# HIGHLY MIGRATORY SPECIES MANAGEMENT TEAM REPORT ON NORTH PACIFIC ALBACORE FISHERIES

## I. Introduction

In April 2010, the Council directed the Highly Migratory Species Management Team (HMSMT) to gather additional information about characteristics of international and domestic albacore fishing fleets. This information could be used to develop any U.S. proposals for albacore conservation and management at the international regional fishery management organization (RFMO) level and appropriate domestic management measures should action be necessary in response to an updated stock assessment. The Council asked to receive a report on these matters in the first half of 2011 in order to consider possible mechanisms for controls on albacore fishing effort. This report presents an overview of the catch of and fishing effort on North Pacific albacore throughout its range by U.S. and foreign fleets; an update of fishing effort estimates for the main U.S. fishery targeting albacore, the commercial surface hook-and-line fishery[1]; details on the participation of U.S. west coast-based commercial fishing vessels landing albacore; and information on illegal, unreported and unregulated (IUU) fishing.

## II. International and U.S. Albacore Catch and Effort

A stock assessment for North Pacific albacore is due to be completed by the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) Albacore Working Group (ALBWG) in early 2011 and recommendations based on the status of the stock will come from the ISC Plenary at their July meeting. The last assessment was completed in 2006. Biomass and spawning biomass were estimated to be near historical high levels; however, fishing mortality rates were also considered high relative to most reference points used to manage large pelagic fish. Based on the 2006 assessment results, the Inter-American Tropical Tuna Commission (IATTC) and the Western and Central Pacific Fisheries Commission (WCPFC) passed conservation measures[2] requiring that the fishing effort of all member nations is not to increase beyond the "recent levels," later proposed by the Northern Committee as the period from 2002-2004. The U.S. submits statistics to the IATTC and WCPFC on commercial albacore catch every six months and on effort annually. If the results of the 2011 stock assessment demonstrate a worsened condition for the albacore stock, the international RFMOs may update their conservation measures and require a reduction in catch and/or effort. This section of the HMSMT report summarizes the recent catch and effort levels for the U.S. west coast based commercial surface fleets (i.e. troll and pole-and-line which will be collectively referred to as surface hook-and-line throughout this report), which constitute the major U.S. fleets landing North Pacific albacore. In addition, albacore catch by foreign fleets has been compiled by the ISC Albacore Working Group and is presented.

Over the past 10 years (2000-2009), the U.S. commercial fleets have accounted for roughly 15 percent of the total North Pacific wide albacore catch (Table 1 and Figure 1). Of that, approximately 94 percent is taken by the commercial surface hook-and-line fleets (See Table 1). Japanese fleets account for the

[1] The surface hook-and-line fishery for albacore is defined in the HMS FMP as commercial vessels landing albacore using pole, troll, or another combination of one or more hooks attached to the vessel by one or more lines.
[2] IATTC Resolution C-05-02 available at http://www.iattc.org/PDFFiles2/Resolutions/C-05-02-Northern-albacore-tuna.pdf; and WCPFC Conservation and Management Measure CMM 2005-03 available at http://www.wcpfc.int/doc/cmm-2005-03/conservation-and-management-measure-north-pacific-albacore.

greatest proportion of the catch at about 65 percent during the same period. Other nations with significant catch include Chinese-Taipei and Canada, each with roughly 7 percent of the total North Pacific catch since 2000. See ISC ALBWG report from July 2010 (ISC 2010) for more detail on international albacore catch and effort including a table of catch history by fleet for the main fishing nations since 1952.

**Table 1. Total North Pacific albacore landings in metric tons, 1995-2009.**

| Year | Japan | | | | Korea | Chinese-Taipei | | United States | | | | | Mexico | Canada | Other | | Grand Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Purse Seine | Pole-and-Line | Longline | Other | Longline | Distant Water Longline | Offshore Longline | Other Pole-and-Line | Surface Hook-and-Line | Sport | Longline | Other | | Troll | Troll | Longline | |
| 1995 | 1,177 | 20,981 | 29,050 | 1,244 | 14 | 4,280 | | 80 | 8,045 | 102 | 882 | 230 | 5 | 1,763 | 94 | | 67,947 |
| 1996 | 581 | 20,272 | 32,440 | 1,101 | 158 | 7,596 | | 24 | 16,938 | 88 | 1,185 | 282 | 21 | 3,316 | 469 | 1,735 | 86,207 |
| 1997 | 1,068 | 32,238 | 38,899 | 2,119 | 404 | 9,119 | 337 | 73 | 14,252 | 1,018 | 1,653 | 196 | 53 | 2,168 | 336 | 2,824 | 106,756 |
| 1998 | 1,554 | 22,926 | 35,755 | 1,541 | 226 | 8,617 | 193 | 79 | 14,410 | 1,208 | 1,120 | 203 | 8 | 4,177 | 341 | 5,871 | 98,229 |
| 1999 | 6,872 | 50,369 | 33,339 | 1,332 | 99 | 8,186 | 207 | 60 | 10,060 | 3,621 | 1,542 | 529 | 57 | 2,734 | 228 | 6,307 | 125,542 |
| 2000 | 2,408 | 21,550 | 29,995 | 934 | 15 | 7,898 | 944 | 69 | 9,645 | 1,798 | 940 | 182 | 103 | 4,531 | 386 | 3,654 | 85,052 |
| 2001 | 974 | 29,430 | 28,801 | 646 | 64 | 7,852 | 832 | 139 | 11,210 | 1,635 | 1,295 | 339 | 23 | 5,248 | 230 | 1,471 | 90,189 |
| 2002 | 3,303 | 48,454 | 23,585 | 1,313 | 112 | 7,055 | 910 | 381 | 10,387 | 2,357 | 525 | 269 | 28 | 5,379 | 466 | 700 | 105,224 |
| 2003 | 627 | 36,114 | 20,907 | 1,133 | 146 | 6,454 | 712 | 59 | 14,102 | 2,214 | 524 | 145 | 28 | 6,861 | 378 | (2,400) | 92,804 |
| 2004 | 7,200 | 32,255 | 17,341 | 887 | 78 | 4,061 | 927 | 127 | 13,346 | 1,506 | 361 | 170 | 104 | 7,856 | | 4,096 | 90,316 |
| 2005 | 850 | 16,133 | 20,420 | 1,053 | 420 | 3,990 | 483 | 66 | 8,413 | 1,719 | 296 | 195 | 0 | 4,845 | | 4,168 | 63,052 |
| 2006 | 364 | 15,400 | 21,027 | 723 | 138 | 3,848 | 469 | 23 | 12,524 | 385 | 270 | 98 | 109 | 5,832 | | 5,039 | 66,249 |
| 2007 | 5,682 | 37,768 | 22,336 | 819 | 56 | 2,465 | 451 | 21 | 11,887 | 1,225 | 250 | 102 | 40 | 6,075 | | 3,510 | 92,687 |
| 2008 | 825 | 19,060 | 22,386 | (2,196) | 365 | 2,490 | 579 | 1,050 | 10,672 | 257 | 353 | 30 | 10 | 5,478 | | 2,777 | 68,528 |
| 2009 | (2,151) | (32,421) | (17,516) | (2,196) | (365) | (1,866) | (512) | (2,084) | (10,686) | (541) | (203) | (141) | (17) | (5,685) | | (1,553) | (77,937) |

Notes: Data provided by John Childers, ISC Albacore Working Group Data Manager.
Values in parentheses are considered preliminary.
Japan "Other" includes gill net, set net, troll other unspecified gears.
U.S. "Other" includes purse seine, gill net, tropical troll and handline, and other unspecified gears.
Mexico fisheries include purse seine and pole-and-line.

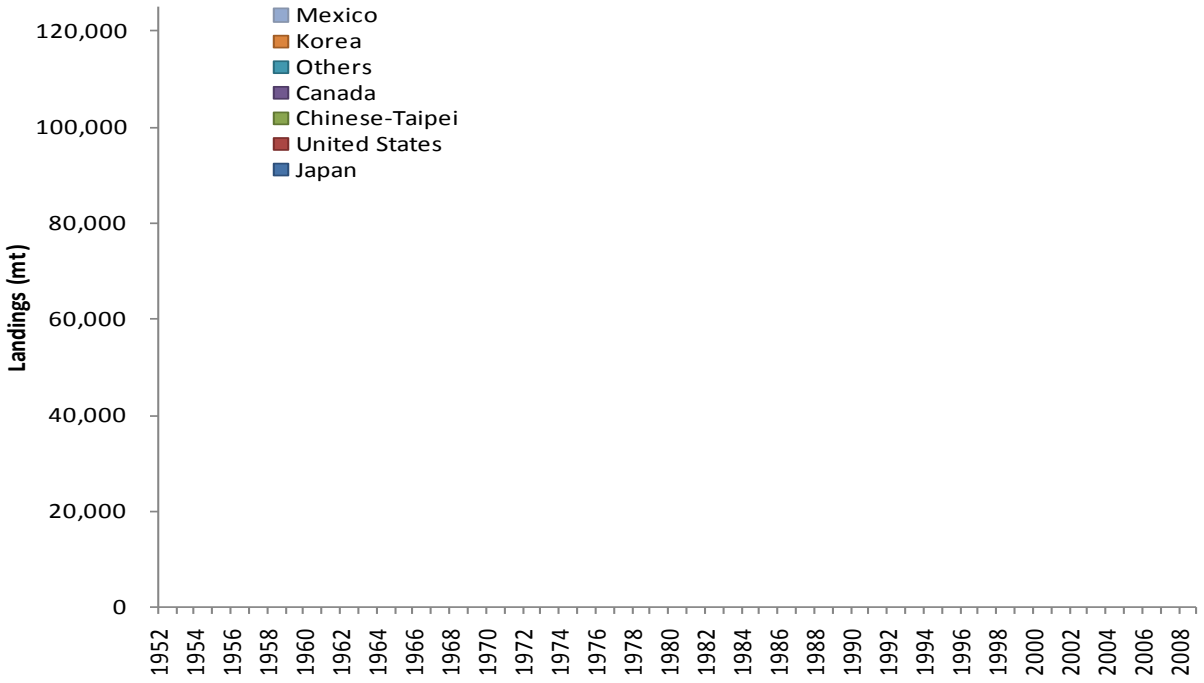


**Figure 1. Total North Pacific albacore landings by nation, 1952-2009.**

Notes: Data provided by John Childers, ISC Albacore Working Group Data Manager.

Under the international conservation measures for North Pacific albacore, all nations are required annually to report on their commercial catch and effort on albacore to the regional fishery management

organizations (RFMOs; IATTC and WCPFC). These data are supposed to be provided by fleet in the most appropriate unit of measure to gauge effort; however, detailed effort data are not readily available in the annual summary reports circulated by the IATTC and WCPFC and the data are held by the RFMOs under strict confidentiality rules. Data on the number of vessels targeting North Pacific albacore are also compiled by the ISC ALBWG for the primary nations targeting albacore by fishery and are provided in Figure 2. The numbers of Japanese longline, Japanese pole-and-line, and U.S. surface hook-and-line vessels have trended down since the mid-1990s, while the numbers of vessels in other fleets have largely remained flat.

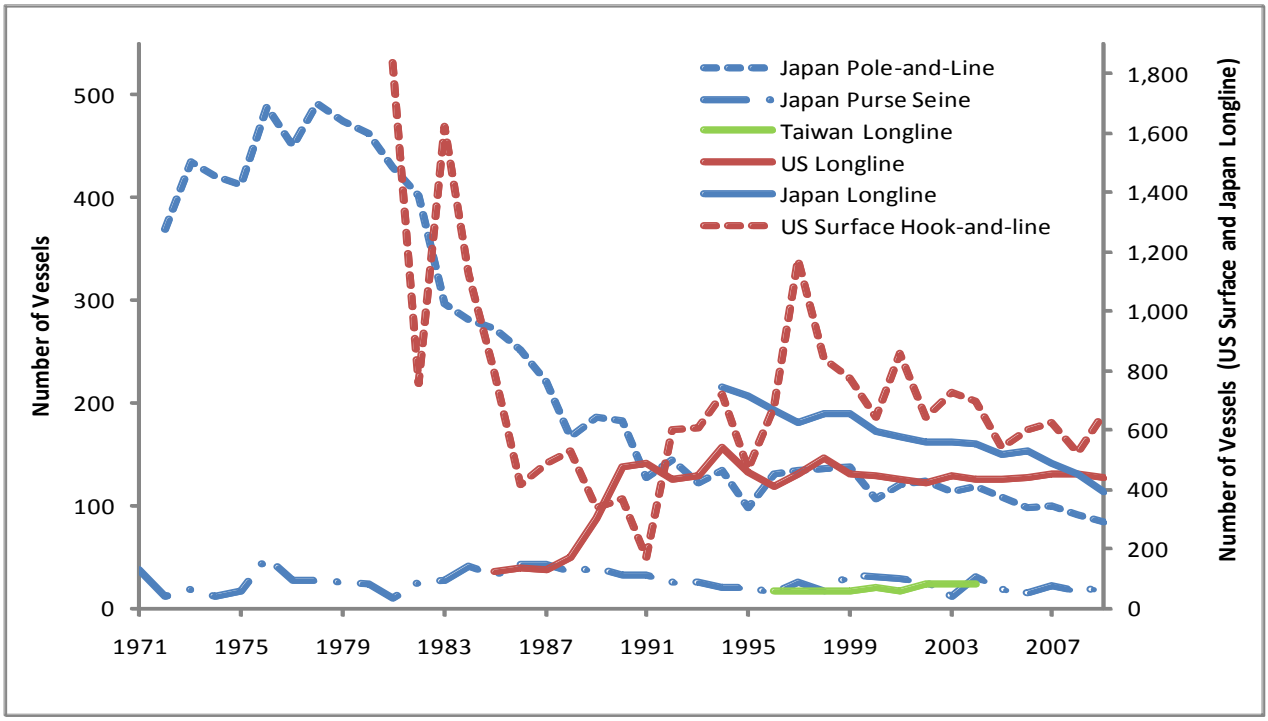


**Figure 2. Number of vessels operating by several international fleets targeting North Pacific albacore, 1971-2009.**

Notes: Data provided by John Childers, ISC Albacore Working Group Data Manager.
Data for 2009 are considered preliminary.

