

Annual Report 2016

NMFS IPA No. 2



Chinook Salmon Bycatch Reduction

Incentive Plan

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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 50 CFR 679.21(f)(13) stipulates that IPA entities report annually on the following:

- Incentive measures in effect in the previous year;
- How incentive measures affected individual vessels;
- How incentive measures affected salmon savings beyond current levels;
- IPA amendments approved by NMFS since the last annual report and the reasons for amendments;
- Sub-allocation to each participating vessel;
- Number of Chinook PSC and amount of pollock (mt) at the start of each fishing season;
- Number of Chinook PSC and amount of pollock (mt) caught at the end of each season;
- In-season transfers among entities of Chinook salmon PSC or pollock among AFA cooperatives;
- Transfers of Chinook salmon PSC and pollock allocations among IPA vessels.

CP IPA Overview

The Catcher-Processor--Chinook salmon bycatch reduction--Incentive Plan Agreement (CP IPA) is designed to provide the incentives necessary to achieve 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 increased access to the fishing grounds. Losing access to good pollock fishing raises vessel operating costs and reduces product values. Avoiding grounds restrictions reduces operating costs and allows for the production of higher-valued products (especially during the A-season), thus increasing profits.

The Chinook bycatch limits depend on whether the fishery participants develop IPAs. If IPAs are developed, then the annual PSC limit is 60,000 Chinook during any two-out-of-seven years, and 47,591 Chinook in other years. During 2016 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 Community Development Quota (CDQ) pollock allocations. For the CP sector, the Chinook PSC limit is 17,040 fish (under the 60,000 fish annual limit) and the pollock quota is 36 percent of the non-CDQ directed fishing allocation. For the CDQ sector, the Chinook PSC limit is 4,896 fish (under the 60,000 fish annual limit) and the pollock quota is 10 percent of the annual directed fishing allocation.

Each year the CP IPA participants manage Chinook bycatch using the lower 47,591 fishery “performance standard” limit. Under the performance standard, the CP sector Chinook quota is 13,516 fish and the CDQ sector Chinook quota is 3,883 fish. These pollock and Chinook quotas are further allocated among the seasons and the participating vessels. Table 1 shows the CP IPA “day-one” allocations of pollock and Chinook salmon PSC quota for 2016.

The IPA is designed to provide an incentive for good vessel Chinook bycatch performance under any condition of pollock and Chinook salmon abundance. 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: (4) an A-season closed area of approximately 755 square nautical miles on the northern flank of the Bering Canyon; and (5) 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 the end of the season during years when the aggregate bycatch of all plan vessels during the month of September exceeds a preset threshold.

Incentive Measures

THE ROLLING HOT-SPOT (RHS) PROGRAM

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. This is because 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 higher volumes of higher valued products each day.

The RHS accomplishes this in two steps. The first step 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, evaluated, and distributed to IPA participants each week during which an IPA vessel catches pollock. With this information, areas of relatively high Chinook bycatch are identified (hot-spots, or 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. Access to this information in real time allows vessels to decide where or where not to fish based on where Chinook are likely to be concentrated. Data shows that CP vessels are using the information provided through this program to avoid fishing in a BAA, even when not required to do so under the provisions of the IPA. This is demonstrated in more detail under ‘Effects of Incentive Measures’ below.

The second step is to evaluate vessel Chinook bycatch performance relative to a grounds-wide index of Chinook abundance (the base rate). This base rate fluctuates depending on average vessel performance to reflect the “base” level of Chinook abundance on the grounds. The base rate is calculated as the grounds-wide number of Chinook caught per ton of pollock caught. Because the base rate fluctuates depending on pollock and Chinook salmon abundance, benchmarking vessel performance against this rate establishes and maintains incentives to avoid Chinook bycatch under any condition of pollock and Chinook abundance. The bycatch performance of an IPA vessel must remain below 75% of the base rate in any given week in order for it to maintain unrestricted access to the fishing grounds (i.e. to not be prohibited from fishing in any BAA). More information about the methods used to identify the base rate is in the IPA agreement: https://alaskafisheries.noaa.gov/sites/default/files/chinook_salmon_ipa_2010.pdf.

Vessel performance (number of Chinook per ton of pollock caught) is measured both currently (most recent two weeks) and cumulatively (over the entire fishing season), relative to the base rate. Vessel performance over these time periods is used to create two different incentives. To evaluate current performance, vessel performance is measured during the prior two weeks and compared to the base rate. 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 performance measure in the creation of an incentive for the individual vessel to avoid bycatch.

The IPA rules stipulate that if the current bycatch performance of an IPA vessel is not lower than 75% of the base rate, then the vessel is prohibited from fishing in the identified BAA for seven days (i.e. the following week). If during the following week the current bycatch rate 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 BAA for an additional seven days. A seven-day fishing prohibition is called a weekly fishing prohibition.

CUMULATIVE CHINOOK BYCATCH PERFORMANCE

The cumulative Chinook 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 2016). So the measure of cumulative vessel performance accumulates from the first day of fishing through to the last, and 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, and this number of bycatch Chinook is the basis for the cumulative performance incentive.

Cumulative bycatch performance is evaluated for those vessels that receive a weekly fishing prohibition. For these vessels, if cumulative Chinook bycatch 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 bycatch 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.

CHRONIC VESSEL POOR BYCATCH PERFORMANCE

An incentive to avoid chronic vessel poor bycatch performance was added to the CP IPA in 2015 in advance of the Amendment 110 requirement. This incentive identifies vessels with poor bycatch performance by comparing relative vessel performance over several pollock seasons. At the end of each season, vessels with bycatch performance (Chinook salmon per ton of pollock catch) greater than one and one-half (1.5) standard deviations above the average vessel performance are identified. If a vessel is so identified during three consecutive seasons, then the vessel is designated a poor performance vessel during the following season. All vessels designated as poor performers are prohibited from fishing in any BAA for the entire season. If the following season is a B-season, then these vessels are also prohibited from fishing in the B-season Chinook Salmon Conservation Areas during October. While this provision is designed to identify and penalize chronic poor performers, an incentive for all vessels to improve Chinook bycatch performance is created as all vessels change fishing behavior to avoid being designated a poor performance vessel.

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 when and where 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; maps and the latitude and longitude coordinates of all CSCA boundaries are provided in the IPA agreement). Figure 1 shows the boundaries of the A-season 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 the fishery will encounter high concentrations of Chinook 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 prohibitions for three areas of approximately 1,295 square miles along the outermost shelf. These areas are called the B-season Chinook Salmon Conservation Areas (Figure 2). 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 catch.

The CP IPA also includes financial penalties for violating a BAA prohibition or for fishing in a CSCA when fishing there is prohibited. These penalties are \$10,000 for the first violation, \$15,000 for a second violation, and \$20,000 for the third and each subsequent violation during the fishing year, with every trawl inside a prohibited area considered a separate violation.

