)	836.98
State & Local Taxes ($ million)	4.50

Source: Based on Leung and Pooley (2002)

Impacts of Alternative 1E (Set effort level commensurate with the current condition of the North Pacific swordfish stock)

Under Alternative 1E, the allowable effort level for swordfish (number of shallow sets allowed) would be established based on the condition of the swordfish stock in the North Pacific and the MSY for this stock. Establishment of this effort limit takes into account catches by other longline fleets and the fraction of the total swordfish catch realized by the Hawaii fleet.

Current swordfish landings in the North Pacific amount to about 14,500 metric tons (31.9 million pounds), which, according to a recent stock assessment, is about 65 percent of an estimated MSY of 22,284 metric tons (49 million pounds; K. Bigelow, PIFSC pers. comm.. based on Kleiber and Yokowa 2004). Thus there are an additional 17.1 million pounds available for harvest before MSY levels are reached. Hawaii's fleet has recently landed an annual average of two million pounds of swordfish with the remaining 29.9 million pounds harvested by foreign fisheries. Assuming that foreign harvest levels remain stable, the Hawaii fleet could harvest up to 19.1 million pounds of swordfish before MSY levels are reached (the two million pounds currently harvested plus the 17.1 million additional available pounds).

Based on the 2004 - 2007 fishing seasons it would take just over 9,925 sets for the Hawaii longline swordfish fishery to catch the available 8,682 metric tons (19.1 million pounds) of swordfish before total North Pacific swordfish catches reach MSY. Therefore under Alternative E, 9,925 Hawaii longline shallow sets would be allowed each year.

Past Hawaii longline shallow set effort peaked in 1991 when 8,355 sets were made. It is not known whether the shallow set fishery would rebound to these levels but the capacity to do so is well within the bounds of current fishery capacity given that there are still 162 longline permits issued (although not all are actively fished every year).

Under Alternative 1E and assuming that all 9,925 allowable sets were made, the Hawaii-based swordfish fishery would be expected to retain and sell 17.7 million pounds of swordfish for $40.4 million in ex-vessel revenues (Table 25). Sales of 2 million pounds of other pelagics would yield an additional $4.8 million in ex-vessel revenues. As compared to anticipated catches and revenues if all 2,120 sets were made under Alternative 1A, this represents a 315 percent increase in swordfish pounds kept, a 320 percent increase in total retained catch and a 317 percent increase in total ex-vessel revenues. Currently, there are approximately 30 vessels participating in the fishery, and under this alternative, that number would be expected to increase

by approximately 50-60 vessels. This increase in vessels, however, is dependent on several factors such as swordfish and bigeye markets, fuel costs, and other operational costs.

Table 14: Predicted ex-vessel revenues under Alternative 1E (9,925 sets made)

Species	Annual pounds kept	Annual ex-vessel revenue	Percent of annual revenue
Swordfish	17,671,145	$ 40,388,647	89.41%
Bigeye Tuna	721,644	$ 2,379,021	5.27%
Mahimahi	355,517	$ 795,173	1.76%
Striped Marlin	349,499	$ 573,179	1.27%
Albacore Tuna	213,368	$ 404,688	0.90%
Blue Marlin	222,911	$ 276,132	0.61%
Yellowfin Tuna	53,545	$ 145,307	0.32%
Oilfishes	29,774	$ 60,144	0.13%
Opah	29,701	$ 57,607	0.13%
Ono	18,664	$ 49,886	0.11%
Pomfret	8,430	$ 20,112	0.04%
Shortbilled Spearfish	16,032	$ 18,116	0.04%
Skipjack Tuna	3,590	$ 3,179	0.01%
All Other Pelagics*			
Annual Total	19,693,820	$45,171,191	100.00%
* All other pelagics account for less than three percent of total annual fish kept, detailed weight and price information not available for all species.			

Utilizing the methodology and model presented by Leung and Pooley (2002) the anticipated ex-vessel revenues under Alternative 1E ($45.2 million, Table 25) would be predicted to have the following impacts to the regional economy (Table 26). In sum it is estimated that under Alternative 1E the Hawaii longline swordfish fishery would generate $109.5 million in direct and indirect business sales, $48.7 million in personal and corporate income, 1,510 jobs, and $8.1 million in state and local taxes.