Effort for the U.S. surface hook-and-line fleet is presented in Table 2 and Figure 3. Effort in vessel-days for the small proportion of catch allocated to other U.S. pole-and-line vessels in Table 1 was calculated based on the catch rates for the surface hook-and-line fleet. Effort both in vessel-days and the number of vessels participating has been decreasing since the late 1990s. A characterization of the total effort for the U.S. commercial fleets was done by the SWFSC staff and HMSMT in 2007 (PFMC 2007). In that analysis, the units of effort for fleets catching albacore in relatively low numbers with gears other than surface hook-and-line were converted to reference fishing days using an algorithm based on calculated albacore catch rates. The results of that analysis for the total commercial effort are shown in Figure 3 for comparison with the current effort analysis for the surface hook-and-line fleet. Generally the analyses show the same trend for data through 2005, with the surface hook-and-line effort representing 90-95 percent of the total effort, on average. The divergence in the effort data for 2006 reflects data that were preliminary at the time and have since been updated to reflect lower effort than was first estimated.

**Table 2. Catch and effort for the U.S. surface hook-and-line fleet.**

| Fishing Season | Catch (mt) | No. of Vessels | No. of Trips | Effort (Vessel-Days) | CPUE (Fish per Day) |
|---|---|---|---|---|---|
| 1995 | 8,125 | 471 | 1,094 | 26,273 | 45 |
| 1996 | 16,962 | 676 | 1,816 | 32,740 | 89 |
| 1997 | 14,325 | 1172 | 4,000 | 45,710 | 45 |
| 1998 | 14,489 | 841 | 2,358 | 21,370 | 104 |
| 1999 | 10,120 | 776 | 2,555 | 35,665 | 35 |
| 2000 | 9,714 | 753 | 1,880 | 38,022 | 38 |
| 2001 | 11,349 | 964 | 2,824 | 26,091 | 66 |
| 2002 | 10,768 | 716 | 1,868 | 26,201 | 67 |
| 2003 | 14,161 | 798 | 2,370 | 21,711 | 75 |
| 2004 | 13,473 | 737 | 2,400 | 26,446 | 79 |
| 2005 | 8,479 | 565 | 1,574 | 24,925 | 46 |
| 2006 | 12,547 | 623 | 1,857 | 22,046 | 87 |
| 2007 | 11,908 | 672 | 2,212 | 24,042 | 70 |
| 2008 | 11,722 | 523 | 1,498 | 18,241 | 88 |
| 2009 | (12,770) | (652) | | (25,675) | (74) |

Notes: SWFSC data; provided by John Childers, HMS Data Manager.
A small proportion of the catch and effort, roughly 3% annually on average, are reported for "unspecified pole-and-line" vessels; effort for those vessels was estimated based on the catch rates for the main surface hook-and-line fleet.
CPUE is based on logbook data and standardized by 1 degree square and 10 day period.

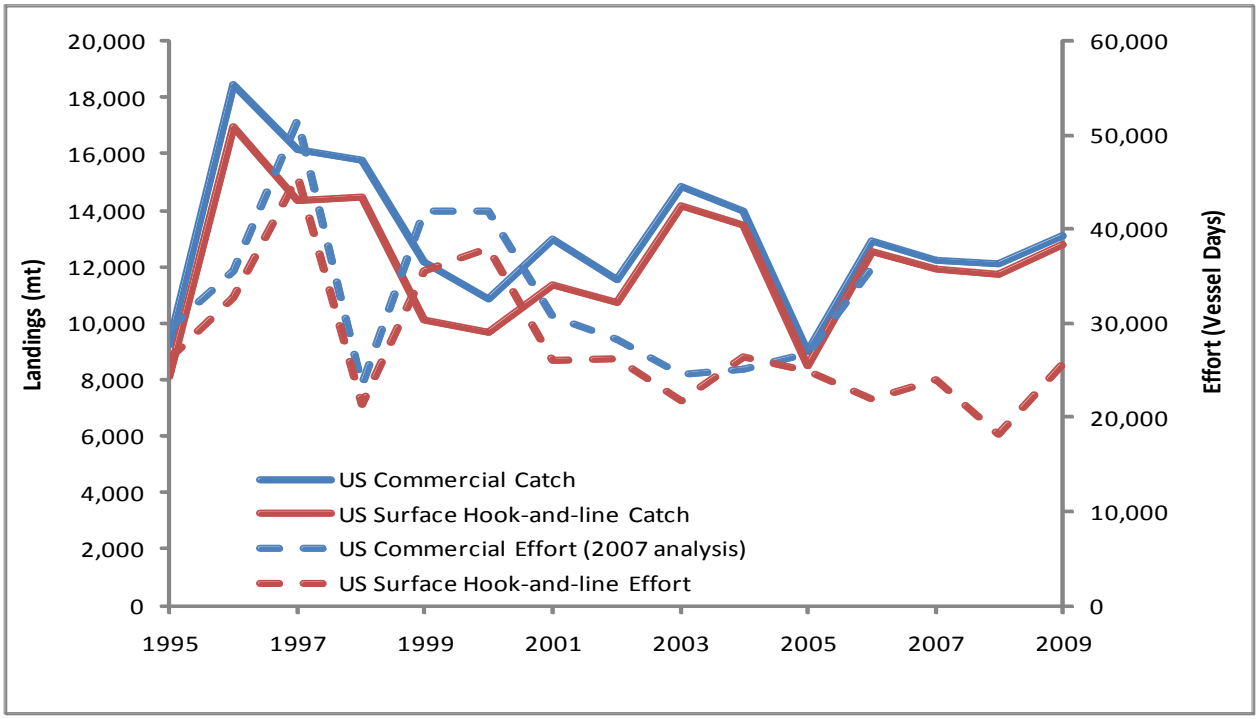


**Figure 3. U.S. commercial catch and effort for North Pacific albacore, 1995-2009.**

Notes: SWFSC preliminary analysis.

While each nation is left to manage their fisheries domestically to comply with IATTC and WCPFC conservation measures if they fish within the respective RFMO areas, there is little information publicly available on the specific national regulations and management structure for foreign fishing nations such as Japan and Taiwan. At this time the HMSMT is uncertain what, if any, national regulations have been put in place to implement the conservations measures for North Pacific albacore.

## III. Characterization of the West Coast Albacore Fishery

### *Historical Trends in the Fishery*

Figure 4 shows U.S. west coast albacore landings recorded in the PacFIN database. The vast majority of landings were made by pole-and-line or troll gear that in most years accounted for 99 percent or more of the total landings. Landings fell in the late 1980s-early 1990s but have been generally trending upward since then. Landings in 1981, 1996, 1998, 2003, and 2004 were more than one standard deviation above the mean (9,129 mt), while landings in 1987 through 1992 series were more than one standard deviation below the mean in each year. Figure 1 includes a smoothing spline, which smoothes annual fluctuations in order to capture local trends. The smoothing spline illustrates the downtrend in albacore landings from the early 1980s through the early 1990s, followed by subsequent recovery by 1996 to a similar level as that in the early 1980s.

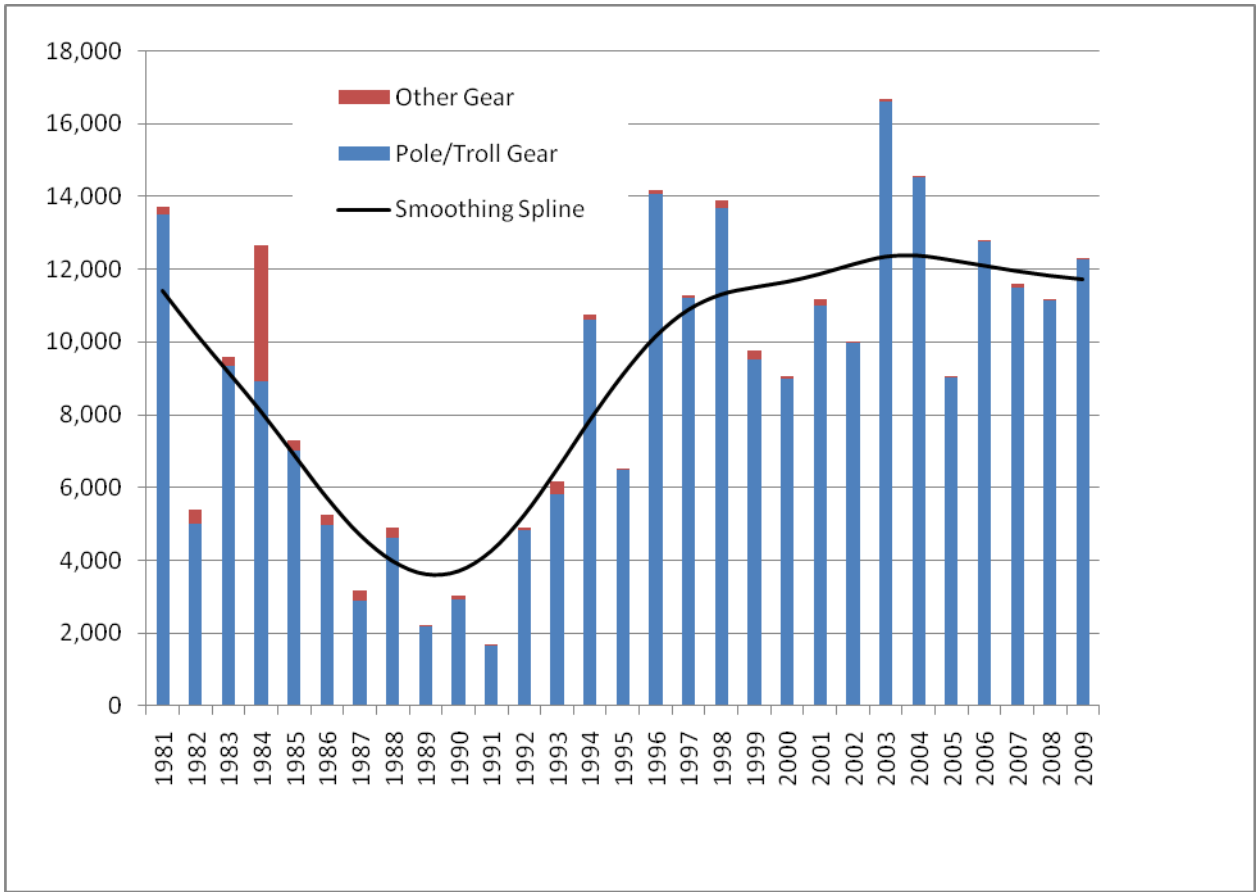


**Figure 4. West coast albacore landings (mt), 1981-2009.**

Notes: Landings obtained from fishticket data using the PacFIN Explorer tool on February 8, 2011. Landed weight in pounds converted to metric tons by dividing by 2204.6. Pole/troll landings represent PacFIN gear codes "POL" and "TRL."