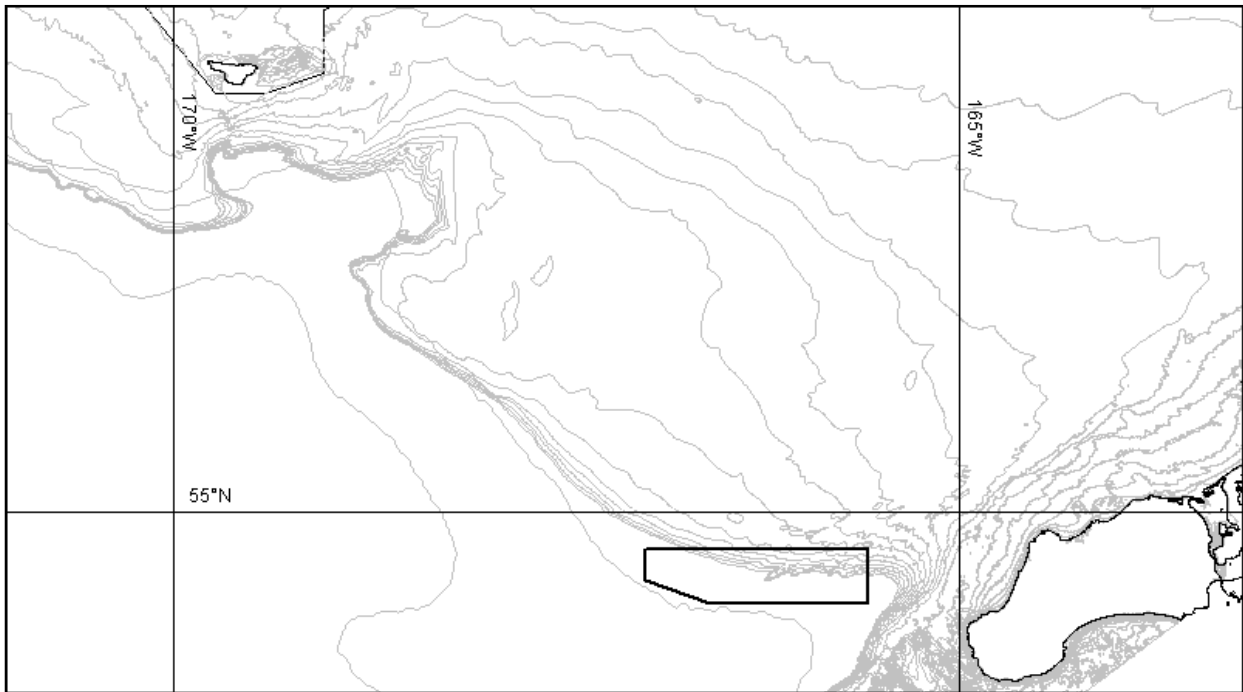


Figure 1. A-season Chinook Conservation Area.

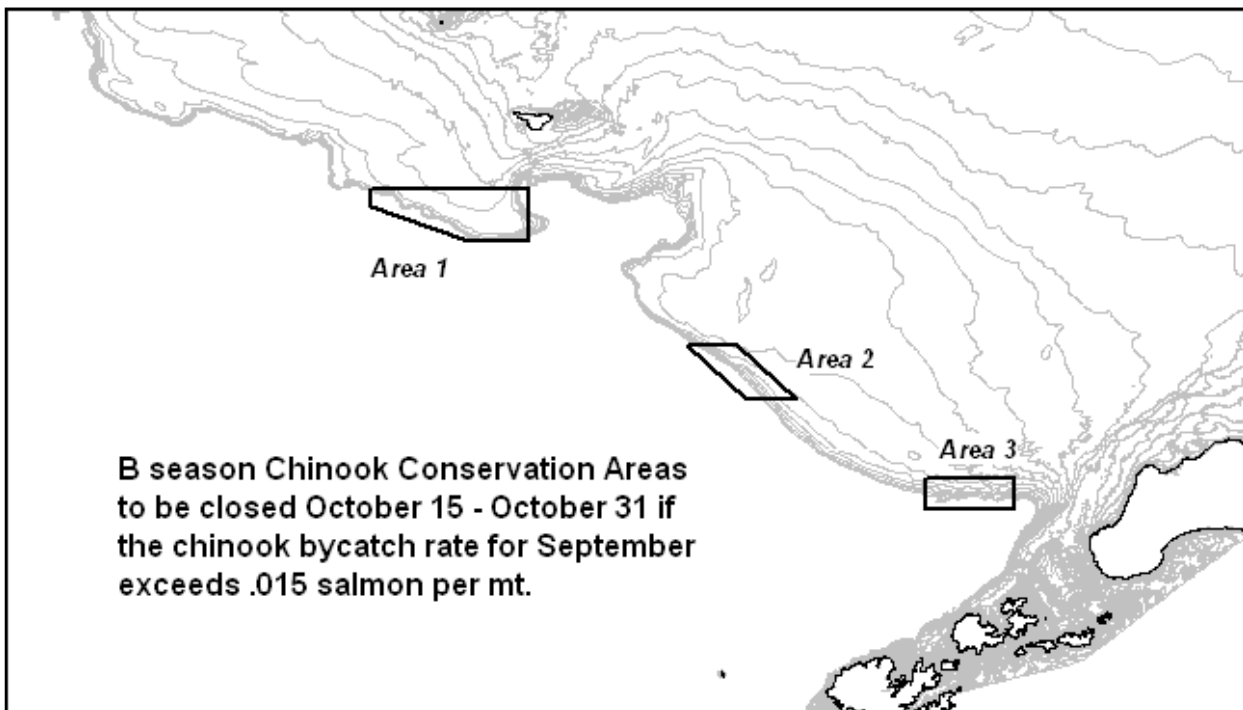


Figure 2. B-season Chinook Conservation Areas.

Management of Vessel Allocations

As discussed in the overview of the CP IPA, Amendment 91 establishes a total Chinook salmon cap of 60,000, with a performance standard of 47,591 Chinook. If the performance standard is met or exceeded in 3 of 7 consecutive years, then AFA vessels are held to the lower performance standard in perpetuity. Therefore the CP IPA is structured so that the absolute cap of 60,000 is never allocated among companies and vessels, unless the CP Salmon Corporation calls a vote and that vote is majority in favor. Instead, the allocation to companies and vessels always starts with the CP portion of the 47,591 performance standard, or 13,516 Chinook. First buffers are subtracted from this 13,516 Chinook, and then the remaining Chinook are allocated by the entity to companies who must then allocate them to their respective vessels before the start of fishing for the year. No company or vessel has received a re-allocation of Chinook salmon from the buffer since the IPA inception.

The CP IPA is designed to work in concert with the bycatch allocation management activities of the entities authorized within Amendment 91 to perform this task. For example, the plan includes a requirement for the constitution of a limit buffer to ensure that the sector bycatch limits established by Amendment 91 are conserved. The buffer is made up of contributions from all plan vessels in amounts equal to at least two-thirds of one percent of the vessel Chinook allocation. Because the limit buffer is planned to address some unexpected, unknown event, it is anticipated that the Chinook salmon allocations in the buffer will not be used to harvest the pollock allocation.

The plan also includes a requirement that the Technical Representative notify the allocation management entity when the Chinook bycatch of any plan vessel reaches 95 percent of its Chinook allocation. This requirement was included in the plan to ensure that the entities managing the bycatch allocations of plan vessels have sufficient time to assess the need for and-or timing of stop fishing orders.

CP IPA Allocations and Catches for 2016

Table 1 shows the CP IPA 2016 “day-one” allocations of pollock and Chinook salmon PSC by vessel for 2016 A- and B-seasons. Table 2 shows transfers of pollock and Chinook between CP IPA vessels in 2016. Table 3 shows 2016 CP IPA pollock catch and Chinook PSC by season and vessel. Vessel bycatch performance is shown by season because the Chinook bycatch environment is different during the A-and B-seasons. During the B-season, and when fishing starts quickly, it is generally possible to complete fishing operations before Chinook salmon arrive on the shelf in the fall to feed. In other years they arrive earlier or fishing continues later, and great effort must be concentrated on limiting the bycatch.

