

Annual Report
Chinook Salmon Bycatch Reduction
Incentive Plan

2011

NMFS IPA No. __CP IPA__

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April 1, 2012

Introduction

Amendment 91 to the Bering Sea and Aleutian Islands Groundfish Fishery Management Plan (BSAI FMP) limits Chinook salmon bycatch in the eastern Bering Sea (EBS) pollock fishery. The rules and regulations implementing Amendment 91 came into force at the start of the 2011 fishery. Amendment 91 is an innovative approach to managing Chinook salmon bycatch in that it combines a prohibited species catch (PSC) limit on the amount of Chinook salmon that may be caught incidentally by the fishery with an incentive plan agreement (IPA) and performance-standard requirement designed to minimize bycatch to the extent practicable in all years. The approach is designed to motivate fishery participants to avoid Chinook salmon bycatch at the individual vessel level under any condition of pollock and Chinook abundance in all years. The vessel-level incentives are created through contracts among the fishery participants.

The Chinook Salmon Bycatch Reduction Incentive Plan (CP IPA) reported on here is designed to provide the incentives necessary to accomplish the goals and objectives of Amendment 91. The plan builds on experience gained in the development and refinement of time-and-area-based, rolling “hot-spot” avoidance programs. The plan creates incentives to avoid salmon bycatch by restricting the pollock fishing opportunities of vessels with poor Chinook bycatch performance while allowing vessels with good performance less restricted access to the fishing grounds. Losing access to good pollock fishing increases vessel operating costs and reduces product values. Avoiding grounds restrictions reduces operating costs and allows for the production of more high-value products (especially during the A-season), thus increasing profits.

The incentive plan is designed to work in concert with the annual Chinook salmon PSC limits specified in Amendment 91. The limits depend on whether the fishery participants develop IPAs. If IPAs are developed, then the annual limit is 60,000 Chinook during any two-out-of-seven years, and 47,591 Chinook in other years. During 2011 all pollock vessels participated in an IPA and the catcher-processor (CP) sector IPA participants included vessels harvesting the American Fisheries Act (AFA) CP Sector and Alaska Community Development Quota (CDQ) pollock allocations. For the CP sector, the Chinook quota was 13,516 fish and the pollock quota was 36 percent of the non-CDQ directed fishing allocation. For the CDQ sector, the Chinook quota was 3,883 fish and the pollock quota was 10 percent of the annual directed fishing allocation. These pollock and Chinook quotas were further allocated among the seasons and the participating vessels. Table 1 shows the CP IPA 2011 “day-one” allocations of pollock and Chinook salmon PSC quota.

Primary IPA components include: (1) data gathering, monitoring, reporting, and information sharing; (2) identification of bycatch avoidance areas (BAA); and (3) fishing-area prohibitions for vessels with poor bycatch performance. Additional components include: (1) an A-season closed area of approximately 755 square nautical miles on the northern flank of the Bering Canyon; and (2) a set of conditional, B-season closed areas of approximately 1,295 square miles along the outermost EBS shelf. Vessels are prohibited from fishing in the B-season areas beginning on October 15th and

continuing through to the end of the season during those years when the aggregate bycatch of all plan vessels during the month of September exceeds a preset threshold.

Table 1. CP IPA Day-One Allocations of Pollock and Chinook Salmon, 2011.

| Vessel | Pollock (tons) | Chinook Salmon (n) |
|--------------------|-------------------|-----------------------|
| American Dynasty | 41,737 | 1,318 |
| American Triumph | 41,737 | 1,318 |
| Northern Eagle | 41,737 | 1,318 |
| Northern Jaeger | 41,737 | 1,318 |
| Ocean Rover | 41,737 | 1,317 |
| Arctic Fjord | 44,766 | 1,205 |
| Arctic Storm | 38,433 | 1,271 |
| Northern Hawk | 59,316 | 1,378 |
| Alaska Ocean | 48,260 | 1,432 |
| Pacific Glacier | 47,745 | 1,433 |
| Starbound | 41,498 | 1,259 |
| Island Enterprise | 26,250 | 772 |
| Kodiak Enterprise | 26,250 | 772 |
| Seattle Enterprise | 26,250 | 772 |
| Ocean Peace | 1,327 | 66 |
| Northern Glacier | 515 | 3 |
| Allocation Buffer | 0 | 447 |
| Total Allocation | 569,295 | 17,399 |

Incentive Measures

One of the most practical and direct methods to create incentives to avoid Chinook salmon bycatch is to limit the pollock fishing opportunities of a vessel when bycatch performance is poor. This simple approach works especially well for catcher-processors because efficient processing requires an uninterrupted flow of fish, and this can be achieved most reliably with unrestricted access to the grounds. Because experience has shown that high, local concentrations of pollock may often be found where concentrations of Chinook are also high (the vessels can “see” the pollock but not the Chinook), limiting access to local areas of relatively high Chinook bycatch is an efficient way to create a financial incentive to avoid Chinook salmon bycatch. The reason for this is that losing access to good pollock fishing grounds increases vessel operating costs and reduces the amount of products that can be produced during a day of fishing. A vessel that retains nearly unrestricted access to good pollock fishing

opportunities avoids costs associated with moving and finding pollock in other areas, and so the vessel can produce more products each day.

About a decade of industry experience has shown that the most efficient way to reduce salmon bycatch to the maximum extent practicable is to focus incentive programs on those areas where Chinook salmon bycatch is highest when compared to the amount of pollock harvested. To accomplish this, vessel performance benchmarks are calculated in a way that reflects the amount of pollock harvested. The first step in creating a program to avoid Chinook bycatch is to employ data gathering, reporting, and information sharing to identify local areas of relatively high Chinook abundance on the pollock grounds. Pollock catch and Chinook bycatch records from all fishery participants are gathered, compiled, and evaluated each week during which an IPA vessel catches pollock. In this analysis, areas of relatively high Chinook bycatch are identified (bycatch avoidance areas; BAA). Should vessels continue to fish in these areas, high Chinook bycatch is likely to occur because local concentrations of Chinook routinely persist in time and space for several weeks.

An important component the evaluation of potential BAA is the generation of a useful grounds-wide index of salmon abundance. This “baseline” index of relative salmon abundance on the grounds over time is called the base rate. More information about the methods used to identify the base rate is in the IPA agreement (available at: www.fakr.noaa.gov/sustainablefisheries/bycatch/salmon/chinook/ipa/chinook_salm_on_ipa_2010.pdf). The base rate also takes into consideration the amount pollock harvested.

To establish and maintain incentives to avoid Chinook bycatch under any condition of pollock and Chinook salmon abundance, the bycatch performance of the IPA vessels is measured both currently (most recent two weeks) and cumulatively (over the entire fishing season). To evaluate current performance, vessel performance is measured during the prior two weeks and compared to a standard that represents better-than-average performance. The measure of current vessel bycatch performance is called the vessel bycatch ratio. The bycatch ratio is calculated by dividing the number of Chinook caught incidentally by the vessel during the prior two weeks by the metric tons of pollock caught by the vessel during the prior two weeks. A two week period is used because experience has shown that day-to-day vessel bycatch performance is influenced by random factors associated with changes in weather, winds, water temperatures, and currents, and measuring performance over a two-week period “dampens” the effects of these random influences. This increases the usefulness of the measure in the creation of an incentive for the individual vessel to avoid bycatch.

If the current bycatch performance of an IPA vessel is not better than average, then the vessel is prohibited from fishing in the BAA for a week. Because the base rate is calculated by aggregating pollock catch and bycatch data from all vessels fishing for pollock, the base rate provides a measure of the average bycatch performance of the vessels fishing for pollock. The plan establishes the better-than-average-performance standard at 75 percent of the base rate. So every plan vessel with current bycatch performance higher than 75 percent of the base rate is prohibited from fishing within the BAA for seven days (i.e., the following week). If during the following week the current bycatch performance of a vessel operating under a fishing prohibition remains

higher than 75 percent of the base rate, then the vessel is prohibited again from fishing in the bycatch avoidance areas for an additional seven days. A seven-day fishing prohibition is called a weekly fishing prohibition.