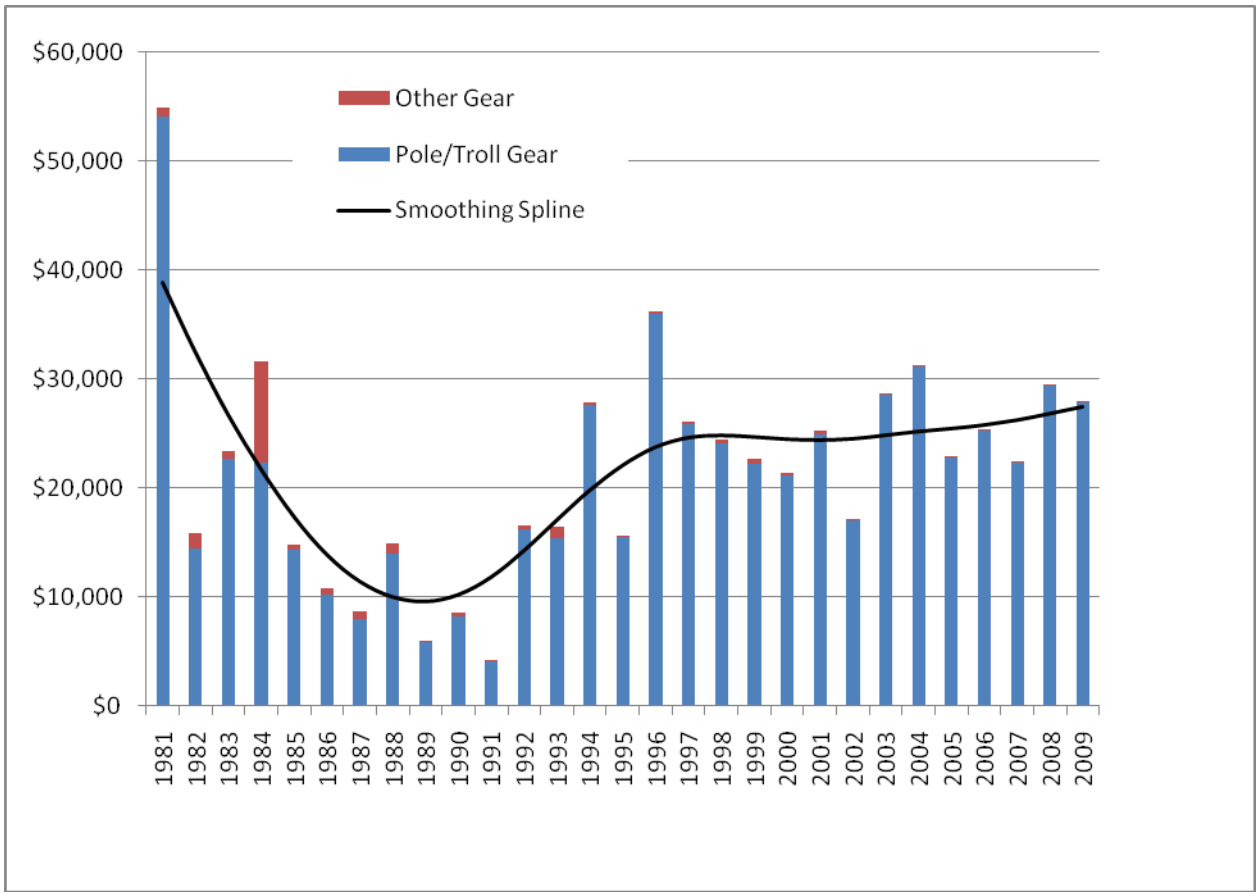


**Figure 5. Ex-vessel revenue from west coast albacore landings in real (inflation adjusted, 2010 prices) dollars, 1,000s, 1981-2009.**

Notes: Revenue obtained from fishticket data using the PacFIN Explorer tool on February 8, 2011. Real prices determined using the gross domestic product: implicit price deflator (2005=100). Pole/troll landings represent PacFIN gear codes "POL" and "TRL."

Figure 5 shows ex-vessel revenue converted to real (inflation adjusted) dollars, with a smoothing spline added to capture local trend. Inflation adjusted revenues show a similar pattern of decline (1981-1991) and subsequent recovery (1991-1996) to that seen in the landings data. Ex-vessel revenue was more than one standard deviation above the mean ($21.8 million) in 1981 and 1996 and more than one standard deviation below the mean in 1986, 1987, and 1989-1991.

Figure 6 shows the prices per pound paid for surface hook-and-line caught albacore, adjusted for inflation. A trend line and a smoothing spline have been added to the figure to highlight average and cyclical trends. The trend line shows a gradual downward trend in real prices over the entire period. The smoothing spline, which is sensitive to the cyclical features of the price data, shows a downtrend in real prices from 1981 ($1.82/lb) through 1985 ($0.93/lb), followed by a subsequent uptrend through 1992 ($1.52/lb), another downtrend through 2002 ($0.77/lb), and finally an increase to the recent levels above $1.00/lb ($1.20/lb in 2008).

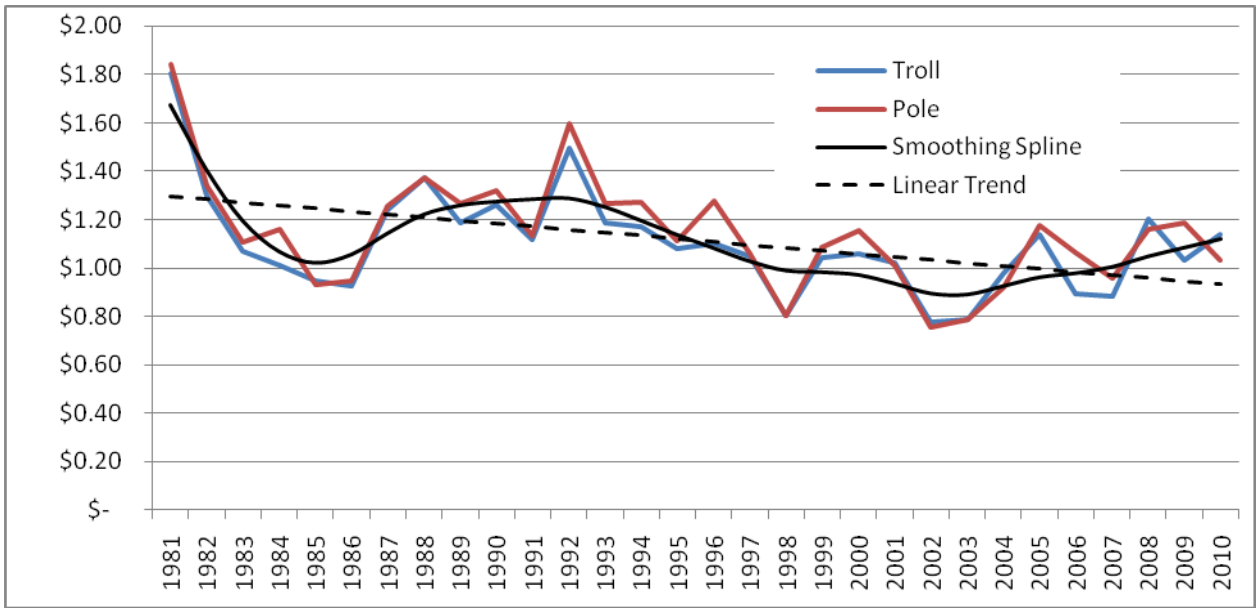


**Figure 6. Average annual price per pound for albacore in real (inflation adjusted, 2010) dollars, 1981-2010.**

Notes: Prices obtained from fishticket data using the PacFIN Explorer tool on February 8, 2011. Real prices determined using the gross domestic product: implicit price deflator (2005=100). Pole/troll landings represent PacFIN gear codes "POL" and "TRL."

## *Geographic Variation in Landings over Time*

Figure 7 shows albacore landings by west coast state from 1981 to 1999. Landings have generally declined in California while increasing in Washington, and to a lesser degree in Oregon.

Table 3 shows the percentage of coastwide landings by state for three decadal periods, illustrating the northward shift in landings.

**Table 3. Percentage of coastwide albacore landings by state for three time periods, 1981-2009.**

| Period | California | Oregon | Washington |
|---|---|---|---|
| 1981-1989 | 65% | 21% | 14% |
| 1990-1999 | 31% | 31% | 38% |
| 2000-2009 | 11% | 34% | 54% |

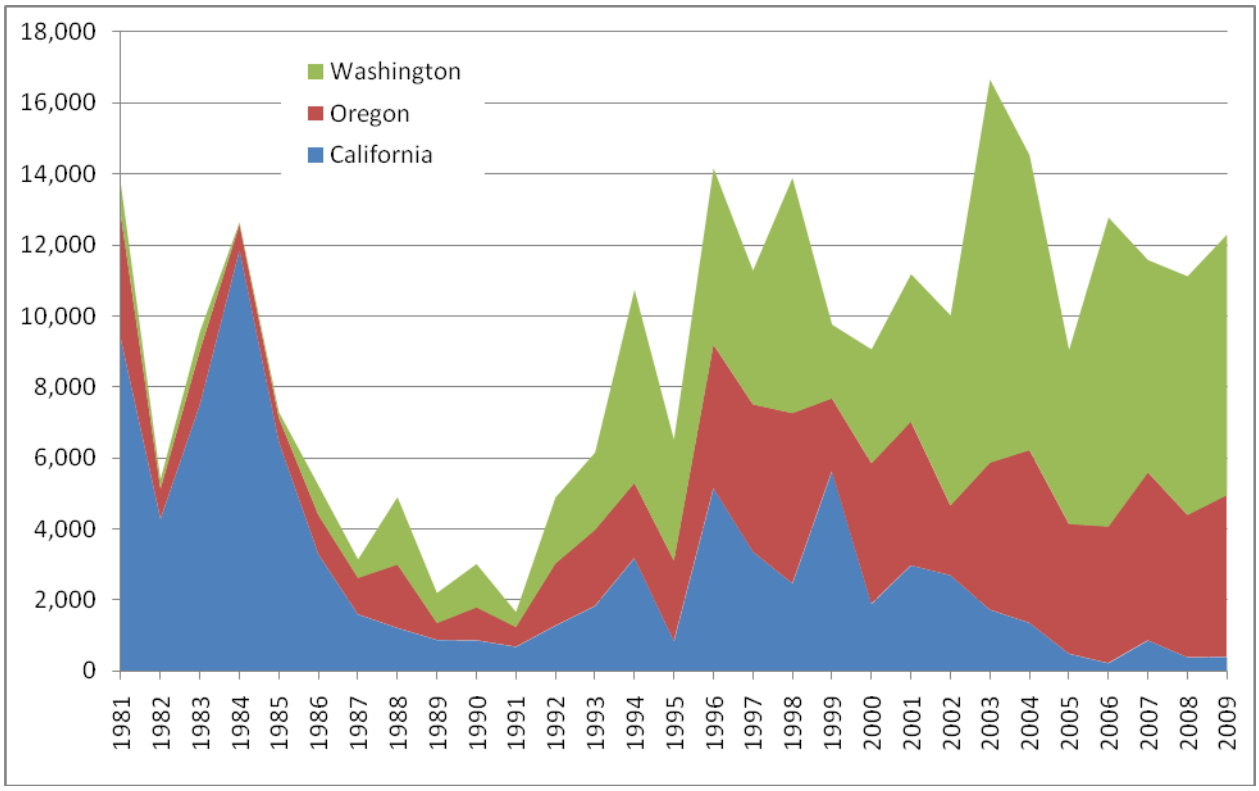


**Figure 7. landings by state (mt), 1981-2009.**

Notes: Landings obtained from fishticket data using the PacFIN Explorer tool on February 8, 2011. Landed weight in pounds converted to metric tons by dividing by 2204.6. Assignment by state based on PacFIN agency id (agid) code.

Figure 8 shows total albacore landings by county for the two most recent decades (1990-1999 and 2000-2009). The panels show the geographic shift in landings at a finer scale.

Table 4 shows the 10 top-ranked counties by landings for these time periods. Los Angeles County shows the largest decline in landings among these counties. Although still ranked in the top 10 for the 2000-2009 period, this county dropped from second to eighth place. It also appears that landings have become more concentrated in the top-ranked counties. For example, during the 1990-1999 period the three top-ranked counties accounted for 57 percent of coastwide landings while in the 2000-2009 period they accounted for 67 percent of coastwide landings.

**Table 4. Top-ranked counties for albacore landings and average annual landings (mt) for two time periods.**

| 1990-1999 | | | 2000-2009 | | |
|---|---|---|---|---|---|
| | County | Landings | | County | Landings |
| 1 | Pacific County, WA | 2,103.00 | 1 | Pacific County, WA | 3,482.10 |
| 2 | Los Angeles County, CA | 1,449.28 | 2 | Grays Harbor County, WA | 2,651.90 |
| 3 | Lincoln County, OR | 1,119.37 | 3 | Lincoln County, OR | 1,780.28 |
| 4 | Grays Harbor County, WA | 983.51 | 4 | Clatsop County, OR | 1,180.67 |
| 5 | Clatsop County, OR | 929.84 | 5 | Coos County, OR | 811.92 |
| 6 | Coos County, OR | 271.43 | 6 | Humboldt County, CA | 340.85 |
| 7 | Monterey County, CA | 269.94 | 7 | Whatcom County, WA | 302.07 |
| 8 | Humboldt County, CA | 232.08 | 8 | Los Angeles County, CA | 244.09 |
| 9 | Del Norte County, CA | 158.54 | 9 | Monterey County, CA | 187.42 |
| 10 | San Diego County, CA | 120.57 | 10 | San Luis Obispo County, CA | 174.03 |