Table 1. CP IPA Day-One Allocations of Pollock and Chinook Salmon, 2016, Including CDQ Pollock and Chinook Allocated to the CP Fleet from CDQ Partners.

Vessel	A-season		B-season	
	Pollock (mt)	Chinook (n)	Pollock (mt)	Chinook (n)
American Dynasty	19,044	1,050	28,858	250
American Triumph	19,044	1,050	28,858	250
Northern Eagle	19,044	1,050	28,857	250
Northern Jaeger	19,044	1,050	28,857	250
Ocean Rover	19,044	1,050	28,857	250
Arctic Fjord	19,111	1,005	31,202	251
Arctic Storm	16,042	818	21,935	204
Northern Hawk	17,672	881	26,587	276
Alaska Ocean	28,680	1,308	33,882	224
Pacific Glacier	23,466	1,070	27,723	183
Starbound	49	323	23,793	635
Island Enterprise	13,055	615	17,641	153
Kodiak Enterprise	13,051	615	17,641	153
Seattle Enterprise	13,051	615	17,641	153
Ocean Peace	930	53	1,411	13
Katie Ann	0	0	0	0
Northern Glacier	0	0	0	0
Total 2016 Allocation			604,070*	16,048
Allocation Buffer			0	1,351**

* Total includes reallocations of pollock from the AI subarea on March 11 and August 8, 2016

** Total includes an additional CDQ buffer

Table 2. Transfers of pollock and Chinook between CP IPA vessels in 2016.

Date	From vessel	To vessel	Amount (mt or N)	Species
3/21/16	American Dynasty	Northern Eagle	759	Coop pollock
3/21/16	American Dynasty	Northern Jaeger	64	Coop pollock
3/19/16	American Triumph	Northern Jaeger	890	Coop pollock
3/28/16	Pacific Glacier	Northern Jaeger	2,018	Coop pollock
3/28/16	Pacific Glacier	Ocean Rover	1,482	Coop pollock
3/20/16	Pacific Glacier	Alaska Ocean	749	Coop pollock
3/24/16	Island Enterprise	Kodiak Enterprise	73	Coop pollock
2/17/16	Ocean Peace	Jaeger	441	Coop pollock
2/17/16	Ocean Peace	Arctic Fjord	46	Coop pollock
2/17/16	Ocean Peace	Arctic Storm	47	Coop pollock
2/17/16	Ocean Peace	Alaska Ocean	158	Coop pollock
2/17/16	Ocean Peace	Starbound	40	Coop pollock
2/17/16	Ocean Peace	Seattle Enterprise	173	Coop pollock
2/17/16	Ocean Peace	Northern Hawk	25	Coop pollock
8/19/16	Starbound	Island Enterprise	3,200	Coop pollock
9/9/16	Starbound	Pacific Glacier	2,000	Coop pollock
9/9/16	Starbound	Seattle Enterprise	1,000	Coop pollock
9/10/16	Starbound	Arctic Fjord	350	Coop pollock
9/10/16	Trident	Starbound	336	Coop pollock
9/9/16	Ocean Peace	Starbound	61	Coop pollock
9/9/16	Ocean Peace	Kodiak Enterprise	262	Coop pollock
9/9/16	Ocean Peace	American Triumph	666	Coop pollock
9/9/16	Ocean Peace	Pacific Glacier	239	Coop pollock
9/9/16	Alaska Ocean	Pacific Glacier	662	Coop pollock
9/9/16	Ocean Peace	Arctic Fjord	140	Coop pollock
9/10/16	Starbound	Arctic Storm	350	Coop pollock
9/9/16	Ocean Peace	Northern Hawk	34	Coop pollock
9/13/16	Northern Jaeger	Pacific Glacier	900	Coop pollock
9/12/16	Northern Jaeger	Kodiak Enterprise	534	Coop pollock
9/10/16	Island Enterprise	Starbound	350	Coop pollock
9/14/16	Seattle Enterprise	Kodiak Enterprise	40	Coop pollock
9/27/16	Arctic Storm	Arctic Fjord	242	Coop pollock
3/7/16	Northern Jaeger	American Dynasty	41	CDQ pollock
3/7/16	Northern Jaeger	American Triumph	20	CDQ pollock
2/27/16	Ocean Rover	American Triumph	12	CDQ pollock
2/22/16	Pacific Glacier	Alaska Ocean	657	CDQ pollock
2/25/16	Kodiak enterprise	Island Enterprise	241	CDQ pollock
9/3/16	Northern Eagle	American Triumph	441	CDQ pollock
9/3/16	Northern Jaeger	American Triumph	174	CDQ pollock
7/22/16	American Dynasty	Ocean Rover	141	CDQ pollock
7/22/16	Northern Jaeger	Ocean Rover	196	CDQ pollock
7/13/16	Arctic Storm	Arctic Fjord	8	CDQ pollock
9/15/16	Pacific Glacier	Northern Jaeger	810	CDQ pollock
7/18/16	Kodiak Enterprise	Island Enterprise	19	CDQ pollock
10/1/16	Northern Jaeger	Aleutian Challenger	810	CDQ pollock
9/14/16	Kodiak Enterprise	Starbound	200	Coop Chinook
10/1/16	Northern Jaeger	Aleutian Challenger	116	CDQ Chinook
10/1/16	Ocean Rover	Aleutian Challenger	130	CDQ Chinook

Table 3. CP IPA Pollock Catch and Chinook Bycatch Performance by Season and Vessel, 2016.

Vessel	A-season			B-season		
	Pollock (mt)	Chinook (n)	Rate (n/mt)	Pollock (mt)	Chinook (n)	Rate (n/mt)
Alaska Ocean	30,086	807	0.026	33,219	142	0.004
American Dynasty	18,261	710	0.038	29,687	157	0.005
American Triumph	18,186	692	0.037	32,938	170	0.005
Arctic Fjord	19,143	528	0.027	31,592	91	0.003
Arctic Storm	16,068	458	0.028	22,070	68	0.003
Island Enterprise	13,370	458	0.034	20,501	201	0.010
Kodiak Enterprise	12,622	350	0.027	18,178	129	0.007
Northern Eagle	19,801	766	0.038	30,856	107	0.003
Northern Hawk	17,649	559	0.031	26,659	115	0.004
Northern Jaeger	21,955	673	0.030	24,924	102	0.004
Ocean Rover	20,701	753	0.036	25,420	65	0.002
Pacific Glacier	18,685	543	0.029	30,728	272	0.009
Seattle Enterprise	11,555	403	0.034	21,407	323	0.015
Starbound	0	0		16,557	602	0.036
Northern Glacier	0	0		0	0	
Katie Ann	0	0		0	0	
Ocean Peace	0	0		0	0	
Forum Star	0	0		0	0	
American Challenger	0	0		0	0	
Ocean Harvester	0	0		0	0	
Neahkanie	0	0		0	0	
Sea Storm	0	0		0	0	
Muir Milach	0	0		0	0	
Aleutian Challenger	0	0		809	211	0.257
Totals	238,081	7,700	0.032	365,546	2,755	0.007
Grand Totals	Pollock A+B (mt) 603,627		Chinook A+B (n) 10,455		Rate A+B (n/mt) 0.017	

Effects of Incentive Measures

This annual report provides a qualitative evaluation and some quantitative information on the effectiveness of the CP IPA in influencing vessel behavior to minimize Chinook bycatch. 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 2011-2016 fisheries is tabulated and compared to performance during prior years. Table 4 shows the aggregate bycatch performance (number of Chinook per ton of pollock caught) of CP IPA vessels since

2006, comprising the five years prior to, and six years since the implementation of the CP IPA. It is clear from Table 4 that CP Chinook bycatch performance has been better since the implementation of the IPA, as compared with the previous five years, although it cannot be determined what role environmental conditions and salmon abundance played throughout this time period.