The cumulative bycatch performance of a vessel is measured as the total amount (number) of Chinook salmon bycatch by the vessel during the fishing year relative to the pollock allocation assigned to that vessel (Table 1 shows the day-one" assignments for 2011). So the measure of cumulative vessel performance accumulates from the first day of fishing through to the last. Vessel cumulative bycatch performance is evaluated against a standard designed to magnify the incentive to avoid salmon bycatch during years when the baseline abundance of Chinook is medium and high. Based on analysis of more than a decade of CP catch records, an annual bycatch of 8,500 Chinook indicates a year when Chinook abundance on the grounds traditionally fished by CP vessels is at a medium level.

Cumulative bycatch performance is evaluated only for those vessels that receive a weekly fishing prohibition. For these vessels, if the cumulative Chinook bycatch rate is higher than the medium-abundance standard, then the vessel is prohibited from fishing in the BAA for two weeks. This standard is called the vessel cumulative amount, and a fourteen-day fishing prohibition is called an extended fishing prohibition. If vessel Chinook bycatch is greater than its cumulative amount, then it is subject to the extended fishing prohibition. Additional information about how the vessel cumulative amount is determined is in the IPA agreement.

Chinook Salmon Conservation Areas

Chinook salmon feeding migrations produce concentrations of Chinook in discrete, local areas along the EBS outer continental shelf, and many of these areas are well known to pollock fishermen. The areas are known to pollock fishermen because more often than not high concentrations of pollock are found in the areas. However, the precise times during which pollock and Chinook may be concentrated in any local area depends on a host of environmental and physical-oceanographic conditions that change with the seasons and the weather, such that it is not generally possible to know precisely where and when pollock and Chinook are concentrated together before going fishing for pollock.

Analysis of catch records over a decade or more has revealed the existence of one area along the outer continental shelf within which it seems that high concentrations of Chinook salmon exist almost every year during the winter fishery. Based on this analysis, an A-season fishing prohibition within an approximately 735 square mile area is included in the plan as a means to reduce bycatch. The area is called the A-season Chinook Salmon Conservation Area (CSCA).

Analysis of B season catch records over two decades shows that when migrating Chinook arrive on the outer continental shelf in sufficient numbers during September, the odds that high concentrations of Chinook will be encountered by the fishery in October appear to increase. To create an incentive to reduce bycatch during the latter portion of the B-season, the CP IPA includes "triggered" fishing prohibition for three

areas of approximately 1,295 square miles along the outermost shelf. These areas are called the B-season Chinook Salmon Conservation Area. To implement the incentive, all vessels are prohibited from fishing in the areas beginning on October 15th and continuing through to the end of the season during those years when the aggregate bycatch rate for all vessels during the month of September exceeds 0.015 Chinook per metric ton of pollock harvest (n/t; hereafter metric tons are referred to simply as tons). Maps of these Chinook Salmon Conservation Areas and the latitude and longitude coordinates of their boundaries are provided in the IPA agreement. The CP IPA also specifies the penalties levied on a vessel for violating a BAA prohibition or fishing in a CSCA when fishing there is prohibited. These penalties are \$10,000 for the first annual violation, \$15,000 for a second annual violation, and \$20,000 for a third and each subsequent violation during a year, with every trawl inside a prohibited area considered a separate violation.

Effects of Incentive Measures on Individual Vessels

This annual report provides a qualitative evaluation and some quantitative information on the effectiveness of the plan. The CP IPA incentive program is largely an area-based program, and this evaluation relies heavily on spatial analysis of pollock trawl locations as well as the bycatch performance of the individual vessels. To begin an assessment of the IPA incentives on the individual vessels, the aggregate performance of the vessels in the 2011 fishery is tabulated and compared to performance during prior years. Table 2 shows the aggregate bycatch performance of CP IPA vessels during 2011.

Comparing years since just before the implementation of the AFA, Chinook salmon bycatch during 2011 is low, especially when adjusted for the size of the pollock catch. Since 1998, the number of bycatch Chinook is the fourth lowest, and only 25 percent higher than the lowest annual bycatch since then. After adjustment for the size of the pollock catch, the 2011 bycatch ratio is the second lowest over the time period, and just 15 percent above the lowest value (a difference of one salmon for every 1,000 tons of pollock catch).

Figure 1 shows how aggregate 2011 CP IPA Chinook bycatch performance compares with that of prior years. Since 1998 climate conditions over the EBS shelf and coastal Alaska are believed to have mainly determined the abundance of Chinook salmon on the pollock grounds, with the warm period during 2001 through 2005 believed to have increased both freshwater and marine survival. In 2011 the bycatch ratio remained at a very low level, continuing a slow downward trend that began in 2008.

Figure 2 shows how aggregate 2011 CP IPA chum bycatch performance compares with that of prior years. The pronounced effect of the warm-weather years on chum salmon survival is also apparent in the chum bycatch performance of the vessels. The bycatch ratios indicate that the abundance of chum salmon was likely higher in 2011 than during recent years. This is consistent with the summer of 2011 likely providing relatively favorable conditions for salmon on the EBS shelf, at least compared

to recent years, and these conditions probably persisted into the fall when concentrations of Chinook first moved onto the EBS shelf to feed.

Table 2. CP IPA Chinook Salmon Bycatch Performance, 2011.

| Season | Pollock (t) | Chinook Salmon (n) | Ratio (n/t) |
|--------|----------------|--------------------------|----------------|
| A | 224,209 | 2,236 | 0.010 |
| B | 316,296 | 1,986 | 0.006 |
| A + B | 540,505 | 4,222 | 0.008 |

Figure 1. Chinook Bycatch Ratios, EBS Pollock, 1998-2011.

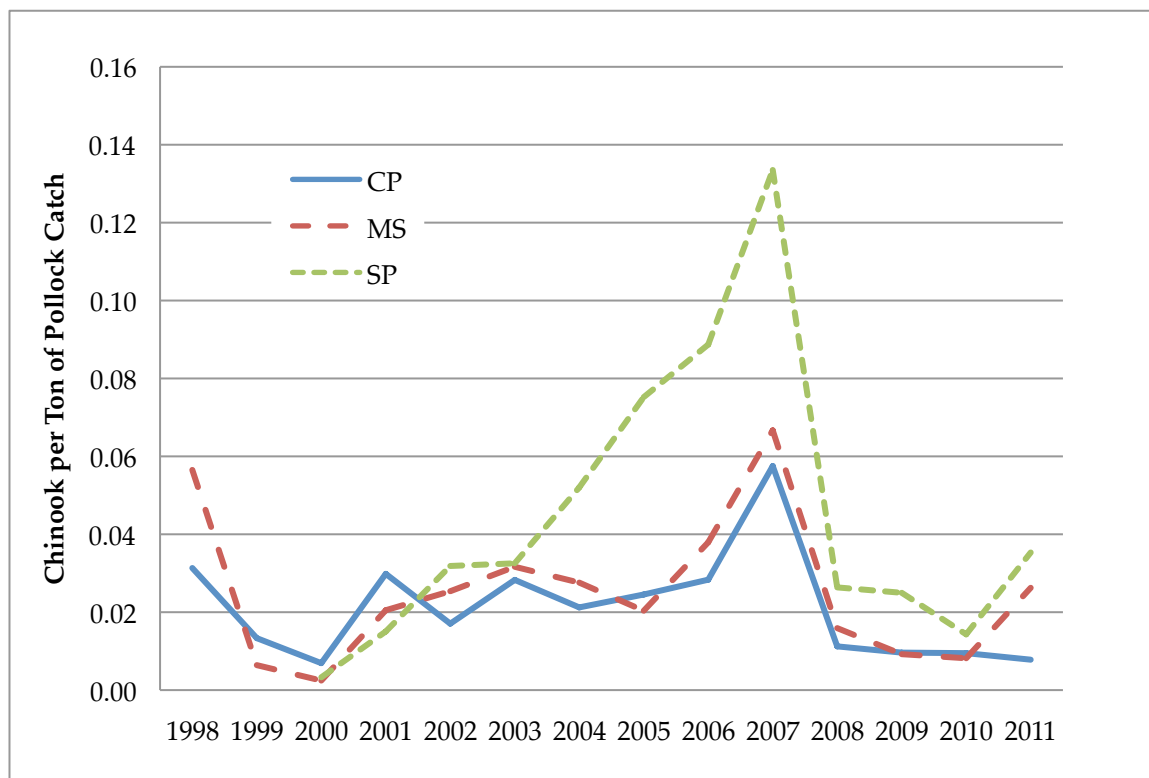


Figure 2. Chum Bycatch Ratios, EBS Pollock B-Season, 1998-2011.