Table 26: Predicted regional impacts under Alternative 1E (9,925 sets made)

Variable	Impact
Predicted Ex-vessel Revenue ($ million)	45.17
Direct Effects	
Business Sales ($ million)	45.17
Income ($ million)	21.87
Employment (jobs)	630.64
State & Local Taxes ($ million)	3.65
Indirect and Induced Effect From Local Purchases of Goods & Services	
Business Sales ($ million)	32.03
Income ($ million)	12.71
Employment (jobs)	398.16
State & Local Taxes ($ million)	2.12

Indirect and Induced Effect From Direct Income of Longline Fishing	
Business Sales ($ million)	32.31
Income ($ million)	14.06
Employment (jobs)	481.51
State & Local Taxes ($ million)	2.35
Total Effect	
Business Sales ($ million)	109.51
Income ($ million)	48.65
Employment (jobs)	1510.32
State & Local Taxes ($ million)	8.12

Impacts of Alternative 1E (Remove effort limit - Preferred)
Under this alternative, the annual effort limit would be removed and fishery would not be managed under an annual set limit cap. Anticipated fishing effort is expected to gradually increase to historic levels between 4,000 and 5,000 sets per year (3.4 - 4.2 million hooks/yr). If anticipated fishing effort incrementally increases under Alternative 1F, impacts to target stocks would be similar in range to those described for Alternatives 1A through 1D and would likely vary by year. For example, in the first 1-3 years after implementation of this alternative, the fishery is expected to expand, and it is annual production of swordfish is predicted to be between 4.6 and 6.5 million lbs (2,085-2,950 mt). Depending on various factors including fuel prices and market demands, swordfish harvests in the near term could further increase to historical levels between 8.6 and 10.6 million pounds (3900-4809 mt) under this alternative. Non-swordfish catches of target species by the shallow-set fishery for species such as bigeye would be expected to also increase as effort increases, with anticipated harvests similar those described under Alternatives 1A through 1D. Because the Hawaii longline fishery (shallow-set and deep-set) in regulated under a limited entry program (maximum 164 permits), any increased effort in the shallow-set fishery would be from vessels that also primarily target bigeye tuna in the deep-set fishery. It is expected that such a shift would reduce bigeye catches by the Hawaii deep-set fishery and thus relieve some pressure (albeit insignificant in terms of overall WCPO bigeye catch and stock status) on bigeye stocks.

Under this alternative, impacts to fishery participants and regional economy depend on the amount fishing of effort expended and the revenues generated. Impacts would be similar to those described for Alternatives 1A-1D. Currently, there are approximately 30 vessels participating in the fishery, and under this alternative, that number would be expected to incrementally increase by approximately 10-30 vessels. This increase in vessels, however, is dependent on several factors such as swordfish and bigeye markets, fuel costs, and other operational costs.

Topic 2: Fishery Participation

Impacts of Alternative 2A (No action)
Maintaining the set certificate requirement under Alternative 2A allows potential participants the opportunity to obtain set certificates for that year from which they could either fish their certificates themselves, trade, sell, or give them to other Hawaii longline limited access permit holders for use during that year.

Financial impacts could be imposed on potential participants that do not apply and obtain set certificates from NMFS and are forced to buy certificates from other participants. On the other hand, financial gains may be obtained by those participants willing to sell their certificates to other participants.

Impacts of Alternative 2B (Discontinue set certificate program - Preferred)
Under this alternative, shallow-set certificates would no longer be issued or required and the annual set-certificate solicitation would be ended. Under alternatives which include effort limits, sets would be cumulatively accounted for on a fleetwide basis and the fishery would close for the remainder of the year when and if the annual set limit was reached.

Eliminating the requirement for certificates in the shallow-set fishery would benefit current shallow-set participants by eliminating the burden to provide written notice by November 1 of each year to obtain certificates. Potential revenue from selling set certificates to other participants would be eliminated and vice versa, potential costs of buying certificates from other participants would also be eliminated. Fishery participants would likely expend effort on a "first come, first served" basis and therefore there may be increased competition for swordfish during the beginning of the year, which is also the time of typically greatest CPUE values, thus leading to higher supply and decreasing ex-vessel revenue.

With international longline quotas already in place for bigeye catches in both the EPO and the WCPO, there is expected to be interest from some Hawaii based tuna-directed fishing vessels to shift their effort into the swordfish-directed fishery. This may also increase competition among participants which could have some market effects. This anticipated effort shift would be facilitated by removing the set certificate requirement through implementation of alternative 2B because deep-set vessels could switch to shallow-setting without the need to possess certificates.

Topic 3 Time-Area Closures

Impacts of Alternative 3A (No action - Do not implement time-area closures - preferred)
Under Alternative 3A the fishery would continue to operate as it has been since re-opening in 2004, with no time-area closures. This is not expected to result in any new impacts to participants or communities. If a turtle hard cap was reached the fishery would be closed for the remainder of the year which may result in some negative impacts to participants through being unable to derive any further income from swordfish harvest; having to switch gear configuration to continue longline fishing by shifting to deep-setting; potential market flooding as occurred in 2006 when the fishery closed which can result in lower prices, time waiting to offload and a reduction in quality of fish onboard; and potentially having to cut a trip short if the closure occurs while at sea. An early closure causing shallow-set vessels to switch to targeting tuna could impact the ability of those currently targeting tuna by increasing competition for a fishery which is now regulated by quotas on bigeye tuna. This would potentially impact all longline fishery participants.