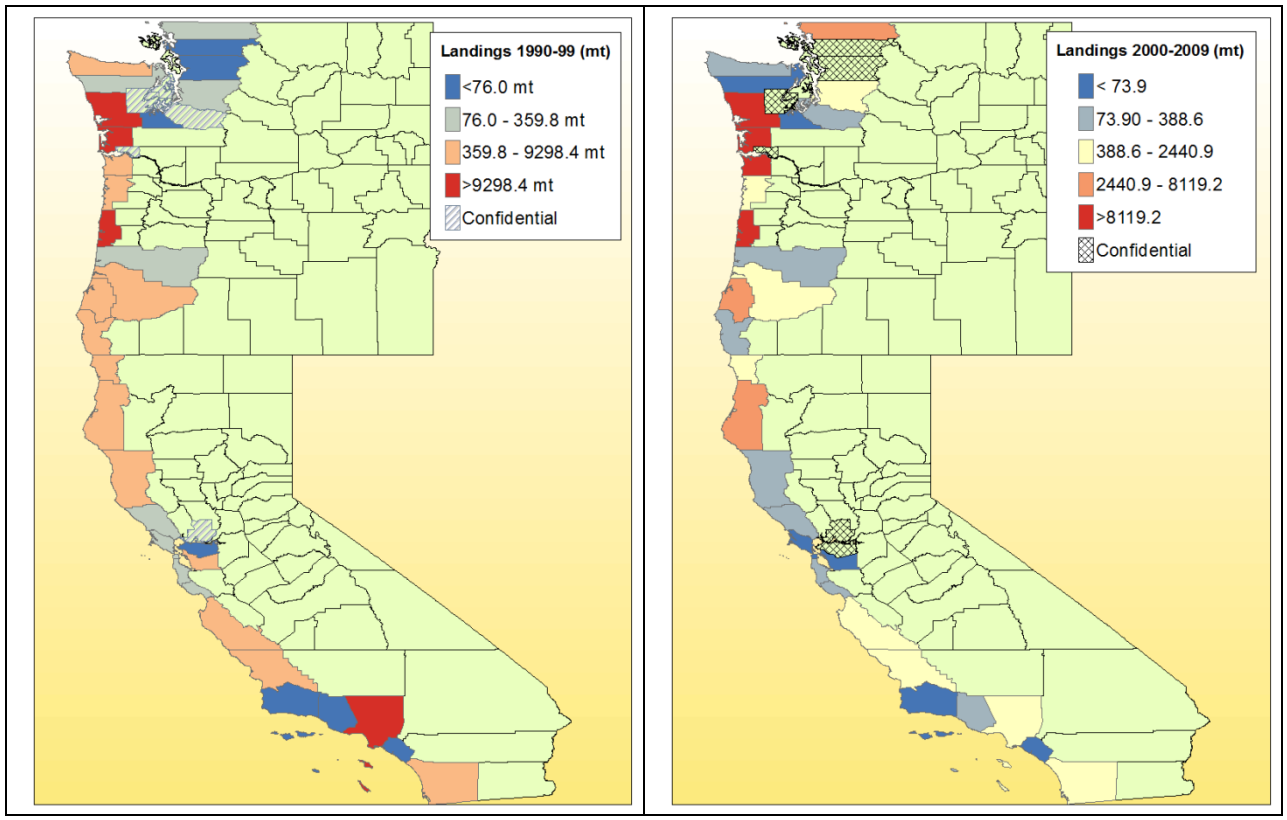


**Figure 8. Albacore landings by county, 1990-1999 and 2000-2009.**

Notes: Landings obtained from fishticket data using the PacFIN Explorer tool on February 8, 2011. Landed weight in pounds converted to metric tons by dividing by 2204.6. Assignment to county based on PacFIN county id (cid) code in apr table. Interval values are total landings for the period; average annual landings obtained by dividing by 10. Counties where less than three vessels made landings during the period are excluded based on data confidentiality rules.

### *Vessel Participation*

Figure 9 shows the numbers of vessels making albacore landings on the U.S. west coast by year; a smoothing spline was added to highlight the intermediate-term trends in participation. As mentioned previously, the vast majority of landings are made by vessels using pole-and-line or troll gear. The graph shows the number of vessels participating generally declined from the early 1980s through the early 90s, then subsequently recovered to about 75 percent of the early-1980s level by 1997. Participation has been generally declining since the interim peak in 1997 of 1,213 vessels (1,191 using pole-and-line or troll gear). From 1998 through 2009 participation by pole/troll vessels has averaged 744 vessels per year.

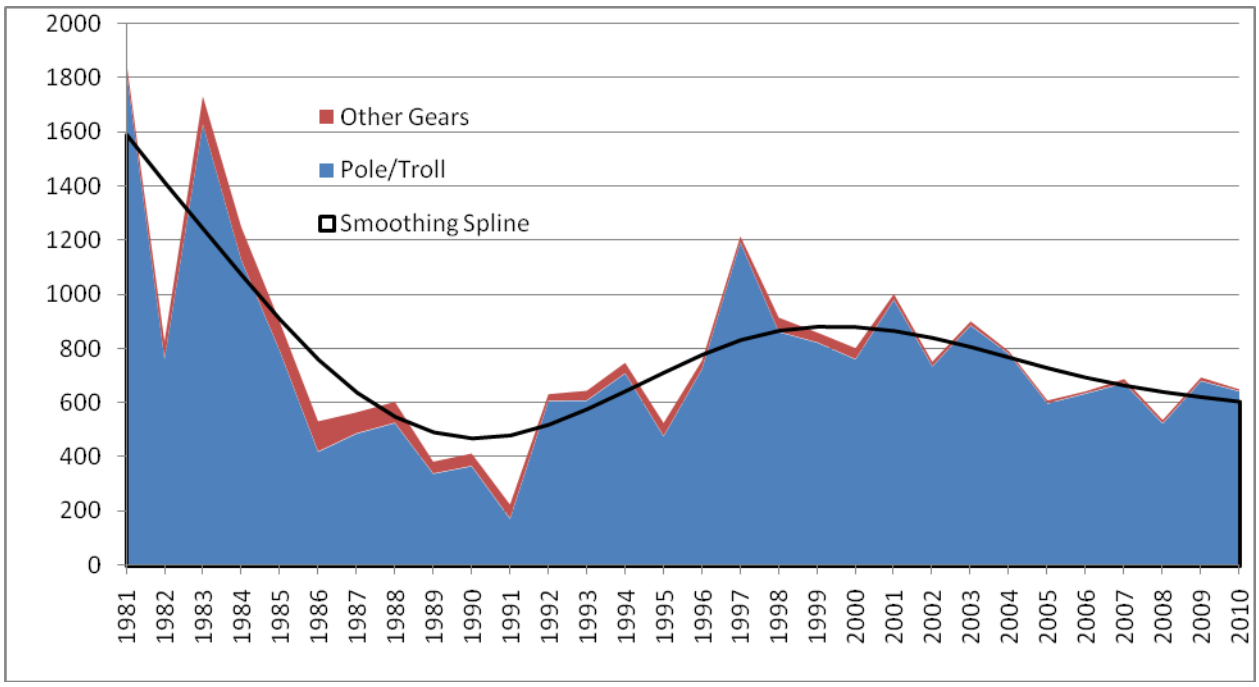


**Figure 9. Number of vessels landing albacore with surface hook-and-line gear and other gears, 1981-2010.**

Notes: Vessel counts obtained from fishticket data using the PacFIN Explorer tool on February 9, 2011.

Taken together, Figures 4, 5, 7, and 9 reflect a historic period of the west coast albacore fishery marked by decline in landings, real revenues and participation during the 1980s through the early-1990s, followed by subsequent recovery, at least in terms of landings, to similar levels as those of the early-1980s. The real price and number of participating vessels were at their highest levels in 1981, which have not been subsequently approached. The decline in the fishery during the 1980s may reflect growth of high-seas driftnet effort during the 1980s. The United Nation's adoption in the early-1990s of a global moratorium[3] on all large-scale pelagic drift-net fishing on the high seas of the world's oceans and seas may help explain the subsequent recovery of the fishery.

[3] United Nations General Assembly 79th plenary meeting (20 December 1991): Large-scale pelagic drift-net fishing and its impact on the living marine resources of the world's oceans and seas (http://www.un.org/documents/ga/res/46/a46r215.htm)

### *Description of Fleet by Percent of Landings and Revenues from Albacore*

Table 5 and Table 6 update the analysis of vessel participation presented to the Council in April 2010. The figure and tables present counts of vessels grouped in percent intervals according to surface hook-and-line (pole-troll albacore, or PTA) as a proportion of total landings or revenue from all species (the lines in the panels in Figure 10). The figure and tables also show average annual per-vessel PTA landings / revenue for each percent bin and the tables additionally show each bin's share of total PTA landings / revenue.

In 1990-1999, 54 percent of all vessels fell in the "10 percent or less" bin (i.e., PTA accounted for less than 10 percent of their total landings) but this group fell to 42 percent of all vessels in the 2000-2009 period. In 1990-1999 this group averaged 550 kg PTA landings per-vessel annually, increasing slightly to 770 kg in the 2000-2009 period. The next largest group of vessels falls in the "more than 90 percent" bin. Measured by landings, this group accounted for 16 percent of all vessels 1990-1999, increasing to 24 percent in the 2000-2009 period. This group of vessels accounted for 44 percent of total PTA landings, 1990-1999, increasing to 50 percent, 2000-2009. Interestingly, on a per-vessel basis vessels in the 80-89 percent range have the highest per-vessel average annual catches of PTA even though they account for a small fraction of total PTA catch. The fishery is dominated by vessels that rely on albacore for upwards of 90 percent of their landings and by fringe vessels that rely on albacore for less than 10 percent of their landings, possibly as part of a portfolio strategy, which relies on albacore landings when it is economical to opportunistically prosecute the fishery. The data suggest that the fringe vessels account for a very small share of overall landings through time.

Comparison of the two time periods indicates that specialization has increased somewhat over time. As mentioned above, vessels in the "more than 90 percent" bin increased their share of total PTA landings and the number of vessels in this bin increased in both absolute and percent terms. The trend holds true for both landings and revenue.

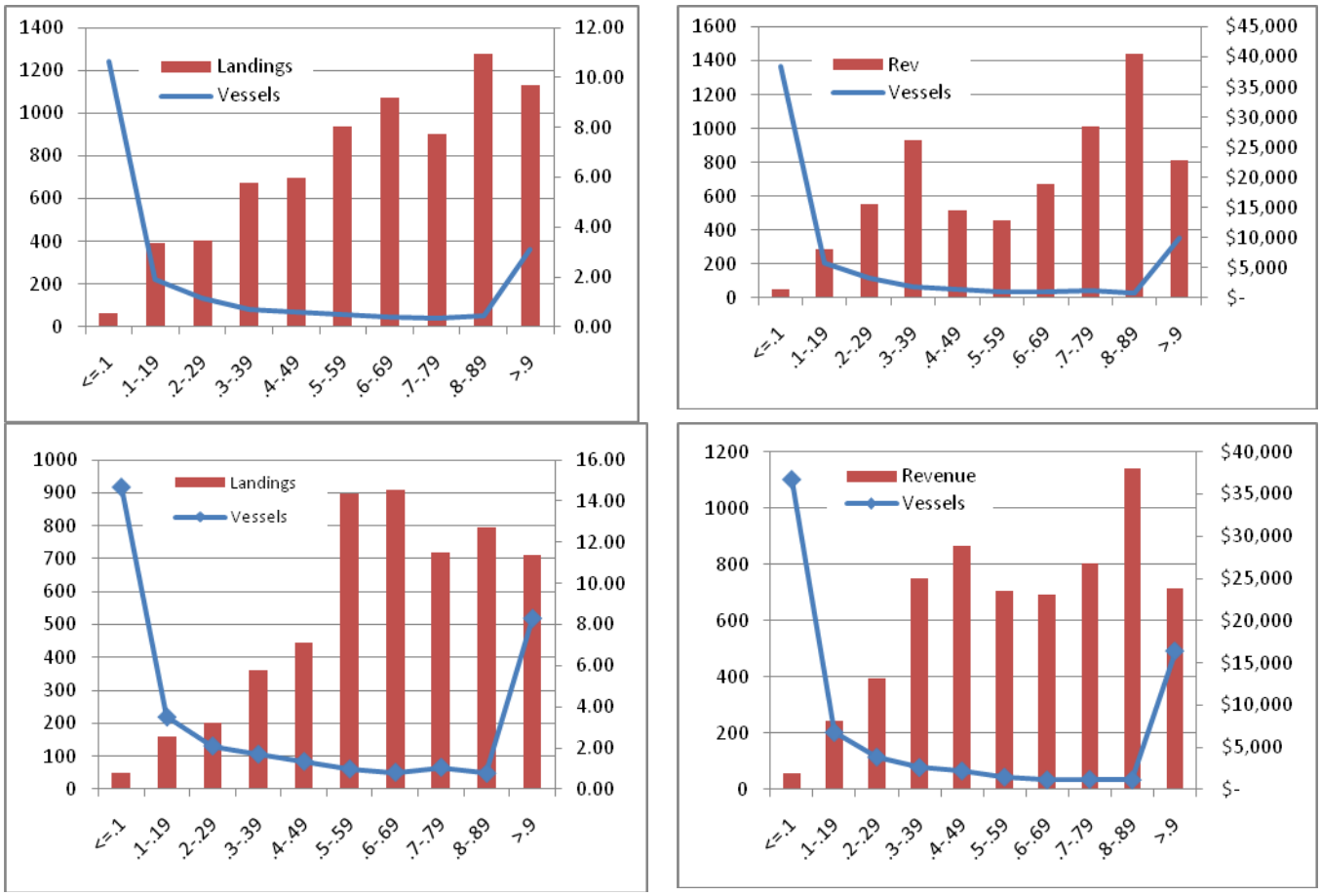


**Figure 10. Number of vessels by percent of landings (left) and revenue (right) from albacore, 1990-1999 (top) and 2000-2009 (bottom).**