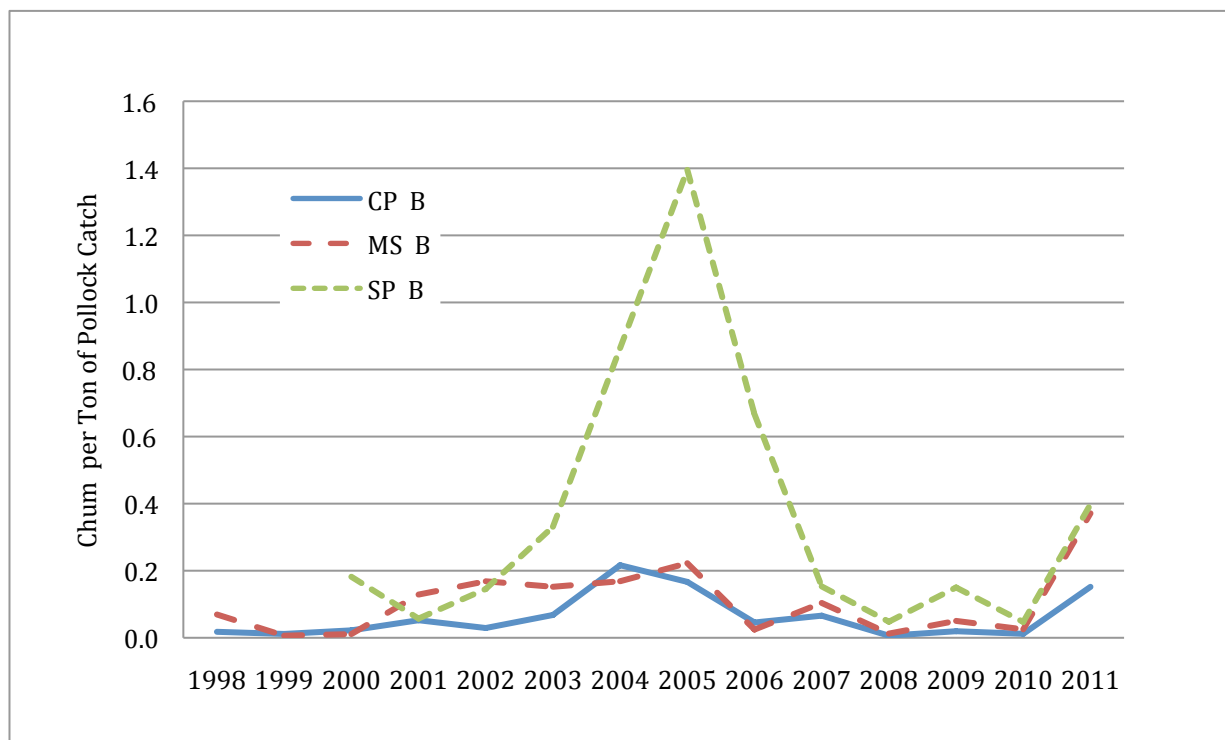


Figure 3 shows how the timing of 2011 IPA fishing activities compares with prior years. For the B-season, fishing spooled up very quickly at the start, but due to a combination of chum bycatch avoidance efforts and a grounds-wide reduction in pollock availability at the beginning of August, just about all of the vessels fished until the season ended. Despite this unusual pattern of effort, about 28,640 tons of pollock (about five percent of the annual quota) went uncaught.

Table 3 shows the Chinook salmon bycatch performance of the IPA vessels. Performance is shown by season because the Chinook bycatch environment is different during the A-and B-seasons. During the A-season, bycatch ratios are often double those of the B-season because when the season starts Chinook salmon are already feeding on the EBS shelf. As the season progresses, Chinook salmon migrate to basin waters, and abundance on the grounds generally reaches a low level by mid March. With the exception of one vessel, which did not catch very much pollock, vessel bycatch performance is tightly clustered around the A-season average ratio of 0.010 n/t.

During the B-season, and when fishing starts quickly, it is sometimes possible to almost complete fishing operations before Chinook salmon arrive on the shelf in the fall to feed. In other years they arrive earlier and great effort must be concentrated on limiting the bycatch. The weekly bycatch data shows that an initial wave of Chinook salmon arrived on the EBS outer continental shelf during the first week of September, and that a second wave arrived about the middle of October. The grounds-wide decrease in pollock availability that began during August persisted through to the end

of the season, and as a consequence, the risk of high pollock bycatch was significantly increased as just about all vessels were forced to fish through to the end of October.

Table 3 shows the range of vessel bycatch performance during the B-season. The data confirms that most vessels were very close to average performance. The exceptions are two vessels with double the average ratio and one at three times the average. The performance of these vessels was influenced most by a few high bycatch trawls near the end of the season. The main cause of this performance was the abrupt decrease in pollock availability during August and the subsequent requirement for most vessels to fish until the season ended. For one vessel (Northern Glacier), its only pollock fishing occurred late in October, and so the high ratio did not reflect many bycatch Chinook. In the latter case, the Northern Eagle obviously delivered the highest bycatch ratio, but the difference between its performance and average performance resulted in only 150 “additional” bycatch Chinook (the vessel did not catch a full share of B-season pollock).

The CP IPA agreement specifies that all fishing in the B-season CSCA is prohibited beginning on October 15th in those years when the bycatch performance for all plan vessels combined exceeds 0.015 n/t during the month of September. The IPA vessels caught 588 Chinook salmon and 59,189 tons of pollock in September, resulting in a bycatch ratio of 0.001 n/t. As such, the IPA vessels were not prohibited from fishing in the CSCA during the last two weeks of October.

Figure 3. Number of IPA Vessels in the Pollock Fishery by Week, 2000-2011.