Impacts of Alternative 3B (Implement January time-area closure)

Under Alternative 3B, an area closure would be implemented during January of each calendar year. The area closure would be located between 175° W and 145° W longitude and encompass the sea surface temperature band of 17.5°-18.5° C. The latitudinal location of this temperature band varies inter-and intra-annually; however, in January it is generally located near 31°-32° N latitude. Research has suggested that the area between sea surface temperatures of 17.5-18.5 C may be a loggerhead sea turtle "hotspot" based on historical and contemporary distribution and foraging studies as well as location data for observed loggerhead sea turtle interactions with the fishery (Howell, PIFSC, pers. comm., December 2008). The month of January was selected because it may be that the number of loggerhead interactions during January is pivotal to whether or not the fishery will reach its annual sea turtle interaction hard cap before all allowable sets are used. For example, in 2006, the fishery interacted with eight loggerheads in January and the fishery reached the cap of 17 on March.17, 2006. In 2007, the fishery did not interact with any loggerheads during January, but ended the first quarter with only15 loggerhead interactions and did not reach the sea turtle cap.

A range of time-area and seasonal fishery closures have been examined to date. NMFS scientists at PIFSC examined the use of seasonal closures, a time-area closure combined with a fixed seasonal closure and multiple area and seasonal closures to examine their combined biological and economic impacts. Although this work is ongoing, a preliminary draft appears to indicate that none of the scenarios examined would decrease sea turtle interactions without simultaneously decreasing fishery revenues and presumably profits in the months when the time-area closure is imposed, as fishing effort would be pushed into less productive or less profitable times and areas. However, a large time-area closure may reduce the risk of exceeding a turtle hard cap very early when there are still many more shallow-sets allowed to be made, as occurred in 2006 so that swordfish fishing may continue later in the year (S. Li, PIFSC, pers. comm. Jan. 2008). Fishery participants have indicated that missing the high swordfish catch rates and prices in the first quarter cannot be compensated for by a longer fishing season with more fishing trips. Furthermore, fishery participants would likely find it difficult to respond to changes of closed areas based on sea surface temperatures which can vary in location on a daily basis.

Impacts of Alternative 3C (In-season time-area closure)

Under Alternative 3C, the sea surface temperature-based (17.5° – 18.5° C) area closure described for Alternative 3B would be implemented in those years for which 75 percent of the annual loggerhead turtle cap was reached and the closure would remain in effect for the remainder of the first quarter. This alternative differs from 3B in that it is contingent on high numbers of interactions during the first quarter.

A range of time-area and seasonal fishery closures have been examined to date. NMFS scientists at PIFSC examined the use of seasonal closures, a time-area closure combined with a fixed seasonal closure and multiple area and seasonal closures to examine their combined biological and economic impacts. Although this work is ongoing, a preliminary draft appears to indicate that none of the scenarios examined would decrease sea turtle interactions without

simultaneously decreasing fishery revenues and presumably profits in the months when the time-area closure is imposed, as fishing effort would be pushed into less productive or less profitable times and areas. However, a large time-area closure may reduce the risk of exceeding a turtle hard cap very early when there are still many more shallow-sets allowed to be made, as occurred in 2006 so that swordfish fishing may continue later in the year (S. Li, PIFSC, pers. comm. Jan. 2008). Fishery participants have indicated that missing the high swordfish catch rates and prices in the first quarter cannot be compensated for by a longer fishing season with more fishing trips. Furthermore, fishery participants would likely find it difficult to respond to changes of closed areas based on sea surface temperatures which can vary in location on a daily basis.

Skills Necessary to Meet Compliance Requirements

Alternatives that would allow increased fishing effort would potentially allow more vessels to fish in distant waters. Many active vessels have already been observed fishing safely in these offshore areas, therefore it is expected that fishery participants are familiar with the at-sea conditions and are able to operate safely in them. Preferred Alternative 2B would discontinue the set certificate program which means that permit holders would no longer need to apply for these certificates or attach them to each shallow set logbook report. No special skills beyond the ability to read and write in English would be required to continue to fill out the necessary permit applications and logbooks which are already required.

VII. Impacts of the Preferred Alternatives on Net National Benefits

Due to limited data availability, as well our limited understanding of the biological, economic, and social linkages of Hawaii's shallow-set longline fishery and associated economic sectors, it is difficult to predict how fishery participants and other stakeholders would respond to the preferred alternatives and how production operations and markets would be affected. It is thus difficult to predict how the total future stream of national benefits and costs (to both producers and consumers) would be affected. However overall this action is anticipated to have positive net national benefits as it is designed to optimize domestic harvests of Pacific swordfish by Hawaii-based longline vessels without jeopardizing the existence of any protected species or their habitats.

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