Table 4. Chinook Bycatch Rates (n/mt) in the CP Fleet for 2006-2016.

Year	A-season (n/mt)	B-season (n/mt)	A+B-season (n/mt)	A+B season (m/t) five year interval
2006	0.066	0.004	0.029	0.028
2007	0.100	0.017	0.066	
2008	0.027	0.002	0.012	
2009	0.021	0.002	0.010	
2010	0.024	0.000	0.009	
2011	0.010	0.006	0.008	0.009
2012	0.013	0.000	0.005	
2013	0.018	0.001	0.008	
2014	0.020	0.002	0.009	
2015	0.016	0.007	0.011	
2016	0.032	0.007	0.017	

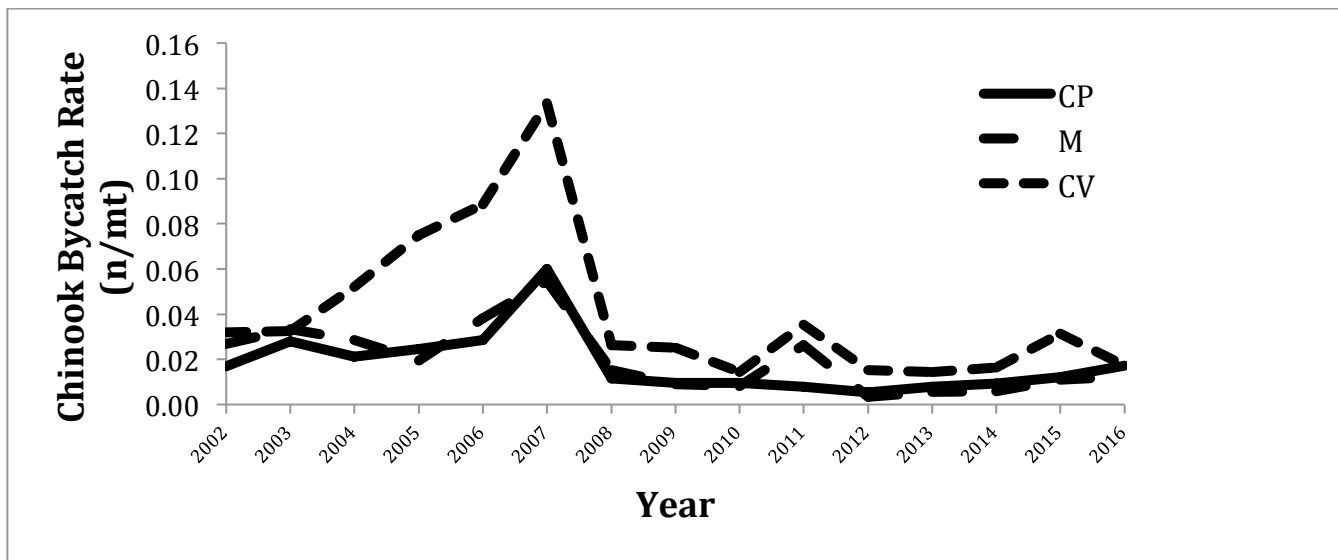


Figure 3. Chinook bycatch rates by year for the Catcher Processor (CP), Catcher Vessel (CV), and Mothership (M) pollock fishing sectors in the Bering Sea.

Figure 3 shows Chinook bycatch rates in the Bering Sea since 2002 by pollock fishing sector. Trends in performance over time are largely consistent among the sectors during the A-season, with the mothership and catcher processors generally having low B-season bycatch since 2002.

Figure 4 shows the range of vessel bycatch performance each year since 2002, during the time period when Chinook are most abundant on the pollock fishing grounds (September-February). In the

prior program, the bycatch performance of a pollock cooperative (group of vessels) was evaluated against a performance benchmark, and under some circumstances, incentives to avoid bycatch weakened for an individual vessel. However, if incentive measures are working at the vessel level, one would expect the distribution of Chinook bycatch rates among the vessels to shrink. This is because vessels are accountable for their own Chinook bycatch, and better performers cannot shelter less well performing vessels. Evident from this graph is that, since the IPA began, vessel bycatch rates have been among the lowest on record, and also that the variance of rates among vessels is reduced (has been very small) in the IPA years, even relative to previous years with similar average rates. **In other words, Chinook bycatch rates among vessels display a smaller range of values since 2011 than in previous years, providing evidence of the effectiveness of the vessel-level incentives.**

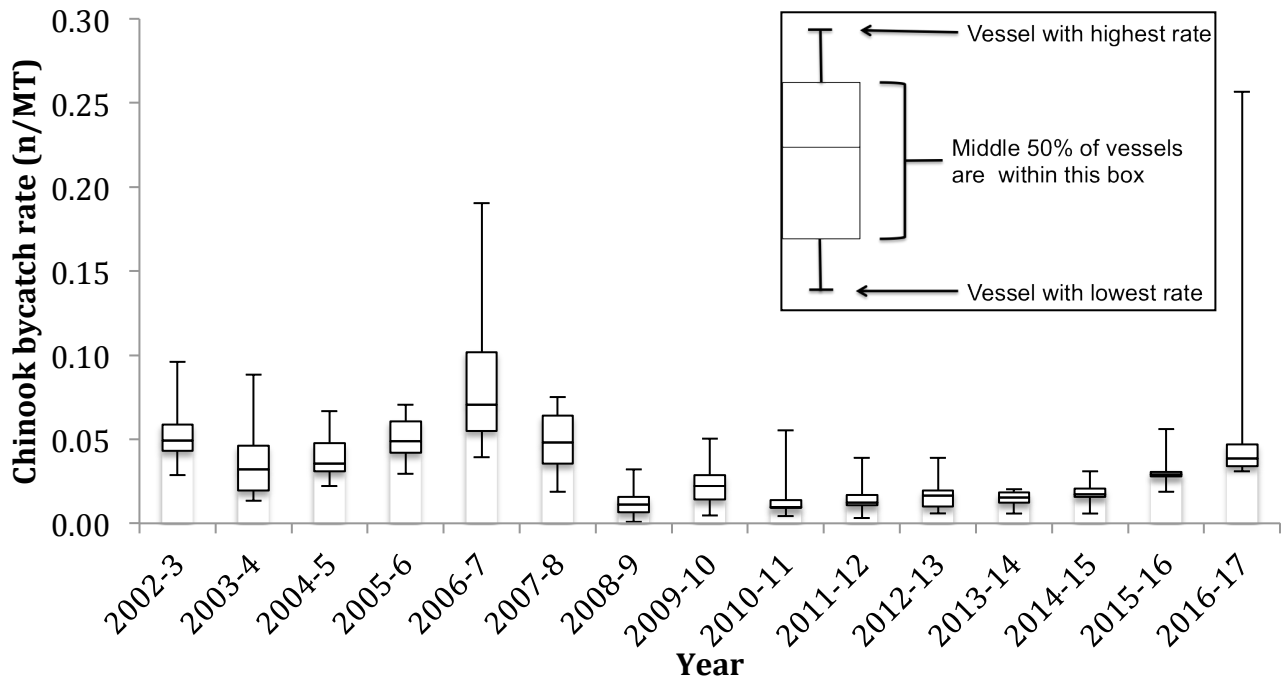


Figure 4. September-February CP Vessel Chinook Bycatch Rate Distribution by year 2002-2017.