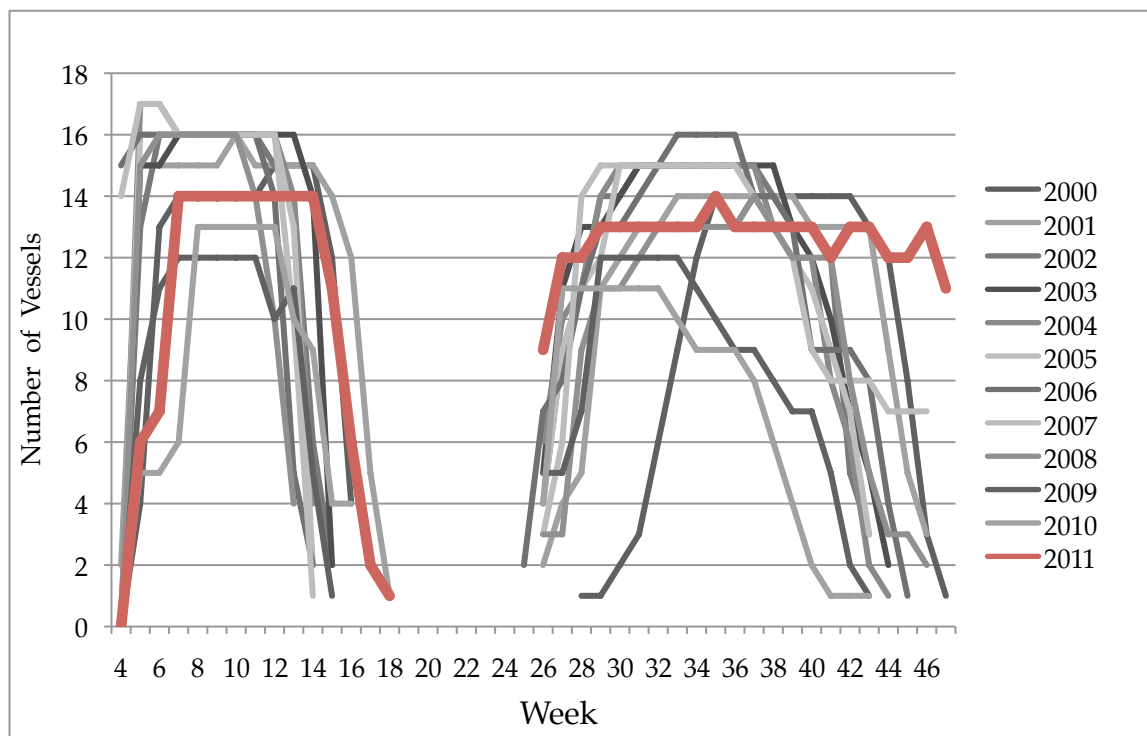


Table 3. CP IPA Pollock Catch and Chinook Bycatch Performance by Season and Vessel, 2011.

| Vessel | A-Season Pollock (t) | Chinook Salmon A (n) | B-Season Pollock (t) | Chinook Salmon B (n) | A-Season Ratio (n/t) | B-Season Ratio (n/t) |
|---------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| American Dynasty | 16,897 | 216 | 26,645 | 169 | 0.013 | 0.006 |
| American Triumph | 16,356 | 150 | 26,910 | 123 | 0.009 | 0.005 |
| Northern Eagle | 16,467 | 140 | 12,620 | 230 | 0.009 | 0.018 |
| Northern Jaeger | 16,032 | 90 | 23,799 | 154 | 0.006 | 0.006 |
| Ocean Rover | 16,660 | 127 | 24,922 | 98 | 0.008 | 0.004 |
| Arctic Fjord | 19,448 | 189 | 25,979 | 237 | 0.010 | 0.009 |
| Arctic Storm | 14,088 | 122 | 23,681 | 30 | 0.009 | 0.001 |
| Northern Hawk | 21,664 | 170 | 26,446 | 150 | 0.008 | 0.006 |
| Alaska Ocean | 22,290 | 255 | 29,799 | 149 | 0.011 | 0.005 |
| Northern Glacier | 485 | 22 | 1,446 | 16 | 0.045 | 0.011 |
| Pacific Glacier | 15,857 | 128 | 24,713 | 101 | 0.008 | 0.004 |
| Starbound | 14,454 | 185 | 22,249 | 147 | 0.013 | 0.007 |
| Island Enterprise | 11,105 | 143 | 21,023 | 184 | 0.013 | 0.009 |
| Kodiak Enterprise | 11,154 | 153 | 16,204 | 187 | 0.014 | 0.012 |
| Seattle Enterprise | 11,253 | 146 | 9,860 | 11 | 0.013 | 0.001 |
| Ocean Peace | 0 | 0 | 0 | 0 | | |
| Forum Star | 0 | 0 | 0 | 0 | | |
| American Challenger | 0 | 0 | 0 | 0 | | |
| Ocean Harvester | 0 | 0 | 0 | 0 | | |
| Tracy Anne | 0 | 0 | 0 | 0 | | |
| Neahkanie | 0 | 0 | 0 | 0 | | |
| Sea Storm | 0 | 0 | 0 | 0 | | |
| Muir Milach | 0 | 0 | 0 | 0 | Weighted Average | Weighted Average |
| Total | 224,209 | 2,236 | 316,296 | 1,986 | 0.010 | 0.006 |

A-Season Fishery Details

The A-season fishery began on January 20th with vessels fishing along the 50 fathom curve to the east of 170° West longitude and well away from the shelf margin (100 fathom curve). All vessels experienced good daily catch rates with little Chinook bycatch and few tows with ratios higher than 0.075 n/t.¹ The incentive plan mandates that a short period at the beginning of each season be used to gather and evaluate catch and bycatch information and to assess the baseline abundance of Chinook on the grounds. The A-season period extends from January 20th to February 14th, and during this period the base rate is set at 0.040 n/t. The initial vessel performance evaluation was made on February 3rd (using the start-up base rate), and no BAA were identified. The average bycatch ratio (cumulative) through February 3rd was 0.015 n/t and the performance benchmark was 0.030 n/t. At this time a new, fishery-wide Chinook bycatch data sharing agreement was still being negotiated, and the technical representative could not use bycatch information from shore-plant catcher-vessels to identify BAA.

Figure 4 shows vessel trawl locations during the week following the first evaluation. At this time a portion of IPA vessels moved fishing operations to the northwest, within a 50-60 fathom depth band away from the shelf margin. The figure shows a half dozen trawl locations with moderate Chinook bycatch ratios (yellow stars) in depths close to 80 fathoms by vessels fishing to the south. Despite continuing, low average bycatch performance, these trawls resulted in the identification of the first BAA of the season. Figure 5 shows the BAA and the trawl locations from the performance evaluation of February 10th, with one vessel prohibited from fishing in the BAA. The trawl locations during February 12-18 confirm that vessels which had been fishing in the vicinity of the BAA moved to shallower grounds.

The performance evaluation sent to the vessels on February 17th shows two BAA in the same local area. These BAA were identified from a combination of IPA vessel and mothership catcher-vessel trawls, and two vessels were prohibited from fishing in the BAA. At this time the start-up period was complete and the base rate was recalculated using IPA and mothership catcher-vessel bycatch performance over the first three weeks of the season. This change reduced the base rate to 0.035 n/t and the vessel bycatch performance benchmark to 0.026 n/t. IPA vessel average bycatch ratio (cumulative) through February 17th was 0.015 n/t.

¹ A rule of thumb for quick appraisal of vessel annual bycatch performance is the 0.050 n/t benchmark (one salmon in every 20 tons of pollock). When Chinook salmon is relatively abundant on the pollock grounds, it is a significant challenge for vessels to remain under this standard (given experience and technology). The figure legend breakpoints correspond to the 0.05 n/t benchmark as per the equation $(0.40 \times 0.075) + (0.60 \times 0.035) = 0.05$. The breakpoints in the A-season figure legends are twice those of the B-season.

Figure 4. Vessel Trawl Locations and Bycatch Performance, February 5-11, 2011.