**Table 5. Landings (mt) and revenue (real $) from surface hook-and-line (PTA) caught albacore as a percent of total landings, revenue, 1990-1999.**

| | Landings | | | | Revenue | | | |
|---|---|---|---|---|---|---|---|---|
| Interval | Vessels | PTA landings (ves./yr.) | Percent of all vessels | Percent of all PTA landings | Vessels | PTA revenue (ves./yr.) | Percent of all vessels | Percent of all PTA revenue |
| <=.1 | 1240 | 0.55 | 54% | 8.5% | 1371 | $1,454 | 60% | 10.3% |
| .1-.19 | 223 | 3.35 | 10% | 9.3% | 203 | $8,140 | 9% | 8.5% |
| .2-.29 | 133 | 3.45 | 6% | 5.7% | 119 | $15,663 | 5% | 9.6% |
| .3-.39 | 79 | 5.78 | 3% | 5.7% | 64 | $26,246 | 3% | 8.6% |
| .4-.49 | 68 | 5.96 | 3% | 5.0% | 47 | $14,627 | 2% | 3.5% |
| .5-.59 | 58 | 8.05 | 3% | 5.8% | 38 | $12,763 | 2% | 2.5% |
| .6-.69 | 47 | 9.20 | 2% | 5.4% | 39 | $18,938 | 2% | 3.8% |
| .7-.79 | 41 | 7.72 | 2% | 3.9% | 40 | $28,461 | 2% | 5.9% |
| .8-.89 | 50 | 10.97 | 2% | 6.8% | 28 | $40,547 | 1% | 5.8% |
| >.9 | 364 | 9.71 | 16% | 43.9% | 354 | $22,796 | 15% | 41.5% |

**Table 6. Landings (mt) and revenue (real $) from surface hook-and-line (PTA) caught albacore as a percent of total landings, revenue, 2000-2009.**

| Landings | | | | | Revenue | | | |
|---|---|---|---|---|---|---|---|---|
| Interval | Vessels | Landings (ves./yr.) | Percent of all vessels | Percent of all landings | Vessels | Revenue (ves./yr.) | Percent of all vessels | Percent of all revenue |
| <=.1 | 918 | 0.77 | 42% | 6% | 1101 | $1,986 | 50% | 9% |
| .1-.19 | 219 | 2.58 | 10% | 5% | 203 | $8,185 | 9% | 7% |
| .2-.29 | 131 | 3.20 | 6% | 4% | 115 | $13,193 | 5% | 6% |
| .3-.39 | 106 | 5.77 | 5% | 5% | 78 | $24,992 | 4% | 8% |
| .4-.49 | 84 | 7.10 | 4% | 5% | 66 | $28,891 | 3% | 8% |
| .5-.59 | 61 | 14.39 | 3% | 7% | 44 | $23,571 | 2% | 4% |
| .6-.69 | 51 | 14.54 | 2% | 6% | 34 | $23,015 | 2% | 3% |
| .7-.79 | 66 | 11.51 | 3% | 6% | 36 | $26,741 | 2% | 4% |
| .8-.89 | 48 | 12.75 | 2% | 5% | 34 | $38,044 | 2% | 5% |
| >.9 | 519 | 11.37 | 24% | 50% | 492 | $23,887 | 22% | 47% |

Table 7 and Table 8 update and expand the analysis of the gear-species combinations, or "primary fishery," participation by vessels catching PTA, presented to the Council in April 2010. These primary fisheries are identified by determining what combination of PacFIN gear code and species code accounts for the largest proportion of each vessel's total catch or revenue over the two periods, 1990-1999 and 2000-2009. (Management group species codes are used except that albacore is broken out separately from the other HMS species codes. For confidentiality reasons all gear-species combinations with fewer than three vessels are grouped into a single category called other gears.) The left panel in each table presents this information by landings weight while the right panel presents it by ex-vessel revenue (adjusted for inflation to 2010 prices). Each panel ranks the primary fisheries by the number of vessels in that fishery, shows the average annual per-vessel landings/revenue from pole-troll albacore (PTA), the percent of total PTA landings/revenue that the vessels in the fishery account for, and PTA as a percent of landings / revenue from all species. Tables 5 and 6 corroborate the great diversity of participation in other fisheries of vessels with at least some PTA landings/revenue.

**Table 7. Number of vessels landing pole-troll albacore (PTA) by primary gear-species combination in terms of PTA landings (left panel) and PTA revenue (right panel), average PTA landings (mt) and revenue ($real), PTA landings / revenue as a percent of total PTA landings / revenue, and PTA landings / revenue as a percent of total landings / revenue (all gear-species), 1990-1999.**

| Gear-Species Combinations | Vessels | PTA Landings (ves./yr.) | PTA landings % all PTA | PTA landings % all landings | Gear-Species Combinations | Vessels | PTA revenue (ves./yr.) | PTA revenue % all PTA | PTA revenue % all revenue |
|---|---|---|---|---|---|---|---|---|---|
| TROLL-ALBC | 557 | 9.06 | 62.7% | 80.2% | TROLL-ALBC | 479 | $22,632.98 | 55.8% | 80.9% |
| TROLL-SAMN | 360 | 0.44 | 2.0% | 12.2% | TROLL-SAMN | 410 | $1,314.48 | 2.8% | 8.7% |
| CRAB POT-CRAB | 251 | 2.77 | 8.6% | 10.5% | CRAB POT-CRAB | 301 | $7,378.43 | 11.4% | 6.3% |
| LONGLINE OR SETLINE-GRND | 137 | 0.65 | 1.1% | 3.5% | CRAB AND LOBSTER POT-CRAB | 156 | $4,487.22 | 3.6% | 5.5% |
| GROUNDFISH TRAWL (OTTER)-GRND | 134 | 1.54 | 2.6% | 0.7% | LONGLINE OR SETLINE-GRND | 127 | $1,539.39 | 1.0% | 2.8% |
| CRAB AND LOBSTER POT-CRAB | 120 | 1.35 | 2.0% | 8.4% | GROUNDFISH TRAWL (OTTER)-GRND | 121 | $2,715.48 | 1.7% | 0.9% |
| POLE (COMMERCIAL)-GRND | 112 | 0.19 | 0.3% | 3.9% | POLE (COMMERCIAL)-GRND | 82 | $340.41 | 0.1% | 2.7% |
| POLE (COMMERCIAL)-ALBC | 50 | 10.91 | 6.8% | 88.6% | POLE (COMMERCIAL)-SAMN | 59 | $971.96 | 0.3% | 8.7% |
| DIVING GEAR-OTHR | 46 | 1.52 | 0.9% | 4.5% | POLE (COMMERCIAL)-ALBC | 49 | $31,416.84 | 7.9% | 92.4% |
| SHRIMP TRAWL, DOUBLE RIGGED-SRMP | 45 | 2.74 | 1.5% | 1.9% | POLE (COMMERCIAL)-OTHR | 46 | $124.29 | <0.1% | 2.1% |
| POLE (COMMERCIAL)-OTHR | 39 | 0.03 | 0.0% | 2.8% | SHRIMP TRAWL, DOUBLE RIGGED-SRMP | 43 | $5,761.14 | 1.3% | 2.3% |
| OTHER HOOK-AND-LINE GEAR-GRND | 37 | 1.12 | 0.5% | 16.9% | DIVING GEAR-OTHR | 41 | $3,454.44 | 0.7% | 3.5% |
| OTHER POT GEAR-CRAB | 35 | 0.57 | 0.2% | 6.6% | LONGLINE OR SETLINE-OTHR | 39 | $6,058.80 | 1.2% | 6.9% |
| LONGLINE OR SETLINE-OTHR | 31 | 2.10 | 0.8% | 9.9% | DRIFT GILL NET-HMSP | 37 | $13,852.67 | 2.6% | 12.1% |
| DRIFT GILL NET-HMSP | 28 | 2.92 | 1.0% | 12.2% | OTHER POT GEAR-CRAB | 36 | $1,588.43 | 0.3% | 5.7% |
| POLE (COMMERCIAL)-SAMN | 28 | 0.19 | 0.1% | 13.0% | SET NET-HMSP | 28 | $18,114.22 | 2.6% | 13.5% |
| SEINE-CPEL | 23 | 4.69 | 1.3% | 1.1% | FISH POT-GRND | 20 | $1,116.77 | 0.1% | 1.1% |
| FISH POT-GRND | 21 | 1.10 | 0.3% | 2.5% | CRAB AND LOBSTER POT-OTHR | 20 | $128.47 | <0.1% | 0.3% |
| OTHER TRAWL GEAR-GRND | 21 | 0.70 | 0.2% | 0.3% | POLE (COMMERCIAL)-HMSP | 19 | $35,337.24 | 3.5% | 24.5% |
| POLE (COMMERCIAL)-HMSP | 19 | 15.12 | 3.6% | 16.0% | OTHER HOOK-AND-LINE GEAR-GRND | 18 | $2,124.95 | 0.2% | 16.9% |
| SHRIMP TRAWL, SINGLE OR DOUBLE RIG-SRMP | 18 | 3.99 | 0.9% | 3.4% | SEINE-CPEL | 13 | $11,692.49 | 0.8% | 4.1% |
| SET NET-HMSP | 15 | 5.16 | 1.0% | 21.0% | SHRIMP TRAWL, SINGLE OR DOUBLE RIG-SRMP | 13 | $3,456.41 | 0.2% | 1.8% |
| OTHER TRAWL GEAR-SRMP | 13 | 1.24 | 0.2% | 1.4% | OTHER KNOWN GEAR-HMSP | 10 | $251.17 | <0.1% | 0.4% |

| Gear-Species Combinations | Vessels | PTA Landings (ves./yr.) | PTA landings % all PTA | PTA landings % all landings | Gear-Species Combinations | Vessels | PTA revenue (ves./yr.) | PTA revenue % all PTA | PTA revenue % all revenue |
|---|---|---|---|---|---|---|---|---|---|
| SHRIMP TRAWL, SINGLE RIGGED-SRMP | 13 | 1.45 | 0.2% | 4.2% | LONGLINE OR SETLINE-HMSP | 9 | $12,479.18 | 0.6% | 11.4% |
| CRAB AND LOBSTER POT-OTHR | 11 | 0.08 | 0.0% | 2.6% | GROUNDFISH TRAWL (OTTER)-OTHR | 9 | $738.68 | <0.1% | 1.3% |
| GILL NET-CPEL | 11 | 0.28 | 0.0% | 1.7% | OTHER TRAWL GEAR-GRND | 8 | $2,450.89 | 0.1% | 1.2% |
| FISH POT-OTHR | 10 | 0.75 | 0.1% | 6.6% | SEINE-SAMN | 7 | $3,826.33 | 0.1% | 11.0% |
| OTHER KNOWN GEAR-HMSP | 10 | 0.10 | 0.0% | 1.7% | OTHER POT GEAR-SRMP | 7 | $3,441.82 | 0.1% | 5.2% |
| SET NET-CPEL | 9 | 0.14 | 0.0% | 0.9% | VERTICAL HOOK-AND-LINE GEAR-GRND | 7 | $121.93 | <0.1% | 4.7% |
| DIP NET-CPEL | 8 | 0.34 | 0.0% | 1.4% | PRAWN TRAP-SRMP | 6 | $2,594.84 | 0.1% | 5.2% |
| MIDWATER TRAWL-GRND | 8 | 0.08 | 0.0% | 0.0% | OTHER TRAWL GEAR-SRMP | 6 | $1,424.37 | <0.1% | 0.7% |
| LONGLINE OR SETLINE-HMSP | 7 | 0.02 | 0.0% | 0.1% | SHRIMP TRAWL, SINGLE RIGGED-SRMP | 6 | $377.27 | <0.1% | 0.2% |
| SEINE-SAMN | 7 | 1.62 | 0.1% | 10.8% | FISH POT-OTHR | 5 | $2,935.46 | 0.1% | 9.7% |
| VERTICAL HOOK-AND-LINE GEAR-GRND | 7 | 0.04 | 0.0% | 8.4% | DIVING GEAR-SHLL | 5 | $2,340.71 | 0.1% | 2.8% |
| JIG-GRND | 6 | 0.12 | 0.0% | 4.0% | GILL NET-CPEL | 5 | $658.26 | <0.1% | 1.1% |
| OTHER KNOWN GEAR-OTHR | 6 | 0.35 | 0.0% | 1.0% | OTHER KNOWN GEAR-OTHR | 5 | $365.48 | <0.1% | 0.5% |
| SET NET-OTHR | 6 | 0.08 | 0.0% | 0.9% | JIG-GRND | 5 | $229.55 | <0.1% | 4.1% |
| GROUNDFISH TRAWL (OTTER)-OTHR | 4 | 0.27 | 0.0% | 3.1% | DIP NET-CPEL | 5 | $148.34 | <0.1% | 0.8% |
| OTHER NET GEAR-CPEL | 4 | 0.39 | 0.0% | 0.8% | MIDWATER TRAWL-GRND | 5 | $29.38 | <0.1% | <0.1% |
| DIP NET-OTHR | 3 | 11.03 | 0.4% | 2.6% | OTHER POT GEAR-OTHR | 4 | $236.62 | <0.1% | 1.0% |
| GILL NET-OTHR | 3 | 0.01 | 0.0% | 0.1% | SET NET-OTHR | 4 | $78.56 | <0.1% | 0.5% |
| OTHER POT GEAR-SRMP | 3 | 1.43 | 0.1% | 24.9% | DIP NET-OTHR | 3 | $26,131.92 | 0.4% | 4.4% |
| TROLL-GRND | 3 | 0.00 | 0.0% | 0.1% | OTHER NET GEAR-CPEL | 3 | $1,044.54 | <0.1% | 1.3% |
| Other gear | 24 | 1.22 | 0.4% | 1.7% | SET NET-CPEL | 3 | $344.21 | <0.1% | 0.8% |
| | | | | | GILL NET-OTHR | 3 | $13.99 | <0.1% | <0.1% |
| | | | | | Other Gear | 16 | $1,116.00 | 0.1% | 0.6% |

Species codes: ALBC- albacore, CPEL-coastal pelagic species, CRAB-crab and lobster, GRND-groundfish, HMSP-highly migratory species other than albacore, OTHR-other species, SAMN-salmon, SHLL-shellfish, SRMP-shrimp.