Another way to look at how incentives have been working at the individual vessel level is to compare the frequency of different levels of Chinook bycatch rates by individual vessels in the period before and after the implementation of Amendment 91. A narrowing distribution of vessel performance in the period since Amendment 91 indicates that vessels are behaving more similarly to each other, thus are exhibiting vessel-level accountability for their Chinook bycatch. Figure 5 shows the distribution of vessel bycatch rates in the A-seasons of 2008-2010 (pre-Amendment 91; top panel) and the same distribution in the A-seasons of 2013-2016 (post-Amendment 91; bottom panel). This figure shows a lower overall average Chinook bycatch rate in the more recent period, as well as a narrower distribution of vessel performance around this mean, thus demonstrating more vessel-level accountability in the period since Amendment 91 implementation. Figure 6 shows the same information for the 2016 A-season only and a further narrowing of the distribution around the mean.

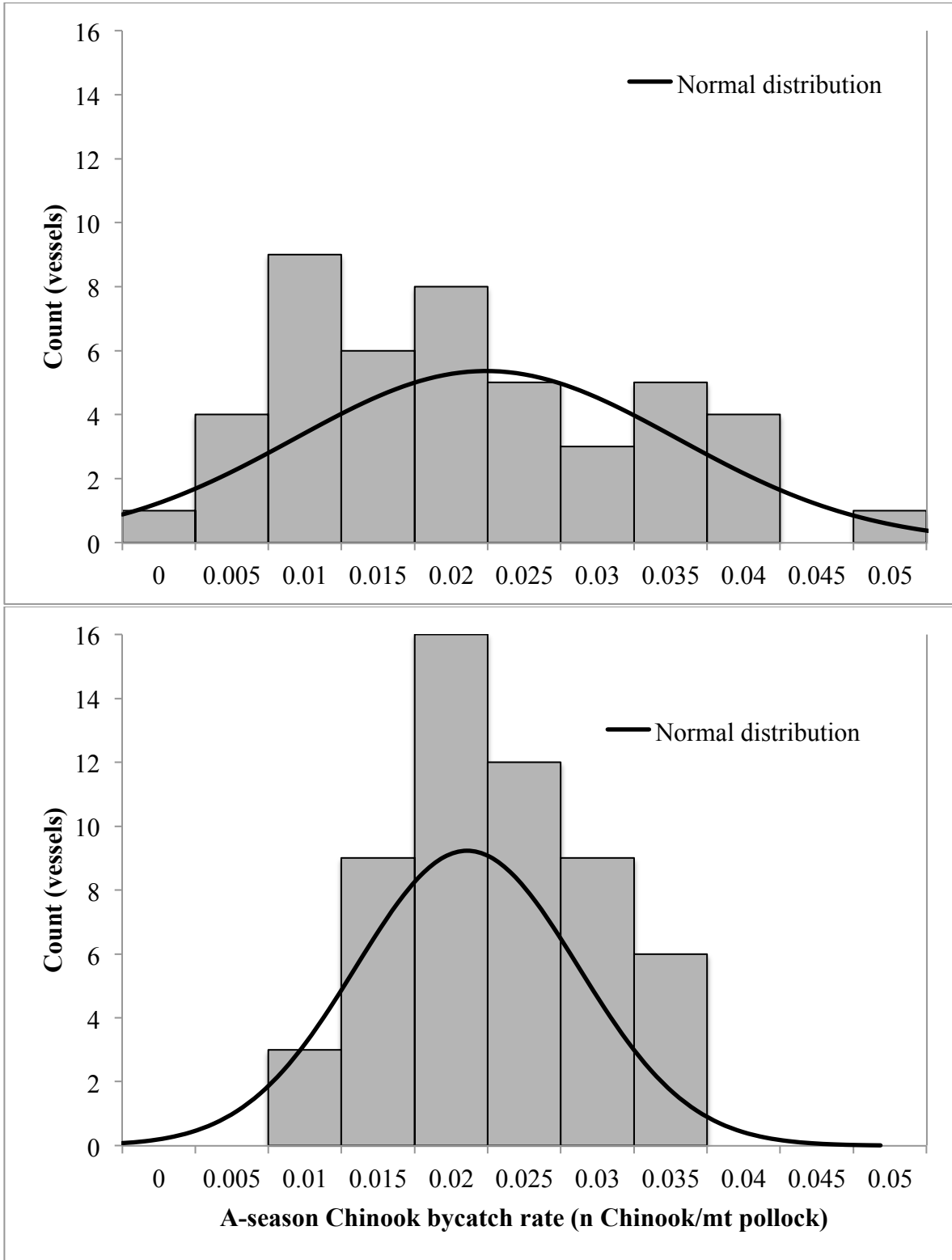


Figure 5. Upper panel: A-Season CP Vessel Chinook Bycatch Rate Frequency Distribution for 2008-2010 with a variance of 0.006 and Lower panel: Distribution for 2013-2016 with variance equal to 0.002.