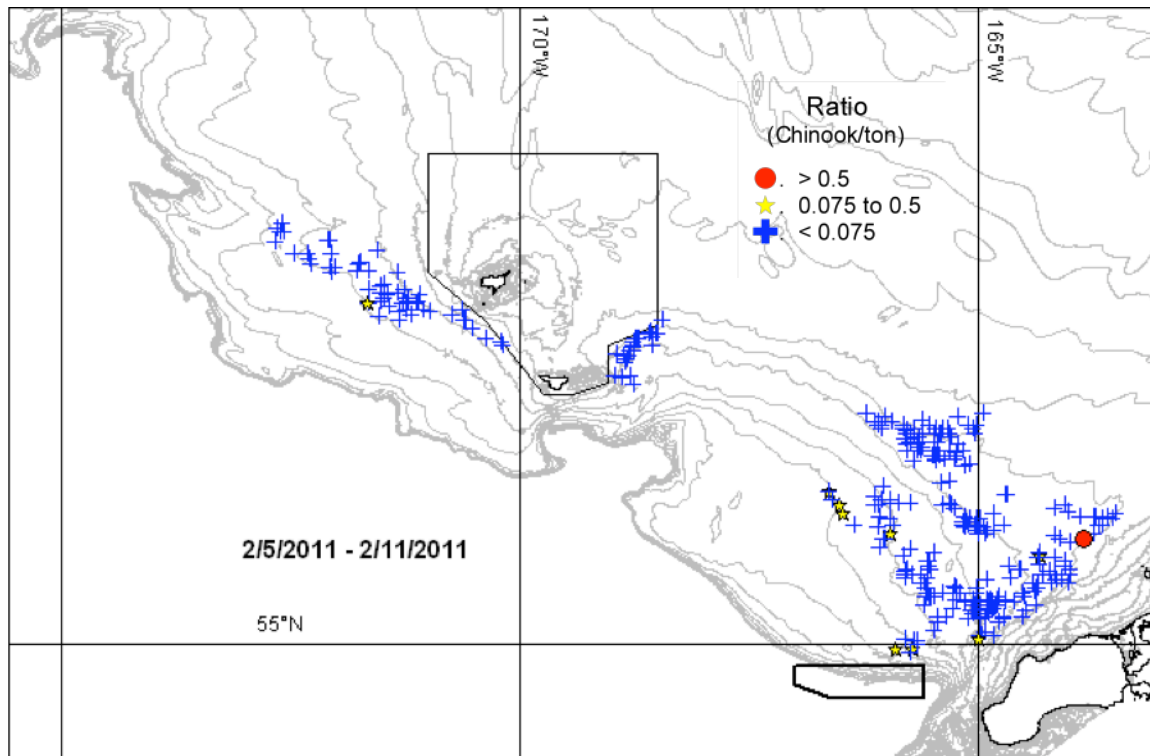
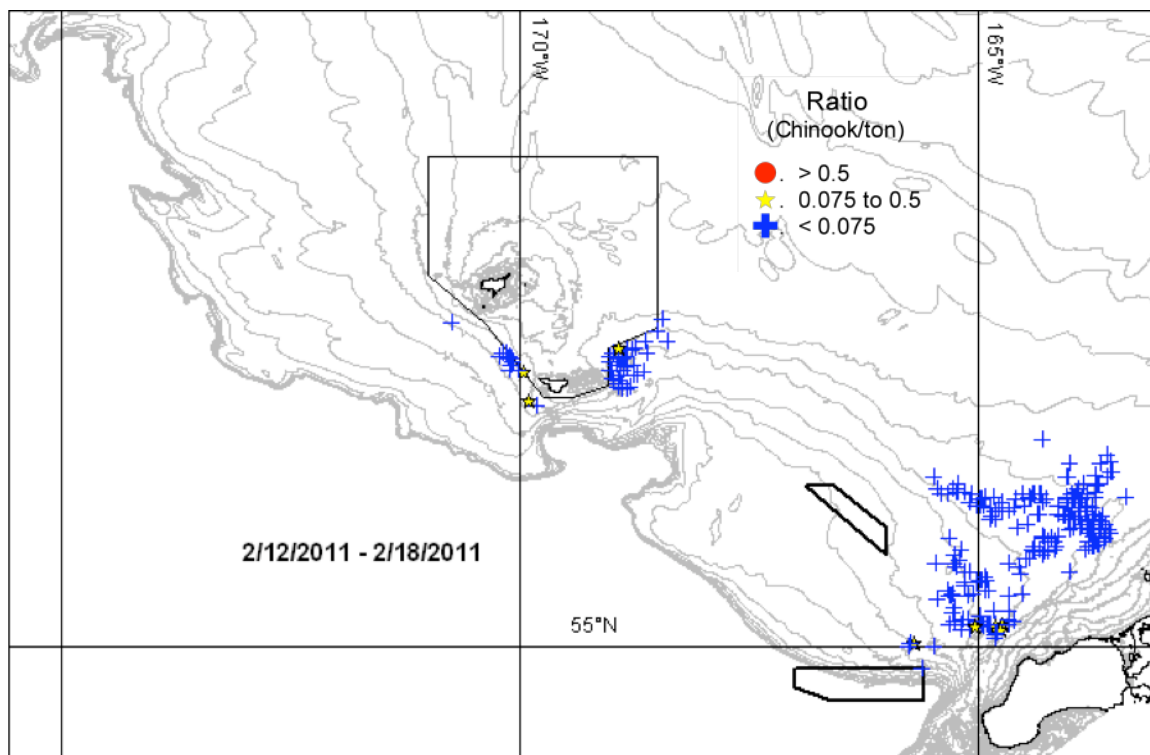


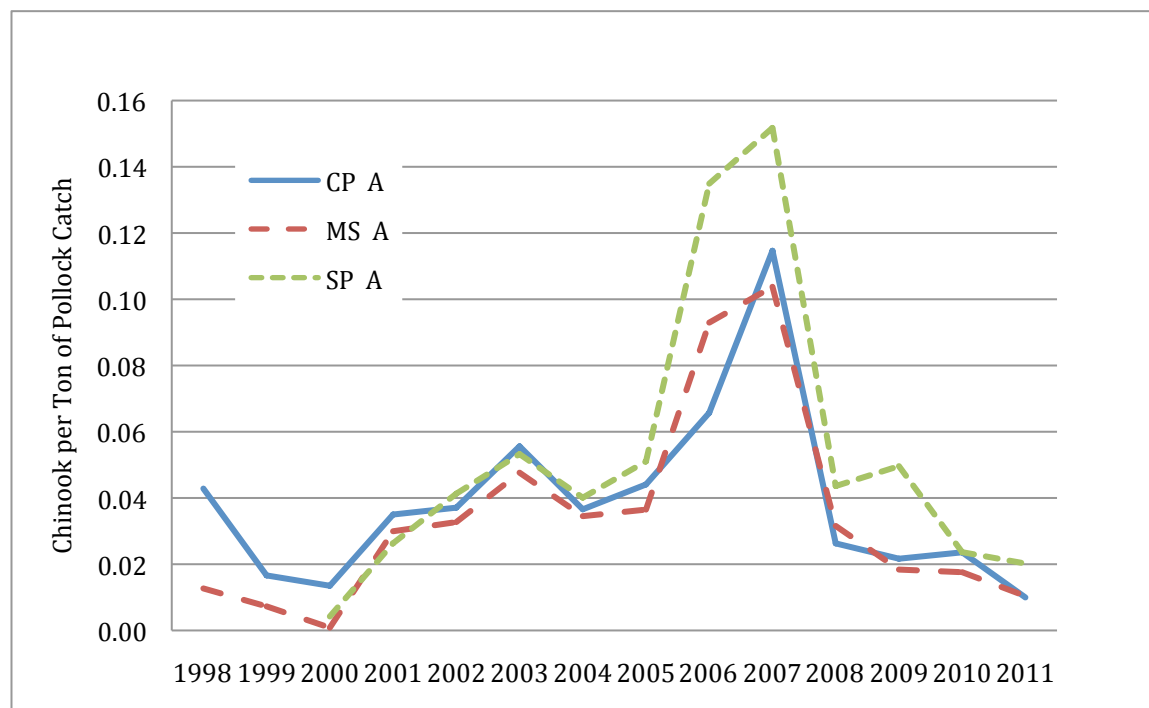
Figure 5. Vessel Trawl Locations and Bycatch Performance, February 12-18, 2011.