**Table 8. Number of vessels landing pole-troll albacore (PTA) by primary gear-species combination in terms of PTA landings (left panel) and PTA revenue (right panel), average PTA landings (mt) and revenue ($real), PTA landings / revenue as a percent of total PTA landings / revenue, and PTA landings / revenue as a percent of total landings / revenue (all gear-species), 2000-2009.**

| Gear-Species Combinations | Vessels | PTA Landings (ves./yr.) | PTA landings % all PTA | PTA landings % all landings | Gear-Species Combinations | Vessels | PTA revenue (ves./yr.) | PTA revenue % all PTA | PTA revenue % all revenue |
|---|---|---|---|---|---|---|---|---|---|
| TROLL-ALBC | 724 | 12.44 | 76.4% | 83.6% | TROLL-ALBC | 611 | $26,743 | 65.2% | 85.8% |
| TROLL-SAMN | 358 | 0.45 | 1.4% | 14.3% | TROLL-SAMN | 435 | $2,170 | 3.8% | 11.7% |
| CRAB POT-CRAB | 326 | 3.50 | 9.7% | 10.7% | CRAB POT-CRAB | 380 | $10,428 | 15.8% | 7.0% |
| CRAB AND LOBSTER POT-CRAB | 174 | 3.41 | 5.0% | 15.1% | CRAB AND LOBSTER POT-CRAB | 191 | $11,482 | 8.8% | 9.9% |
| LONGLINE OR SETLINE-GRND | 68 | 0.31 | 0.2% | 2.1% | LONGLINE OR SETLINE-GRND | 68 | $1,580 | 0.4% | 2.7% |
| POLE (COMMERCIAL)-ALBC | 56 | 0.42 | 0.2% | 90.5% | POLE (COMMERCIAL)-OTHR | 65 | $288 | 0.1% | 7.9% |
| POLE (COMMERCIAL)-OTHR | 50 | 0.06 | 0.0% | 10.1% | POLE (COMMERCIAL)-ALBC | 49 | $1,037 | 0.2% | 84.2% |
| SHRIMP TRAWL, DOUBLE RIGGED-SRMP | 40 | 4.67 | 1.6% | 2.1% | POLE (COMMERCIAL)-GRND | 45 | $252 | 0.0% | 4.4% |
| POLE (COMMERCIAL)-GRND | 38 | 0.08 | 0.0% | 7.1% | ROLLER TRAWL-GRND | 36 | $3,365 | 0.5% | 1.2% |
| OTHER HOOK-AND-LINE GEAR-GRND | 33 | 0.08 | 0.0% | 6.0% | OTHER HOOK-AND-LINE GEAR-GRND | 31 | $231 | 0.0% | 4.4% |
| ROLLER TRAWL-GRND | 30 | 2.48 | 0.6% | 1.3% | CRAB AND LOBSTER POT-OTHR | 28 | $326 | 0.0% | 0.5% |
| DRIFT GILL NET-HMSP | 24 | 4.37 | 0.9% | 20.5% | DRIFT GILL NET-HMSP | 24 | $10,116 | 1.0% | 13.7% |
| SEINE-CPEL | 22 | 2.26 | 0.4% | 0.2% | SHRIMP TRAWL, DOUBLE RIGGED-SRMP | 21 | $8,277 | 0.7% | 2.4% |
| DIVING GEAR-OTHR | 19 | 1.75 | 0.3% | 3.8% | DIVING GEAR-OTHR | 19 | $4,582 | 0.3% | 5.5% |
| GROUNDFISH TRAWL, FOOTROPE < 8 IN.-GRND | 19 | 0.39 | 0.1% | 0.5% | SEINE-CPEL | 17 | $3,923 | 0.3% | 1.0% |
| GROUNDFISH TRAWL, FOOTROPE > 8 IN.-GRND | 18 | 3.97 | 0.6% | 2.3% | GROUNDFISH TRAWL, FOOTROPE > 8 IN.-GRND | 15 | $4,556 | 0.3% | 2.1% |
| CRAB AND LOBSTER POT-OTHR | 18 | 0.11 | 0.0% | 2.7% | LONGLINE OR SETLINE-HMSP | 13 | $19,976 | 1.0% | 16.6% |
| FISH POT-OTHR | 14 | 2.56 | 0.3% | 9.7% | OTHER KNOWN GEAR-HMSP | 13 | $711 | 0.0% | 2.1% |
| MIDWATER TRAWL-GRND | 14 | 0.42 | 0.0% | 0.0% | FISH POT-GRND | 12 | $5,849 | 0.3% | 5.5% |
| FISH POT-GRND | 14 | 0.29 | 0.0% | 8.0% | GROUNDFISH TRAWL, FOOTROPE < 8 IN.-GRND | 12 | $844 | 0.0% | 0.8% |
| POLE (COMMERCIAL)-HMSP | 13 | 0.03 | 0.0% | 10.5% | POLE (COMMERCIAL)-HMSP | 12 | $230 | 0.0% | 16.9% |
| SHRIMP TRAWL, SINGLE OR DOUBLE RIG-SRMP | 12 | 5.92 | 0.6% | 4.1% | LONGLINE OR SETLINE-OTHR | 10 | $3,528 | 0.1% | 2.7% |
| DIP NET-CPEL | 12 | 3.22 | 0.3% | 5.3% | DIP NET-CPEL | 9 | $8,624 | 0.3% | 17.5% |

| Gear-Species Combinations | Vessels | PTA Landings (ves./yr.) | PTA landings % all PTA | PTA landings % all landings | Gear-Species Combinations | Vessels | PTA revenue (ves./yr.) | PTA revenue % all PTA | PTA revenue % all revenue |
|---|---|---|---|---|---|---|---|---|---|
| LONGLINE OR SETLINE-HMSP | 12 | 0.41 | 0.0% | 2.2% | SHRIMP TRAWL, SINGLE OR DOUBLE RIG-SRMP | 9 | $5,789 | 0.2% | 3.7% |
| FLATFISH TRAWL-GRND | 10 | 1.12 | 0.1% | 1.3% | MIDWATER TRAWL-GRND | 8 | $329 | 0.0% | 0.1% |
| OTHER KNOWN GEAR-HMSP | 10 | 0.39 | 0.0% | 8.5% | GILL NET-OTHR | 7 | $793 | 0.0% | 2.8% |
| SEINE-SAMN | 9 | 2.36 | 0.2% | 15.7% | PRAWN TRAP-SRMP | 7 | $80 | 0.0% | 0.1% |
| LONGLINE OR SETLINE-OTHR | 8 | 1.82 | 0.1% | 6.6% | FISH POT-OTHR | 6 | $9,220 | 0.2% | 17.7% |
| SELECTIVE FF TRAWL, SMALL FOOTROPE-GRND | 6 | 0.68 | 0.0% | 0.8% | FLATFISH TRAWL-GRND | 6 | $742 | 0.0% | 0.6% |
| GILL NET-OTHR | 6 | 0.10 | 0.0% | 2.0% | GILL NET-SAMN | 6 | $78 | 0.0% | 0.6% |
| VERTICAL HOOK-AND-LINE GEAR-GRND | 6 | 0.05 | 0.0% | 3.4% | VERTICAL HOOK-AND-LINE GEAR-GRND | 5 | $120 | 0.0% | 0.6% |
| PRAWN TRAP-SRMP | 6 | 0.05 | 0.0% | 0.6% | GROUNDFISH TRAWL (OTTER)-OTHR | 3 | $4,344 | 0.1% | 3.7% |
| GILL NET-SAMN | 5 | 0.03 | 0.0% | 0.6% | SHRIMP TRAWL, SINGLE RIGGED-SRMP | 3 | $914 | 0.0% | 2.4% |
| OTHER NET GEAR-CPEL | 4 | 4.25 | 0.1% | 1.6% | SEINE-SAMN | 3 | $716 | 0.0% | 10.3% |
| GROUNDFISH TRAWL (OTTER)-GRND | 3 | 2.12 | 0.1% | 12.8% | OTHER NET GEAR-CPEL | 3 | $269 | 0.0% | 0.5% |
| SHRIMP TRAWL, SINGLE RIGGED-SRMP | 3 | 1.98 | 0.1% | 4.3% | OTHER KNOWN GEAR-CRAB | 3 | $137 | 0.0% | 9.1% |
| GILL NET-CPEL | 3 | 0.01 | 0.0% | 0.2% | Other gear | 18 | $620 | 0.2% | 0.6% |
| Other gear | 16 | 3.11 | 0.4% | 3.5% | | | | | |

Species codes: ALBC- albacore, CPEL-coastal pelagic species, CRAB-crab and lobster, GRND-groundfish, HMSP-highly migratory species other than albacore, OTHR-other species, SAMN-salmon, SHLL-shellfish, SRMP-shrimp.

**Table 9. Five top-ranked primary fisheries by landings and revenue, showing percentages of total for top-ranked (troll-albacore) and top-5 ranked, 1990-1999 (top panel) and 2000-2009 (bottom panel).**

| Landings | | Revenue | |
|---|---|---|---|
| **Rank by no. vessels** | **Rank by percent of total PTA landings** | **Rank by no. vessels** | **Rank by percent of total PTA rev.** |
| TROLL-ALBC **(24.2%)** | TROLL-ALBC **(62.7%)** | TROLL-ALBC **(20.8%)** | TROLL-ALBC **(55.8%)** |
| TROLL-SAMN | CRAB POT-CRAB | TROLL-SAMN | CRAB POT-CRAB |
| CRAB POT-CRAB | POLE (COMMERCIAL)-ALBC | CRAB POT-CRAB | POLE (COMMERCIAL)-ALBC |
| LONGLINE OR SETLINE-GRND | POLE (COMMERCIAL)-HMSP | CRAB AND LOBSTER POT-CRAB | CRAB AND LOBSTER POT-CRAB |
| GROUNDFISH TRAWL (OTTER)-GRND | GROUNDFISH TRAWL (OTTER)-GRND | LONGLINE OR SETLINE-GRND | POLE (COMMERCIAL)-HMSP |
| **Percent all vessels: 62.5%** | **Percent all PTA landings: 84.2%** | **Percent all vessels: 64.5%** | **Percent of all PTA revenue: 82.1%** |
| **Landings** | | **Revenue** | |
| **Rank by no. vessels** | **Rank by percent of total PTA landings** | **Rank by no. vessels** | **Rank by percent of total PTA rev.** |
| TROLL-ALBC **(32.9%)** | TROLL-ALBC **(76.4%)** | TROLL-ALBC **(27.7%)** | TROLL-ALBC **(65.2%)** |
| TROLL-SAMN | CRAB POT-CRAB | TROLL-SAMN | CRAB POT-CRAB |
| CRAB POT-CRAB | CRAB AND LOBSTER POT-CRAB | CRAB POT-CRAB | CRAB AND LOBSTER POT-CRAB |
| CRAB AND LOBSTER POT-CRAB | SHRIMP TRAWL, DOUBLE RIGGED-SRMP | CRAB AND LOBSTER POT-CRAB | TROLL-SAMN |
| LONGLINE OR SETLINE-GRND | TROLL-SAMN | LONGLINE OR SETLINE-GRND | LONGLINE OR SETLINE-HMSP |
| **Percent all vessels: 74.9%** | **Percent all PTA landings: 94.1%** | **Percent all vessels: 76.5%** | **Percent of all PTA revenue: 94.6%** |

**Table 10. Comparison of primary source of landings to primary revenue source for two periods, 1990-1999 and 2000-2009.**

| Fishery ranked by landings (# vessels) | Percent of vessels whose main source of revenue is a different fishery | Fishery ranked by revenue (# vessels) | Percent of vessels whose main source of landings is a different fishery |
|---|---|---|---|
| **1990-1999** | | | |
| TROLL-ALBC | 16.9% | TROLL-ALBC | 3.2% |
| TROLL-SAMN | 7.2% | TROLL-SAMN | 15.6% |
| CRAB POT-CRAB | 2.0% | CRAB POT-CRAB | 15.4% |
| LONGLINE OR SETLINE-GRND | 16.8% | CRAB AND LOBSTER POT-CRAB | 21.2% |
| GROUNDFISH TRAWL (OTTER)-GRND | 14.9% | LONGLINE OR SETLINE-GRND | 9.3% |
| **2000-2009** | | | |
| TROLL-ALBC | 16.4% | TROLL-ALBC | 1.0% |
| TROLL-SAMN | 2.8% | TROLL-SAMN | 20.0% |
| CRAB POT-CRAB | 2.1% | CRAB POT-CRAB | 14.7% |
| CRAB AND LOBSTER POT-CRAB | 0.0% | CRAB AND LOBSTER POT-CRAB | 12.7% |
| LONGLINE OR SETLINE-GRND | 10.3% | LONGLINE OR SETLINE-GRND | 10.3% |

Table 9 focuses on the five top-ranked primary fisheries for the two periods, showing percentages of the total for number of vessels and total landings or revenue. As expected, the troll albacore fishery is the top-ranked primary fishery in both periods for both landings and revenue when ranked by number of vessels in the fishery and the percent of total PTA landings or revenue that primary fishery accounts for. Troll-salmon ranks second in all cases in terms of number of vessels, but crab pot-crab ranks second in terms of the proportion of total PTA revenue. This reflects the fact that troll-salmon accounts for a much smaller fraction of total PTA landings/revenue (1-4 %) than crab pot-crab (9-16%). Other primary fisheries showing up in the top five by these two ranking methods and in the two periods include longline-groundfish, trawl-groundfish, pole-albacore, pole-HMS, and crab and lobster pot-crab for the 1990-1999 period. (It should be noted that the PacFIN gear code for crab pot and crab and lobster pot are based on state gear codes—crab pot for Washington and Oregon and crab and lobster pot for California—and are probably functionally equivalent from a fishery perspective.) During the 2000-2009 period shrimp trawl-shrimp and pelagic longline-HMS were additionally in the top five by one of these ranking methods.