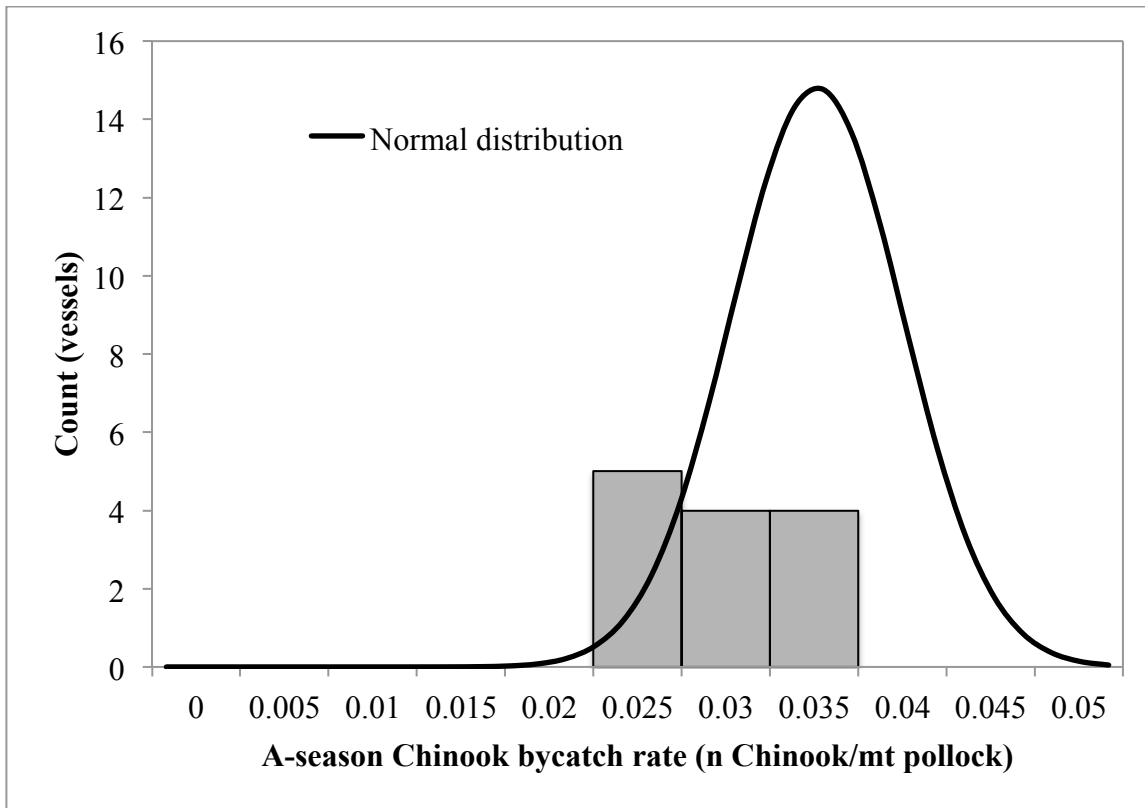


Figure 6. A-Season CP Vessel Chinook Bycatch Rate Frequency Distribution for 2016.

Chinook Bycatch Avoidance Behavior

As mentioned previously, important elements of the CP IPA incentive program include: 1) the provision of real-time information to the fleet concerning areas of relatively high Chinook salmon abundance; and 2) designated time-area closures for vessels with Chinook bycatch rates higher than 75% of the base rate. Over time, data on Chinook bycatch rates on the fishing grounds has revealed certain patterns, with the highest bycatch rates occurring in predictable areas at certain times of the year. Figure 7 shows all CP fishing locations between 2000 and 2016 during the time period where Chinook are most often present on the EBS shelf (September-February), color coded according to Chinook bycatch rate. The blue crosses indicate trawls made between 2000 and 2010—the years prior to Amendment 91. The orange crosses indicate tows taken between 2011 and 2016—the years since Amendment 91. It is clear from this figure that CP pollock vessels are now avoiding grounds with the highest Chinook bycatch rates (darkest blue) historically. The presence of blue crosses in these areas means these are productive pollock fishing grounds, and the absence of orange crosses indicates these areas are now being avoided in order to avoid Chinook.

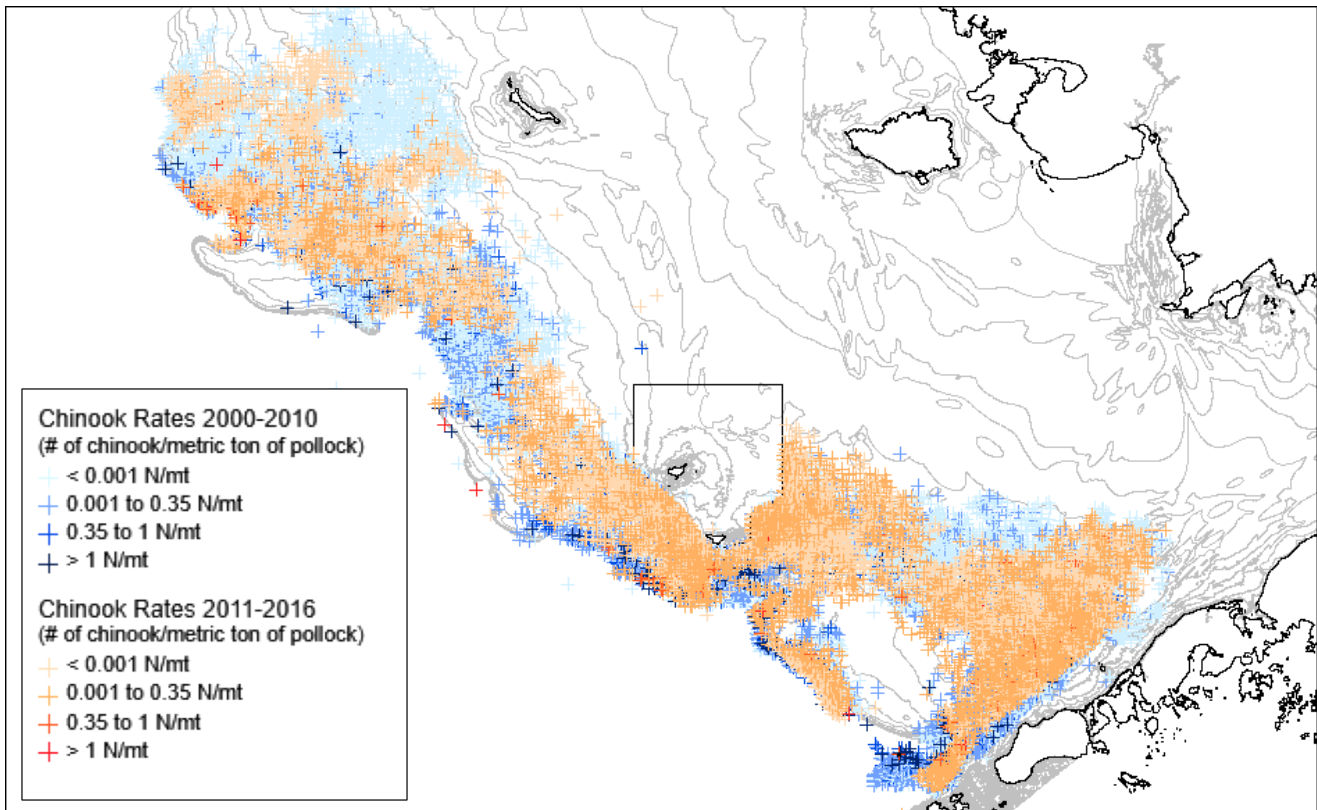


Figure 7. Pollock CP trawl locations between September 1st and February 28th for the years 2000-2010 (blue), 2011-2016 (orange). Darker color indicates higher Chinook bycatch rates.

A close examination of the trawl locations in space and time, their bycatch rates, and the bycatch performance of all CP IPA vessels shows clearly that the vessels have 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 has been 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 was most pronounced during the A-season and occurred in multiple areas when trawl bycatch rates showed high concentrations of salmon, as e.g., when schools of Chinook salmon move into a local area to feed.

As mentioned in the above paragraph, an important component of changing CP fishing behavior subsequent to Amendment 91 is fishing depth, because Chinook salmon are known to occur in deeper areas along the EBS shelf. Comparing effort, pollock and Chinook catches in the five years prior to and five years since Amendment 91, there has been a clear reduction in the amount of fishing effort at depths greater than 130 fathoms, where a large portion of Chinook bycatch has typically been encountered. In recent years, most A-season fishing has occurred at depths less than 50 fathoms and roe recovery has been significantly reduced as the target fish size and age typically declines in shallower waters.

Under the RHS program, several BAA were designated for the CP fleet during the 2016 A-season (Figure 8). The BAA are made known to all vessels on a weekly basis; only those vessels with a Chinook bycatch rate of greater than 75% of the base rate are required to avoid these areas. However, because the designations indicate where Chinook bycatch has been highest over a given week, even vessels that are not required to fish outside the BAA often voluntarily do so, in order to avoid Chinook bycatch (Figure 9). It is important to remember that, due to the way the base rate is calculated, there must be pollock fishing in an area in order for it to become a bycatch avoidance area, so those areas where CPs avoided fishing entirely will not contain any BAA.