The performance evaluation sent to the vessels on February 24th was the first that could identify BAA using fishery-wide bycatch performance (the new Chinook data-sharing agreement was in place). The report shows high bycatch ratios in several areas from a combination of shore-plant and mothership catcher-vessel trawls, but all IPA vessels were below the performance benchmark. During the last week of February and through to the end of March IPA vessels located most fishing on grounds west of 170° West longitude and very few Chinook showed up as bycatch. At the beginning of March Chinook abundance on the grounds appeared to decrease, with high concentrations remaining only in the Bering Canyon (shore-plant catcher-vessel bycatch routinely identified BAA adjacent to the CSCA during March). The IPA vessels completed their A-season fishery during the first two weeks of April, again with very few bycatch Chinook. A final performance evaluation on April 14th showed a cumulative vessel average bycatch ratio of 0.010 n/t.

Figure 6 shows A-season bycatch ratios from 1998 through 2011. Despite what is believed to have been a similar level of Chinook abundance on the pollock grounds as during 2008-2010, the IPA vessels managed to achieve relatively low Chinook bycatch during 2011 A-season and so continued a trend of good bycatch performance that began in 2008.

Figure 6. Chinook Bycatch Ratios, EBS Pollock A-Season, 1998-2011.



B-Season Fishery Details

As Figure 3 shows, most IPA vessels were on the grounds as the B-season opened. The B-season data-gathering period extends from June 10th to July 14th, and during this period the base rate is set at 0.035 n/t. The initial vessel performance evaluation was made on July 14th using the start-up base rate and no BAA were identified. Pollock daily catch rates were good from the season start through to the end of July with virtually all fishing west of 170° West longitude. Very few concentrations of Chinook were encountered and no BAA were identified. During the second week of August the vessels experienced what many vessel masters characterized as a “never-before-seen,” abrupt change in pollock availability. Figure 7 shows trawl locations for the IPA vessels during the first week of August, which was the last time the vessels were observed fishing on a substantial aggregation of pollock. The figure also shows a chum-salmon BAA over a large portion of the grounds above the Bering Canyon.

Figure 8 shows a pattern that characterized fishing after the abrupt change in pollock distribution. For the remainder of August the vessels encountered very few Chinook, fishing operations remained west of 170° West longitude, and no BAA were identified (again a chum-salmon BAA is shown in the figure). The September 1st evaluation showed a B-season cumulative average bycatch ratio of 0.001 n/t. However, just after the beginning of September it became evident that an initial wave of Chinook salmon had begun to feed along the shelf margin. At this time most IPA vessels moved fishing to shallower water to limit bycatch, locating most fishing in 50-80 fathom depth bands to the east of Pervents Canyon.

The September 22nd bycatch report was the first B-season report that included a BAA. It was over deep water in the Bering Canyon and affected the CDQ fishing operations of one vessel. By this time the cumulative average bycatch ratio had increased to 0.003 n/t (three bycatch Chinook for every 1,000 tons of pollock catch). During the last week of September the vessels moved most fishing to the southeast, with virtually all fishing taking place east of 170° West longitude by the end of September. The September 29th report again identified a BAA over deep water in the Bering Canyon, and again the CDQ fishing operations of one vessel were affected (same vessel).

During the middle of October a second wave of Chinook arrived and the number of trawls with bycatch ratio greater than 0.035 n/t increased noticeably. The second wave is typically made up of more numerous, smaller (younger) Chinook. In response one IPA vessel made a 500 nautical mile round-trip to evaluate fishing conditions between the Pribilof Islands and the US-Russia convention line. Most of these trawls showed bycatch ratios greater than 0.035 n/t and no IPA vessels moved fishing operations back to the northwest. During most of October IPA vessels fished in the vicinity of the Pribilof Islands (performance reports for the last three weeks of the season showed advisory BAA in the Bering Canyon).

Figure 7. Vessel Trawl Locations and Bycatch Performance, July 30 - Aug. 5, 2011.

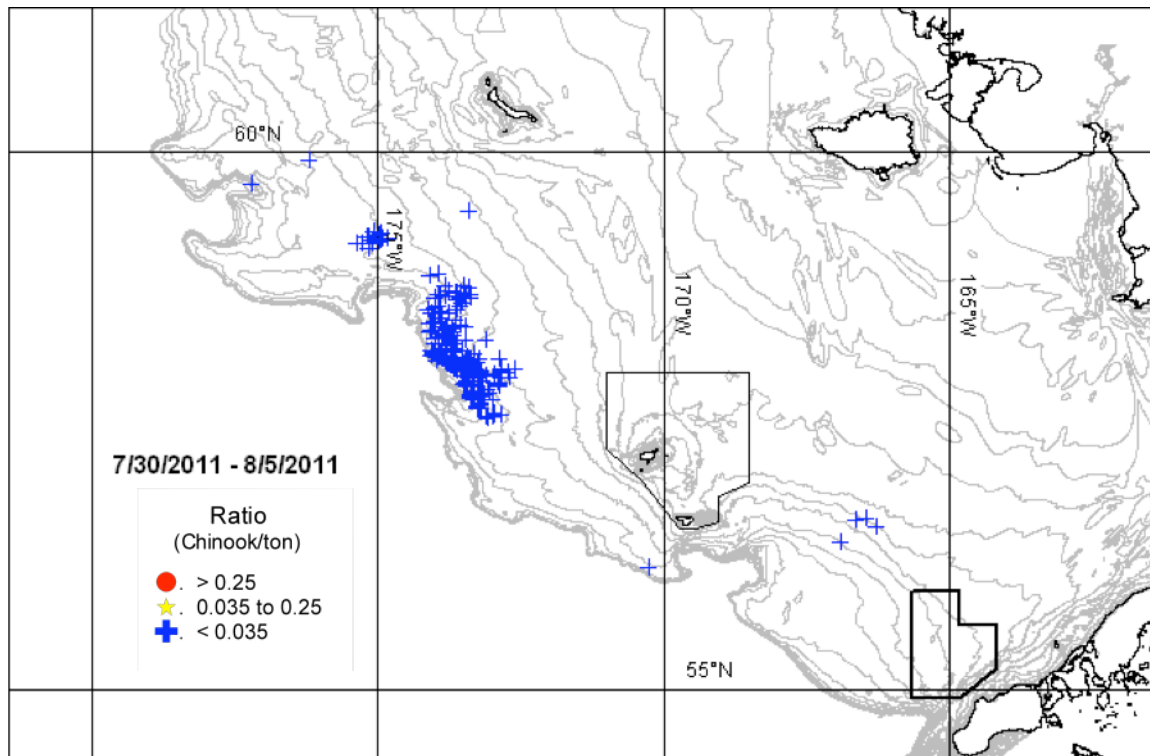
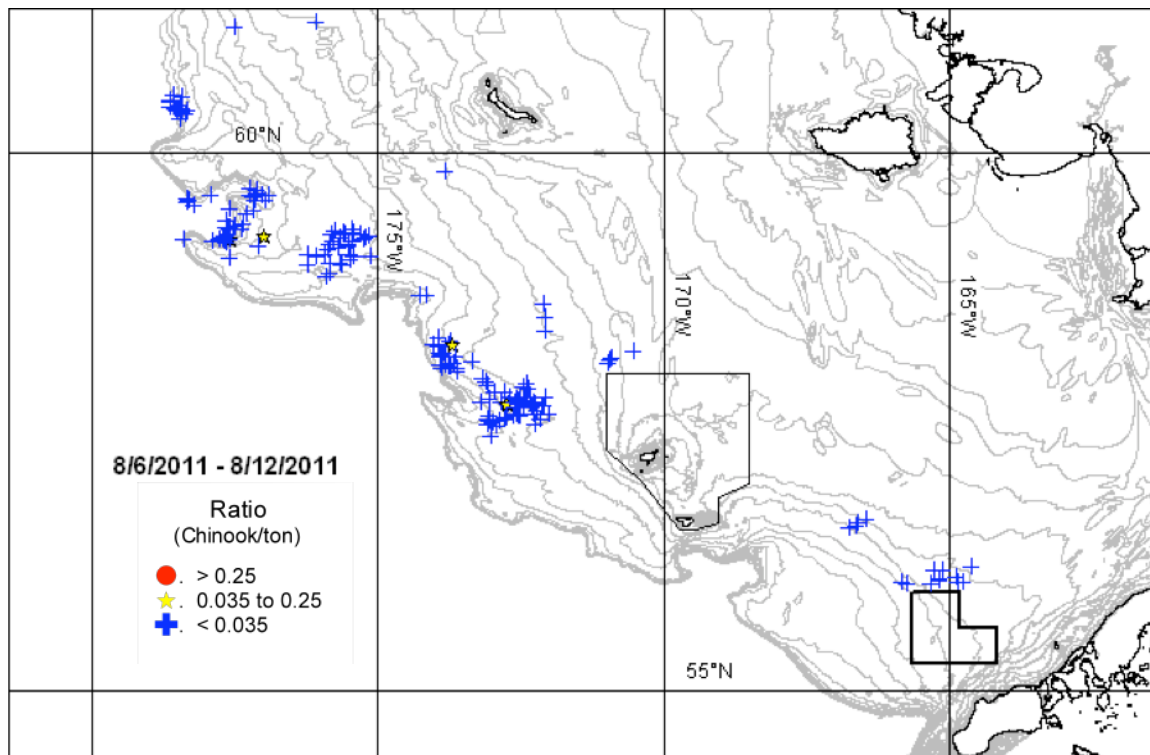