Table 9 also shows the percentage values for the PTA fishery (the top-ranked fishery in all cases) and for the top-five primary fisheries combined. Notably, in all cases the percentages, whether by number of vessels or total landings/revenue, increased from the 1990-1999 period to the 2000-2009 period for both troll-albacore and the top-five fisheries combined. This corroborates the evidence discussed above indicating that there has been more specialization over time. In other words, vessels with the largest fraction of their landings and revenue from troll albacore account for a larger fraction of the total number of vessels catching PTA and the total amount of PTA caught. The same holds true for the top-five ranked fisheries. In general, we can say that the troll albacore, troll salmon, and crab fisheries are closely interlinked in terms of vessel participation.

Another interesting result that shows up in these tables is the difference between the number of vessels in the troll albacore fishery in terms of PTA landings versus PTA revenue. During the 1990-1999 period, for example, 463 vessels in the troll albacore fishery as computed from landings were also in this primary fishery as computed by revenue. Therefore, 94 vessels whose primary source of landings was PTA derived their primary source of revenue from some other fishery while 16 vessels whose primary source of revenue was PTA landed greater amounts from some other gear-species combination. Table 10 takes this comparison a bit further by comparing fisheries in terms of the percent of vessels that derive more revenue from a fishery different from where most of their landings come from and vice versa. The results are shown for the top-five ranked fisheries in Table 9. In both periods about 16 percent of vessels whose main source of landings was troll albacore derived their largest source of revenue from some other fishery. Conversely, only 3 percent, 1990-1999, and 1 percent, 2000-2009, of vessels whose primary source of revenue was troll albacore derived more landings from some other fishery. For troll salmon and crab-pot crab, the next ranked fisheries, the pattern is reversed. For example, in the 1990-1999 period only 7.2 percent vessels whose primary source of landings was troll-salmon derived the largest share of their revenue from some other fishery. For crab pot-crab it is only 2 percent. This suggests that in comparison to these other fisheries troll albacore is relatively less valuable.

### *Participation by Canadian Vessels in the U.S. West Coast EEZ*

Under the U.S.-Canada Albacore Treaty, a limited number of Canadian albacore troll vessels are allowed to fish in the U.S. west coast EEZ and reciprocal rights are granted to U.S. vessels, thus U.S. vessels are also allowed to fish in Canadian waters. Figure 11 is based on data provided by Craig D'Angelo, NMFS SWR, from a query run on PacFIN fishticket data. It shows landings and vessel counts broken out for Canadian, U.S. surface hook-and-line and U.S. other gear types. (Ambiguous vessel identification numbers are excluded from the vessel counts, but associated landings are included in landings amounts.) Landings by Canadian vessels fishing in U.S. waters (and landing to U.S. ports as recorded in PacFIN)

averaged just under 8 percent of total landings for the period displayed. On average, 45 Canadian vessels made albacore landings in west coast ports annually during the period, representing just under 6 percent of all vessels making albacore landings.

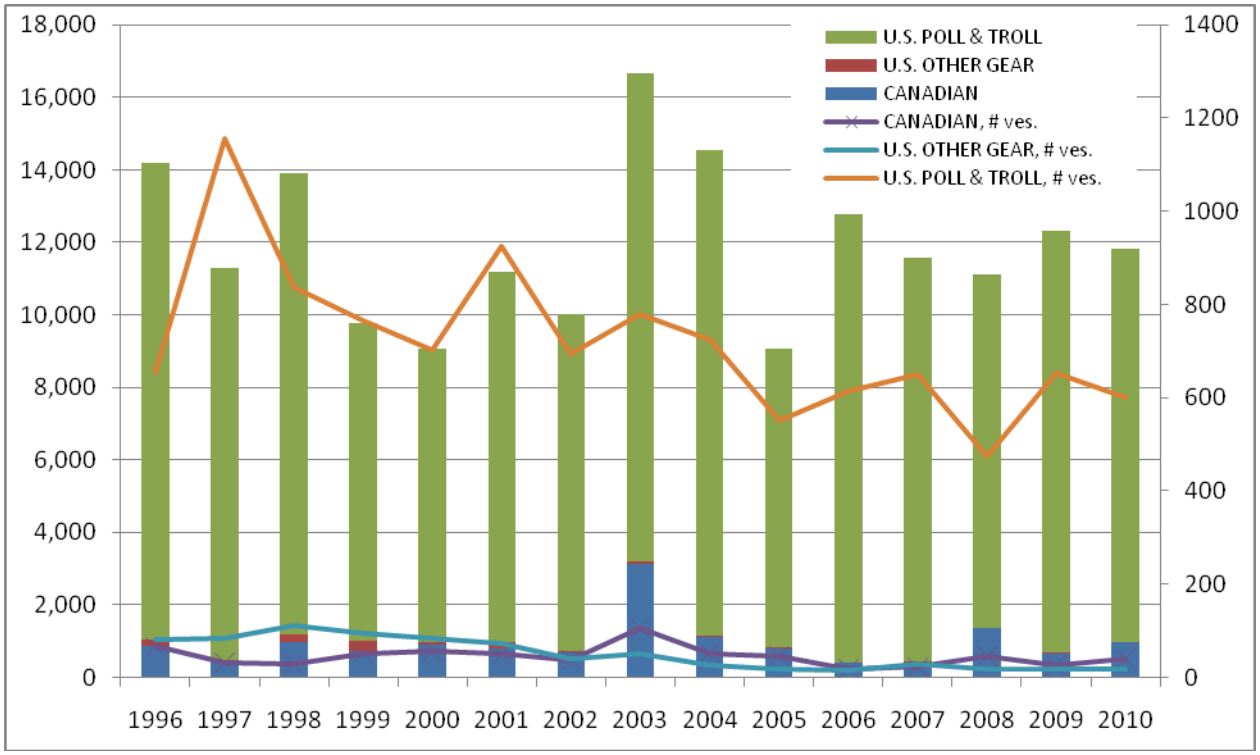


**Figure 11. Canadian and U.S. vessel landings and numbers for the U.S. west coast EEZ, 1996-2010.**

## *A Note on the PacFIN Pole and Troll Gear Codes*

Table 11 shows the state gear codes grouped under the PacFIN gear id (grid) codes "POL" and "TRL" and their inclusion on the HMS SAFE fishery classification "surface hook-and-line." It can be seen that there are three state codes in these gear ids that are not considered part of the surface hook-and-line fishery. A query on PacFIN fishticket data indicates that of these three codes, albacore landings occurred under C-004 (mooching) in 2001 and 2003 but in small amounts. To simplify the PacFIN query used to obtain the data for this analysis the PacFIN grid codes were used rather than the state codes. This may have introduced a minor discrepancy between the characterization here and the HMS SAFE characterization of the fishery.

**Table 11. State gear codes included in the PacFIN "POL" and "TRL" gear ids.**

| GRID | State Code | Description | SAFE "surface hook-and-line" fishery? |
|---|---|---|---|
| POL | C-001 | HOOK-AND-LINE | Yes |
| POL | C-002 | LIVE BAIT | Yes |
| POL | C-004 | MOOCHING (DRIFTING FOR SALMON) | No |
| POL | C-006 | JIG (ALBACORE) | Yes |
| TRL | C-007 | TROLL (ALBACORE) | Yes |
| TRL | C-009 | TROLL, (SALMON) | Yes |
| TRL | O-120 | OCEAN TROLL | Yes |
| POL | O-170 | TUNA BAITBOAT | Yes |
| POL | W-10 | HOOK-AND-LINE | No |
| TRL | W-41 | TROLL (SALMON) | Yes |
| TRL | W-61 | TROLL (BOTTOMFISH) | No |

## IV. Illegal, Unreported, and Unregulated (IUU) Fishing: Potential Impacts on North Pacific Albacore Stock

The Magnuson-Stevens Act recognizes the importance of active U.S. involvement in international efforts to combat IUU fishing through activities such as adoption of IUU vessel lists; stronger port State controls; improved monitoring, control, and surveillance; implementation of market related measures to help ensure compliance; and capacity-building assistance. This section briefly highlights some of these current efforts; however, several factors make reporting on monitoring, control, and surveillance of IUU fishing activities very challenging. These factors include: the covert nature of IUU fishing activities; the vast expanse and offshore nature of where IUU fishing takes place; the need to coordinate with foreign governments and surveillance assets; the potential use of transshipment to launder IUU fishing activities; and the expanding homeland protection role of the U.S. Coast Guard (USCG). As such, there is very little quantitative catch and effort data available to assess the potential removals of NPA by IUU fishing for incorporation into stock assessment models and outputs. Oftentimes a qualitative analysis is included in stock assessments along with a recommendation to take precaution in interpreting the results of the stock assessments and developing management measures based on those results.

### *Regulatory and Conservation Measures to Combat IUU Activities*

On April 12, 2011, NMFS published the final rule in the Federal Register (76 FR 2011) to implement identification and certification procedures to address IUU fishing activities and bycatch of protected living marine resources (PLMRs) pursuant to the High Seas Driftnet Fishing Moratorium Protection Act (Moratorium Protection Act). The intent of these procedures is to promote the sustainability of transboundary and shared fishery stocks and to enhance the conservation and recovery of PLMRs. The rule implements existing U.S. statutory authorities to address noncompliance with international fisheries management and conservation agreements and encourage the use of bycatch reduction methods in international fisheries that are comparable to methods used by U.S. fishermen. Agency actions and recommendations under this rule will be in accordance with U.S. obligations under applicable international trade law, including the World Trade Organization Agreement. The Moratorium Protection Act also requires the establishment of procedures to certify whether nations identified in the biennial report are taking appropriate corrective actions to address IUU fishing or bycatch of PLMRs by fishing vessels of those nations. Identified nations that are not positively certified by the Secretary of Commerce could be subject to prohibitions on the importation of certain fisheries products into the United States and other measures, including limitations on port access, under the High Seas Driftnet Fisheries Enforcement Act (Enforcement Act)(16 U.S.C. 1826a).

The 2011 Biennial Report of the Secretary of Commerce to the Congress of the United States Concerning U.S. Actions Taken on Foreign Large-Scale High Seas Driftnet Fishing[4] provides a detailed summary of enforcement efforts taken under the Moratorium Protection Act. The report includes historical information on sighting of vessels violating the moratorium and various nations' enforcement efforts in the North Pacific Ocean. The 2011 report identified six countries (Colombia, Ecuador, Italy, Panama, Portugal, and Venezuela) as having been engaged in IUU fishing during 2009 or 2010; although, none of the IUU fishing activities that were considered in the identification process occurred in the North Pacific Ocean involving NPA. As in 2009, the identifications are based on violations of international measures, not on overfishing of shared stocks or on fishing practices destructive of vulnerable marine ecosystems. NMFS considered 12 other countries for identification during the reporting period, but consultations with those nations indicate corrective actions have already been taken to address the IUU fishing activities of concern, or the allegations of IUU fishing information were refuted.

This report also contains updates on U.S., regional, and global efforts to combat IUU fishing and to minimize bycatch of protected species. Important developments of interest to IUU issues in the North Pacific Ocean include:

- Adoption of the Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported, and Unregulated Fishing, in November 2009. One of the Agreement's objectives is to eliminate "ports of convenience" that serve as safe havens for IUU vessels and as portals for illegally harvested fish to enter the stream of commerce;
- Recommendations by an FAO Technical Consultation in November 2010 that the Committee on Fisheries should launch the Global Record of Fishing Vessels, Refrigerated Transport Vessels and Supply Vessels, beginning with Phase I (2011-2013) during which the largest vessels would enter the record;
- Expansion of the negotiations to establish a new RFMO in the North Pacific Ocean, to cover a wider geographic area (all high seas areas of the North Pacific Ocean) and include additional countries and entities, as well as agreement by negotiators on interim measures with regard to bottom fishing and steps to protect vulnerable marine ecosystems; and
- Entry into force on August 27, 2010, of the Antigua Convention, with improved enforcement provisions to combat IUU fishing as well as new measures to minimize impacts on bycatch species and conserve marine ecosystems.