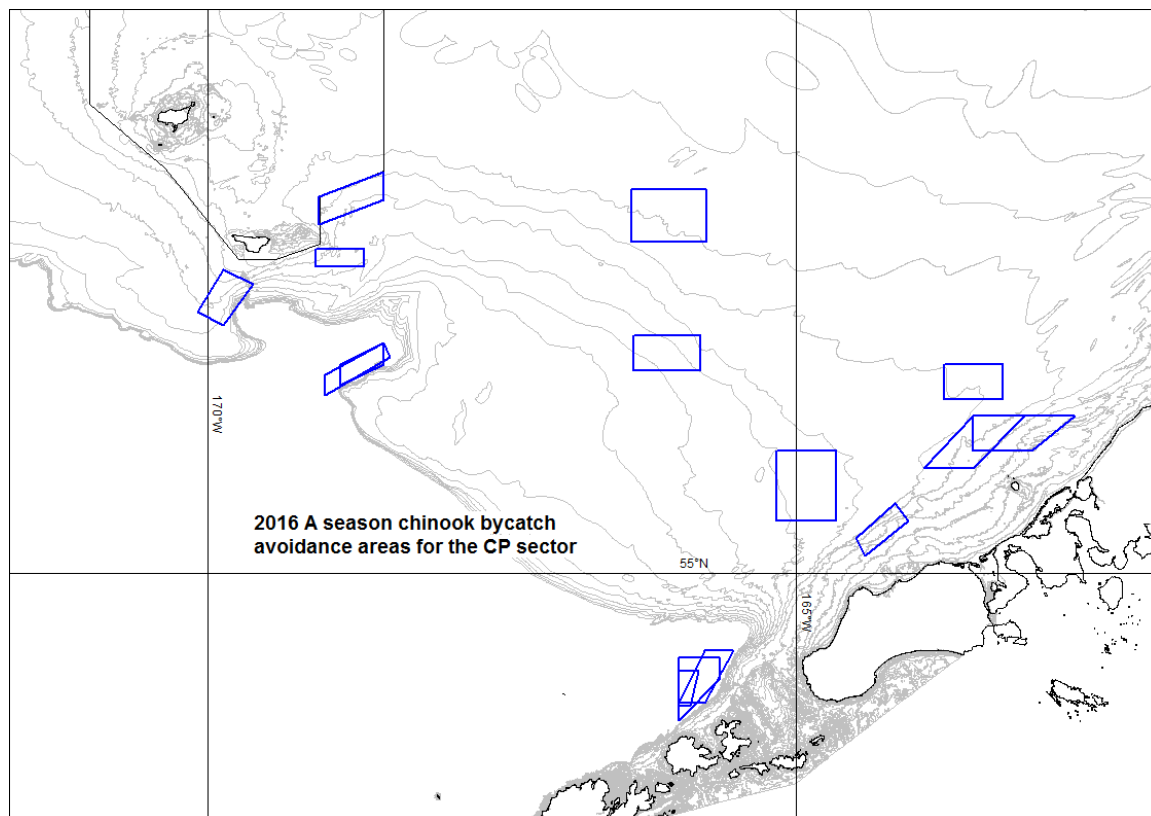


Figure 8. Chinook bycatch avoidance areas for the CP sector, A-season, 2016.

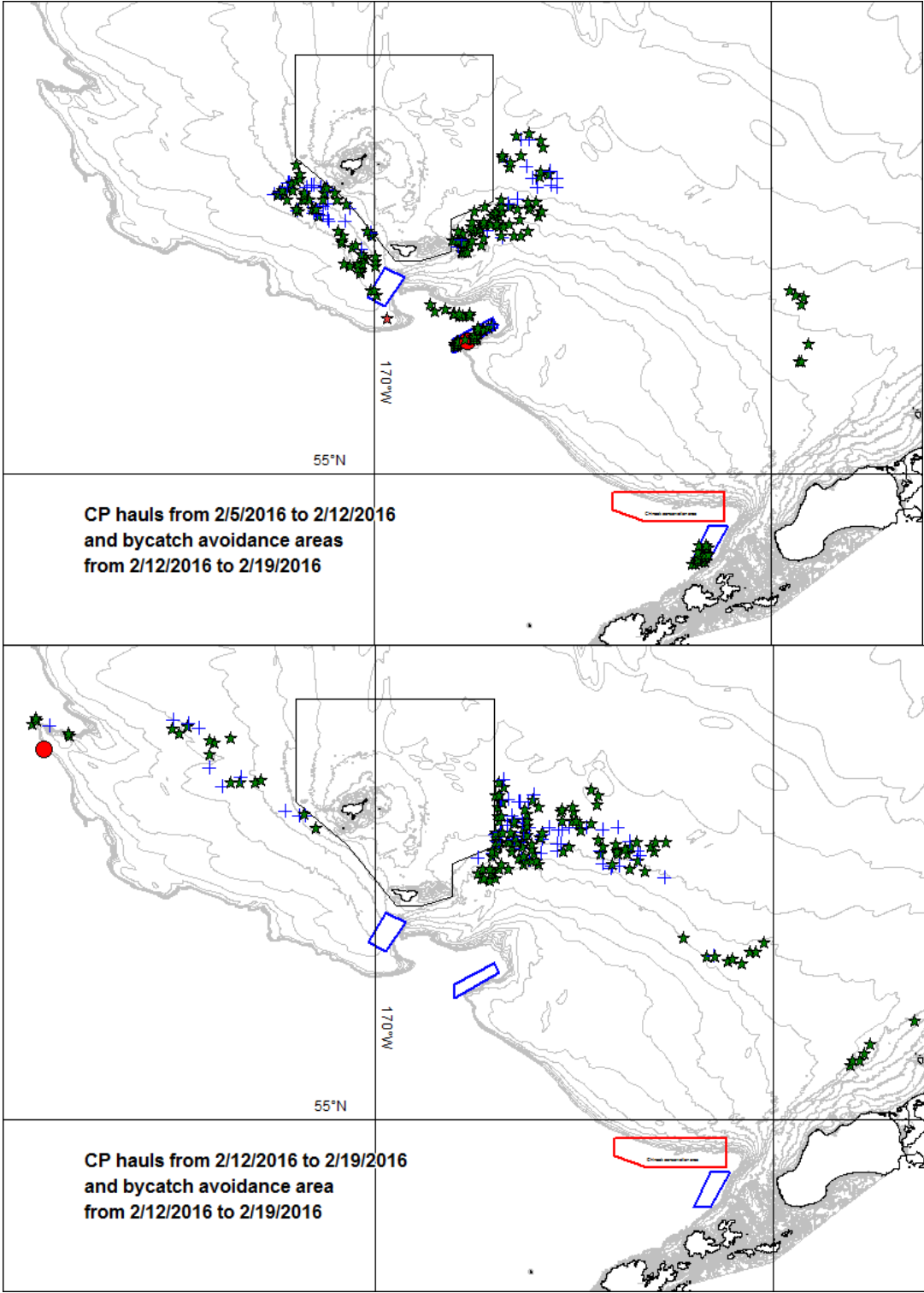


Figure 9. Shows CP movement caused by BAAs for the week of 2/12/16. Top panel fishing locations from 2/5/16 to 2/12/16, Bottom panel fishing locations from 2/12/16 to 2/19/16 due to BAA.