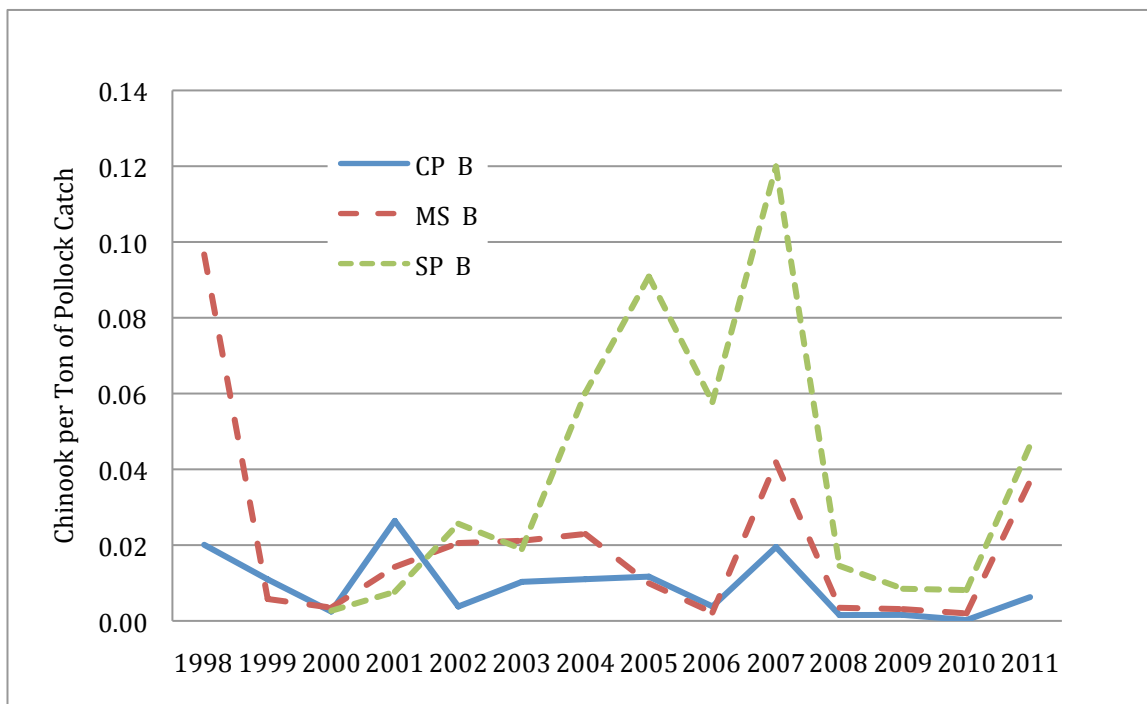
Figure 8. Vessel Trawl Locations and Bycatch Performance, August 6-12, 2011.



The final B-season report was distributed to the vessels on October 20th and showed the IPA vessels with a cumulative average bycatch ratio of 0.007 n/t. This ratio was one-third lower than for the mother-ship catcher vessels and just one-fourth as high as for shore-plant catcher-vessels.

Figure 9 shows Chinook bycatch ratios for the pollock fishery during the 1998-2011 B-seasons. The data shows that the unexpected, abrupt change in pollock abundance during the 2011 B-season resulted in a relatively adverse Chinook bycatch environment, at least when compared to recent years. Most IPA vessels fished for two weeks after the second wave of Chinook arrived, a period when Chinook abundance in local areas can reach high levels. IPA vessels responded to these conditions by fishing shallower grounds somewhat removed from the outer shelf, especially when concentrations of Chinook were believed present. After the pollock dispersed, the IPA vessels continued fishing on grounds to the northwest, and then, in what appeared to be a search for more favorable bycatch conditions, conducted a wholesale movement of fishing to grounds just east of 170° West longitude. The IPA vessels remained in this local area until the season closed, passing up good CDQ pollock fishing near the Bering Canyon because bycatch reports showed BAA and advisory BAA there.

Figure 9. Chinook Bycatch Ratios, EBS Pollock B-Season, 1998-2011.



Chinook Salmon Savings

The CP IPA is a time-and-area-based program that prohibits fishing in areas with high concentrations of Chinook salmon when compared to the abundance of pollock. Because performance benchmarks are calculated for each vessel individually, the program generates incentives to avoid Chinook bycatch for the individual vessel. This simple approach works especially well for CP vessels because efficient processing requires an uninterrupted flow of fish, and this can be achieved most reliably with unrestricted access to the grounds. Because CP vessels fully integrate catching and processing activities, the benefit of unrestricted access to good pollock fishing grounds includes economic profits that reflect both catching value and processing value. This obvious difference in operational structure is believed to play an outsized role in motivating the IPA vessels to avoid potentially significant risks to both catching and processing value from unexpected, repeated episodes of high Chinook bycatch. This economic motivation remains even when bycatch is anticipated to remain below the annual limit.¹

A close examination of the trawl locations in space and time, their bycatch ratios, and the bycatch performance of all of the IPA vessels shows clearly that the vessels changed their fishing strategy to avoid Chinook bycatch. The most salient feature of this changed approach was for vessels to locate initial fishing operations away from the outer margins of the shelf. Depending on the locations of pollock concentrations, any profitable movement of fishing to deeper water was accomplished via a deliberate, slow, and cautious progression while maintaining awareness of information about Chinook concentrations within the area. Evidence of local Chinook concentrations generally caused vessels fishing in deep water to move fishing to more shallow grounds. This behavior occurred in multiple areas when trawl bycatch ratios showed high concentrations of salmon, as, e.g., when a wave of Chinook salmon moved into a local area to feed.

Close tracking of the trawl locations and their bycatch ratios shows that Chinook bycatch would have been higher had IPA vessels not moved fishing when bycatch ratios showed concentrations of Chinook. Combining the trawl locations, their bycatch ratios, and the locations of both BAA and advisory BAA within the same week also shows that IPA vessels located very few trawls along the edges of the BAA, and in those few cases where trawls approached the edge of a BAA, very little Chinook bycatch was recorded.

Another way to look at bycatch performance is to make an evaluation using statistics. In this case, the statistics describe the distribution of the vessel bycatch ratios (relative performance). The hypothesis is that the current, Amendment 91-compliant

¹ A mothership and its catcher-vessels also integrate catching and processing activities, but the incentives in the mothership catcher-vessel IPA do not extend all the way down to the individual vessel.