### *Monitoring, Control, and Surveillance Activities*

According to the report on Extent of Global Illegal Fishing[5] (April 2008), estimates of the annual value of IUU-harvested fish range from USD 9 to 25 billion. Based in part on enforcement reports from existing multi-national surveillance programs, illegal catch in the northeast Pacific Ocean is currently estimated to be low and may have steadily declined in recent years (2008, NPAFC Doc 1132). However, during this time NMFS has received anecdotal information from several members of the U.S. NPA fleet that indicates that some level of large-scale high seas driftnet fishing continues to occur in the North Pacific Ocean potentially impacting albacore resources. The primary information provided to NMFS has been photographs of "net-marked" albacore and industry-reported sightings of vessels and/or vessel radio traffic signifying potential IUU fishing activities. The NMFS Southwest Regional office catalogs all IUU information sent as evidence and passes on relevant information to USCG and NOAA's Office of Law Enforcement (NOAA OLE). In 2010, a U.S. NPA fisherman notified NMFS Southwest Region, the

[4] This report was compiled by the NMFS pursuant to Section 206(E) of the Magnuson-Stevens Fishery Conservation and Management Act, as amended by Public Law 104-297, the Sustainable Fisheries Act of 1996. Electronic copies are available at http://www.nmfs.noaa.gov/msa2007/intlprovisions.html

[5] MRAG and Fisheries Ecosystems Restoration Research, Fisheries Centre, University of British Colombia, April 2008.

USCG, and NOAA OLE that he had sighted a vessel illegally fishing on the high seas in the North Pacific Ocean using a driftnet. A USCG C-130 was sent to the area several days later and initiated a search for the suspected vessel. The vessel was not encountered. USCG asked for position location verification from U.S. vessels once they were in the general area; however, unfortunately they did not receive the desired level of assistance.

The USCG has been actively involved with NOAA OLE in a multi-national high seas IUU surveillance program under the auspices of the North Pacific Anadromous Fisheries Commission (NPAFC). Although the NPAFC Enforcement efforts are targeting IUU fishing for salmon stocks, the area under surveillance and the IUU fleets in question also intercept NPA and squid. Information on the surveillance program is available on the NPAFC website[6] and summarized below. Agencies responsible for the planning and execution of enforcement activities coordinate their enforcement efforts to detect and deter illegal fishing in the NPAFC Convention Area (Figure 12). Since the establishment of the NPAFC, the Parties to that Convention have cooperated on the exchange of information regarding violations of the provisions of the Convention and on the exchange of enforcement plans and actions. The agencies of Contracting Parties which are directly responsible for the planning and execution of enforcement activities within the Convention Area are:

- Department of Fisheries and Oceans of Canada and Department of National Defense, Canada;
- Fisheries Agency of Japan and Japan Coast Guard;
- Ministry of Food, Agriculture, Forestry and Fisheries of the Republic of Korea;
- Fisheries Agency of the Russian Federation and Federal Security Service of Russia; and
- United States National Marine Fisheries Service and United States Coast Guard.

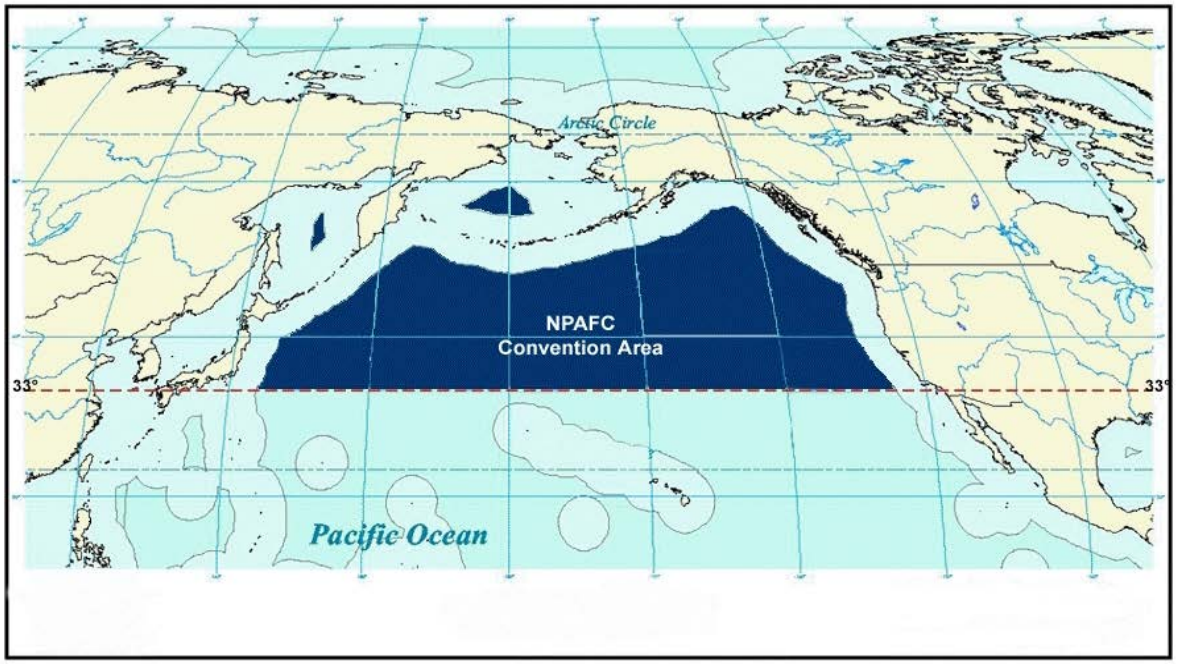


**Figure 12. The North Pacific Anadromous Fisheries Commission Convention Area.**

On 2 November 1992, the President signed Public Law 102-582, the High Seas Driftnet Fisheries Enforcement Act. Among other things, this Act is intended to enforce implementation of UNGA

[6] http://www.npafc.org/new/index.html

Resolution 46/215, which called for a worldwide driftnet moratorium beginning 31 December 1992.[7] From 1993-2009, the cooperative enforcement efforts of the NPAFC Parties resulted in the detection of 41 vessels conducting directed driftnet fishing operations for salmon in the NPAFC Convention Area. Of those vessels, 16 were apprehended (Table 12). Joint long-range aircraft patrols and coordination with each Party's enforcement vessels are used to detect illegal fishing during various high effort months in the Convention Area (Figure 13). Member countries conducted 188 ship patrol days and 279 aerial patrol hours in the Convention Area. In 2009, no Parties sighted any vessels suspected of illegal fishing, although Taiwan (a NPAFC observer) sighted one vessel with driftnets deployed. Recent years' results may reflect a reduction in IUU fishing in the North Pacific Ocean and may be a result of a significant increase in patrol efforts in recent years. Due to the continued threat of high seas fishing for salmon in the NPAFC Convention Area, all Parties reaffirmed their commitment to maintain 2010 enforcement activities at high levels as a deterrent to the threat of potential unauthorized fishing activities.

**Table 12. Number of detected/apprehended vessels for the period 1993-2009 under the NPAFC Surveillance Program. Source: NPAFC Annual Report 2009.**

| Year | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Detections | 6 | 1 | 3 | 1 | 6 | 9 | 11 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| Apprehensions | 2 | 0 | 1 | 1 | 2 | 4 | 3 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |

In 2006 the development of the Integrated Information System (IIS) was completed. The IIS allows the Parties to NPAFC to keep all electronic information about illegal or suspected vessels in the NPAFC Convention Area on a closed website. In 2007, the NPAFC Enforcement Committee initiated a program of cooperation with the Technical and Compliance Committee of the WCPFC and the Fisheries Working Group of the North Pacific Coast Guard Forum. In 2008 the first ever International North Pacific IUU Workshop was held in Vancouver, B.C., Canada.

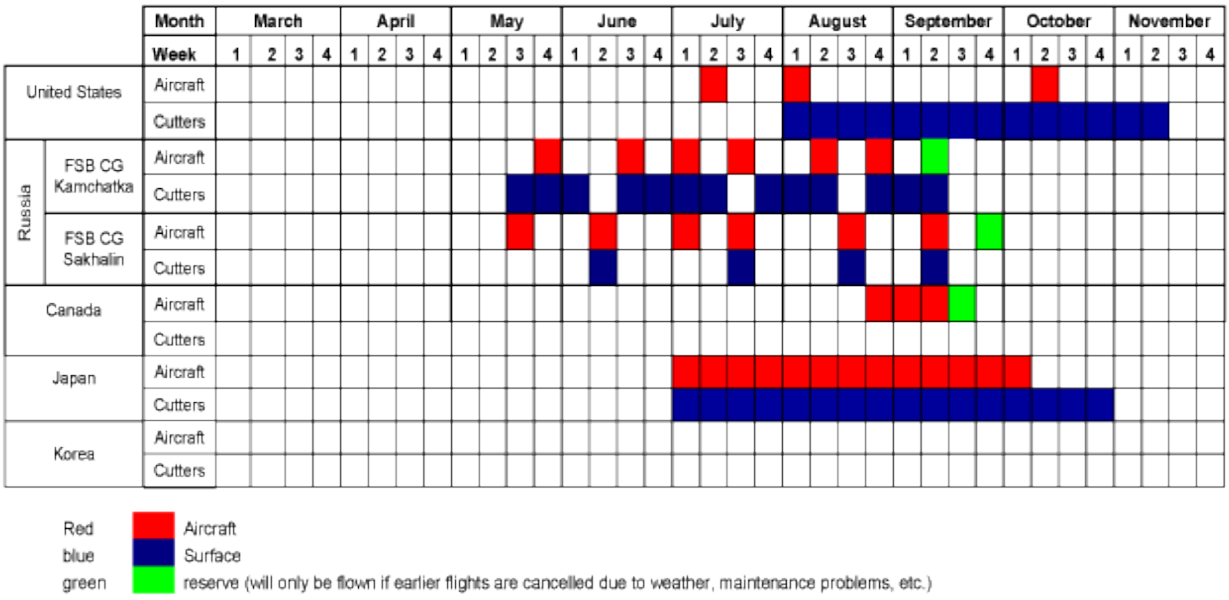


**Figure 13. Multi-national joint long-range patrol efforts in 2009 within the NPAFC Convention Area. Source: Enforcement Activities Section of NPAFC's 2009 Annual Report.**

[7] "U.S. Actions Taken on Foreign Large-Scale High Seas Driftnet Fishing Compiled by the National Marine Fisheries Service Pursuant to Section 206(E) of the Magnuson-Stevens Fishery Conservation and Management Act, as Amended by Public Law 104-297, The Sustainable Fisheries Act of 1996" (available at http://www.nmfs.noaa.gov/ia/intlbycatch/docs/congo_08_rpt.pdf)

### *Level of NPA removals by IUU fishing activities*

The International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) Albacore Working Group held a workshop from April 20-26, 2010 in Shizuoka, Japan. According to the report of the workshop (see Annex 6: page 15),[8] reports are received periodically of net marked albacore and other highly migratory species. It was clarified that IUU fishing refers to activities on the high seas, e.g., driftnets used outside the coastal waters of member countries. The working group noted that it considered the issue at a March 2008 meeting in La Jolla, California, and that the working group had no further information since that meeting. The following text was excerpted from the March 2008 meeting report of the Albacore Working Group:

*"Anecdotal evidence confirms that IUU is occurring, but the level of removals and impact(s) on the North Pacific albacore stock are unknown. At present, no country has a formal program for monitoring IUU or obtaining data for inclusion in Table 1 (catches by country and gear) and it would be speculative of the ALBWG to attempt to estimate an IUU time-series for technical use. The ALBWG recommends the creation of a joint multi-member discussion paper on IUU at the ISC level rather than technical level as a first step in addressing the issue. Since IUU is also an enforcement issue, the ALBWG felt that the Enforcement Committees of the WCPFC and IATTC should be engaged to begin surveillance during the fishing season and perhaps obtain some preliminary data on IUU."*

The working group considered these observations, conclusions and recommendations to be relevant in 2010. The ISC Plenary also noted concerns about the lack of IUU data and the impact this may have on stock assessments at their 2010 meeting.

## V. References:

International Scientific Committee for Tuna and Tuna-like Species in the North Pacific (ISC). 2010. Annex 9 - Report of the Albacore Working Group Workshop, 12-13 July, 2010 *In* Report of the Tenth Meeting of the International Scientific Committee for Tuna and Tuna-like Species In the North Pacific Ocean, 21-26 July 2010, Victoria, B.C. Canada.

Bartoo, Norman, David Holts and Cheryl Brown. Evidence of Interactions Between High Seas Driftnet Fisheries and the North American Troll Fishery for Albacore. International North Pacific Fisheries Commission Bulletin Number 53(III).

Pacific Fishery Management Council (PFMC). 2007. Characterization of Recent U.S. North Pacific Albacore Commercial Fishing Effort Report and Analyses Prepared by NOAA Fisheries Southwest Fisheries Science Center and the Pacific Fishery Management Council's Highly Migratory Species Management Team. May 2007.

[8] Available at: http://isc.ac.affrc.go.jp/pdf/ISC10pdf/Annex_6_ISC10_ALBWG_Apr10.pdf