Table 5 shows the A-season weeks of 2016 and the number of vessels excluded from designated bycatch avoidance areas during each week. There were a total of nineteen CP BAA during the 2016 A-season and nine CP BAA for the B-season, with two vessels prohibited from fishing in B-season BAA. There were also two vessels subject to an extended (2-week) fishing prohibition during 2016.

Table 5. Number of CP vessels excluded from designated bycatch avoidance areas during the 2016 A-season.

Week	1/28	2/05	2/11	2/18	2/25	3/03	3/10	3/17	3/24	3/31	4/07
Number of CPs excluded from BAAs	3	9	13	9	2	4	10	12	6	2	0

The incentive to avoid chronic vessel poor bycatch performance first came into force during 2015, but its provisions applied retroactively to vessel performance during the 2014 A- and B-seasons. During the past six seasons, seven unique vessels have been designated an “outlier” for their Chinook bycatch performance, with only one vessel a repeat poor performer not in consecutive seasons.

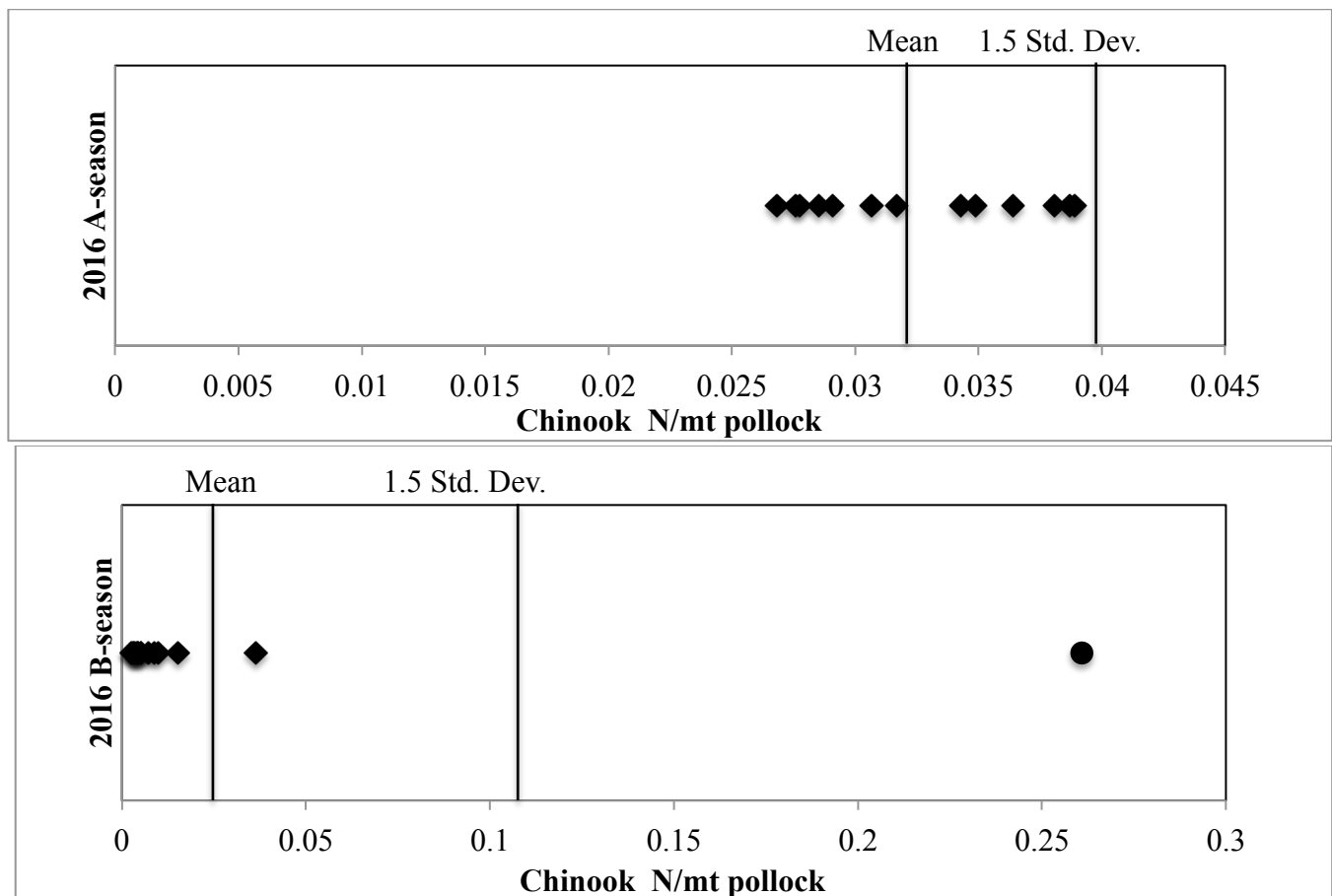


Figure 10. Fleetwide Chinook bycatch ratio distribution for 2016 fishing seasons. Circles denote outlier vessels.

Figure 10 above shows the relative performance of the fleet for the 2016 A- and B-seasons. Differences are evident between vessel bycatch performance in A-season versus the B-season, therefore the provision is applied on a seasonal basis to account for different bycatch environments. The maximum number of vessels that can fall in the worst 10% of fleet performance is three with a minimum of one vessel. However, due to the absence of one vessel in the 2016 A-season, and the extremely narrow distribution of bycatch rates, there were no outlier vessels. During the 2016 B-season the two vessels that fished late into October when Chinook abundance is highest due to operational circumstances were also the two vessels that clearly separate themselves from the otherwise narrow distribution shown above during the 2016 B-season. The outlier vessel shown above had just 809 tons of pollock catch and one lightning strike trawl of 84 Chinook. The new disincentive to chronic poor bycatch performance has proven effective in its first three years of implementation—only one vessel has been a repeat outlier in the past six seasons. Vessels now have strong incentive to change fishing behavior to avoid being an outlier in any consecutive seasons, because although a vessel might have long periods of good relative bycatch performance, one lightning strike trawl can render it an outlier in any given season. Given a constant abundance of Chinook and pollock over time, the incentive provision should encourage a shift in the distribution of vessel bycatch performance to the left.

Ongoing Gear Research and Development

The C/P IPA also was amended prior to the 2015 fishing season in advance of Amendment 110 to require all vessels use a salmon excluder device during trawls made during the A-season and the end of the B-season. During 2016, vessel crew and Pollock Conservation Cooperative staff continued an at-sea monitoring program to evaluate the design and rigging of the salmon-excluder trawls used by IPA vessels. Monitoring is accomplished using deploy-and-retrieve video cameras placed in the trawl net.

Further development of a prototype titanium trawl camera from MacMarine Incorporated (MMI) was conducted aboard the F/T Ocean Rover and Northern Jaeger during the pollock fishery in Spring and early fall of 2016. The camera incorporates a 4-LED array and a Mobius ActionCam HD wide-angle lens camera and DVR combination. In addition, new flapper materials, weighting of flapper panels, and monitoring of escape openings have been conducted aboard PCC vessels. There has also been progress made in the use of salmon lights to assist in attracting salmon to escape routes in the salmon excluder.

Results from ongoing experimental trials continue to indicate that salmon bycatch is highly variable trawl-to-trawl even for circumstances where trawls are spaced very closely in space and time. Similarly, the experiments so far conducted indicate the salmon escape fractions are as variable, if not more so, than salmon bycatch, trawl-to-trawl, even for circumstances where trawls are spaced very closely in space and time. The goal of future experiments is to develop new gear technologies that produce escape fractions that would be more consistent and higher than those obtained currently.