IPA program creates a more uniform incentive to avoid Chinook salmon bycatch among the individual vessels. In the prior program, the bycatch performance of a cooperative vessel group was evaluated against a performance benchmark, and under some circumstances, incentives to avoid bycatch weakened for an individual vessel. With a more uniform incentive, the distribution of vessel bycatch performance is expected to narrow, reflecting more uniform vessel performance.

The standard deviation of a distribution provides information about data dispersion. A low standard deviation indicates that the data points tend to be very close to the mean, whereas high standard deviation indicates that the data points are spread out over a large range of values. To interpret this statistic, it is believed that stronger, more uniform incentives for the individual vessel would reduce the “variability” of the observations. In this case, the standard deviation would be lower.

Skewness is another out-come statistic that may provide some perspective on incentive changes. Skewness is a measure of the asymmetry of the distribution of a random variable, and can be positive or negative. Negative skew indicates that the tail on the left side of the distribution is longer than the right side; a positive skew indicates that the right-side tail is longer than the left. A zero value indicates that the values are relatively evenly distributed on both sides of the mean, usually implying a symmetric distribution. To interpret this statistic, it is believed that stronger incentives for the individual vessel would reduce the likelihood of poor-performance outliers, thus increasing the symmetry of the distribution.

Table 4 shows features of the IPA vessel Chinook bycatch performance distribution during the 2008-2011 A-seasons. Salient changes in the distribution features for 2011 coincide with the implementation of the Amendment 91 CP IPA. Analysis of the IPA vessel data 2008-2011 seems to indicate approximately similar Chinook abundance on the grounds. A similar comparison of B-season performance was not considered useful, as the bycatch environment was significantly tougher in 2011 than during any of the previous three B-seasons (total IPA vessel bycatch for the 2008-2010 B-seasons combined is 797 Chinook). That a large change in bycatch conditions occurred during the same year that the Amendment 91 program was implemented makes it more difficult to measure the separate effect of the incentive change.

The IPA vessel pollock catch also changed during 2008-2011, ranging from a low of 140,000 tons in 2009 to a high of 224,000 tons in 2011. However, the influence of a larger pollock quota on the strength of the individual vessel incentive to avoid Chinook bycatch is a matter of opinion. The “experimental” conditions that did occur provide data consistent with a more uniform distribution of IPA vessel bycatch performance during the 2011 A-season. A skew of zero indicates that there were no poor-performance outliers in the distribution (no right-hand tail). The distribution coefficient of variation, which is a normalized measure of dispersion (standard deviation corrected for scale), is reduced by roughly half under the Amendment 91 program as compared to the 2008-2010 A-seasons.

Table 4. IPA Vessel A-season Bycatch Performance Distribution Features, 2008-2011.

| Year | N (vessels) | Mean Ratio (n/t) | Standard Deviation (n/t) | Skewness | Coefficient of Variation |
|------|----------------|------------------------|--------------------------------|----------|-----------------------------|
| 2008 | 16 | 0.026 | 0.013 | 0.2 | 0.49 |
| 2009 | 12 | 0.022 | 0.011 | 0.7 | 0.49 |
| 2010 | 13 | 0.025 | 0.011 | 0.8 | 0.43 |
| 2011 | 14 | 0.010 | 0.003 | 0.0 | 0.25 |

The 2011 year was the first for the CP IPA program. The program identified relatively few BAA during both seasons, and most were selected based on the bycatch performance at shore-plant and mothership catcher-vessel fishing locations. Nevertheless, the 2011 bycatch performance of the IPA vessels is just about the best recorded since 1998, and this period includes the salmon “crisis” years during which Chinook abundance on the grounds was low. The analyses carried out to assess the effectiveness of the CP IPA leaves an impression that the vessels relied on spatial, temporal, and bycatch performance data from a large number of individual pollock trawls to guide a cautious adaptation to the new program. The changed fishing strategy that resulted perhaps limited the number of BAA identified during 2011.

IPA Amendments

There were no amendments to the CP IPA during 2011.

Salmon Bycatch Research

The EBS pollock industry has supported research to reduce salmon bycatch for about ten years. During 2011 support was provided for research to improve the genetic baseline used to identify the stock of origin of chum salmon, and for efforts to develop a trawl-net section designed to reduce salmon bycatch. The design of the trawl-net section allows salmon caught by the trawl to swim free before the net is hauled back. A pelagic pollock trawl with the section installed is a salmon-excluder trawl.

Most but not all excluder-trawl development has been supported by the North Pacific Fishery Research Foundation via the development and execution of exempted fishing permits (EFP). The current EFP allows research to proceed during the 2011 and 2012 pollock seasons. A final report on these activities will be provided after the completion of the research planned for the 2012 A- and B-seasons.

EFP activities during 2011 focused on measuring chum-salmon escapement using the excluder-trawl design developed during 2010. Trials were made using a catcher vessel and a high-horsepower, catcher-processor vessel. The most recent design places

the excluder section just in front of the cod end where water flow (inside the net) is slowest. Prior designs placed the section more forward, where water flow is faster, in part due to the tapered shape of the net. Because chum salmon are not thought to be strong swimmers, it was believed that chum escapement rates from earlier designs (generally poor, less than three percent) could be improved upon with a revised design that would be easier for salmon to escape from. However, the trials did not reveal any improvement in chum escapement, with an average for all trials less than ten percent (but pollock escapement remained very low, about one-half of one percent).

The initial A-season trials occurred in an area with some intermittent Chinook salmon bycatch as well as reliable chum bycatch of between 30 and 100 fish. When Chinook were encountered, escapement averaged close to 40 percent, but chum escapement remained less than ten percent. The results reinforced conclusions drawn from video observations that chum and Chinook salmon behave differently inside the trawl and-or have different swimming abilities, or may react differently to escape path location. However, the EFP allowed for a total bycatch of just 125 Chinook for the A-season trials, and so research operations had to leave the area after making only eight trials. This limited the amount of data obtained about simultaneous Chinook and chum escapement.

Experimental fishing trials during the 2011 B-season were designed to investigate a modification of the excluder design that reduced somewhat the escape path. The hypothesis was that the change might allow slowly-swimming salmon to escape more frequently. The trials showed no change for both chum and pollock escapement. As no Chinook salmon were present where the trials were made, no information was obtained on whether the modification might affect Chinook escapement.

During 2011 the pollock industry also supported a research project to conduct a comprehensive gap analysis of deficiencies in genetic sample locations, sample sizes, and sample quality for Bering Sea and North Pacific Rim chum salmon populations. The project is headed by Dr. Tony Gharrett at the University of Alaska and the objective is to add genetic information for approximately 50 populations to the coast-wide genetic baseline for chum salmon. A second part of the project will develop new, single nucleotide polymorphism (SNP) markers to improve discrimination of coastal western Alaskan chum salmon, including lower Yukon River, Kuskokwim River, and Norton Sound populations.

If successful, the project will provide some new methods that may be used by NOAA Fisheries and Alaska Department of Fish and Game geneticists to detect and estimate the proportions of western Alaska chum salmon stocks taken in both directed and incidental fisheries. In particular, improved stock-or-origin estimates can be used to inform estimates of impacts of groundfish fisheries on chum stocks as well as provide temporal and spatial information that may be useful for forecasts of salmon abundance. This work is relevant to management of western Alaska chum salmon populations that support subsistence and commercial fisheries, and also should provide useful information about other North Pacific Ocean stocks of conservation and treaty interest.

Use of New Gear Technologies

It is estimated that about half of the IPA vessels used salmon-excluder trawls for some portion of trawls made during 2011. One vessel conducted fishing trials that required the use of an excluder-trawl during 2011. A survey-based assessment of the degree that IPA vessels embody new technology to avoid Chinook bycatch will be provided in the 2012 annual report.