Annual Report 2015

NMFS IPA No. 2

Chinook Salmon Bycatch Reduction

Incentive Plan

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Table of Contents

List of Figures

List of Tables

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 2015 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 2015.

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.

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 2015). 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.

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.

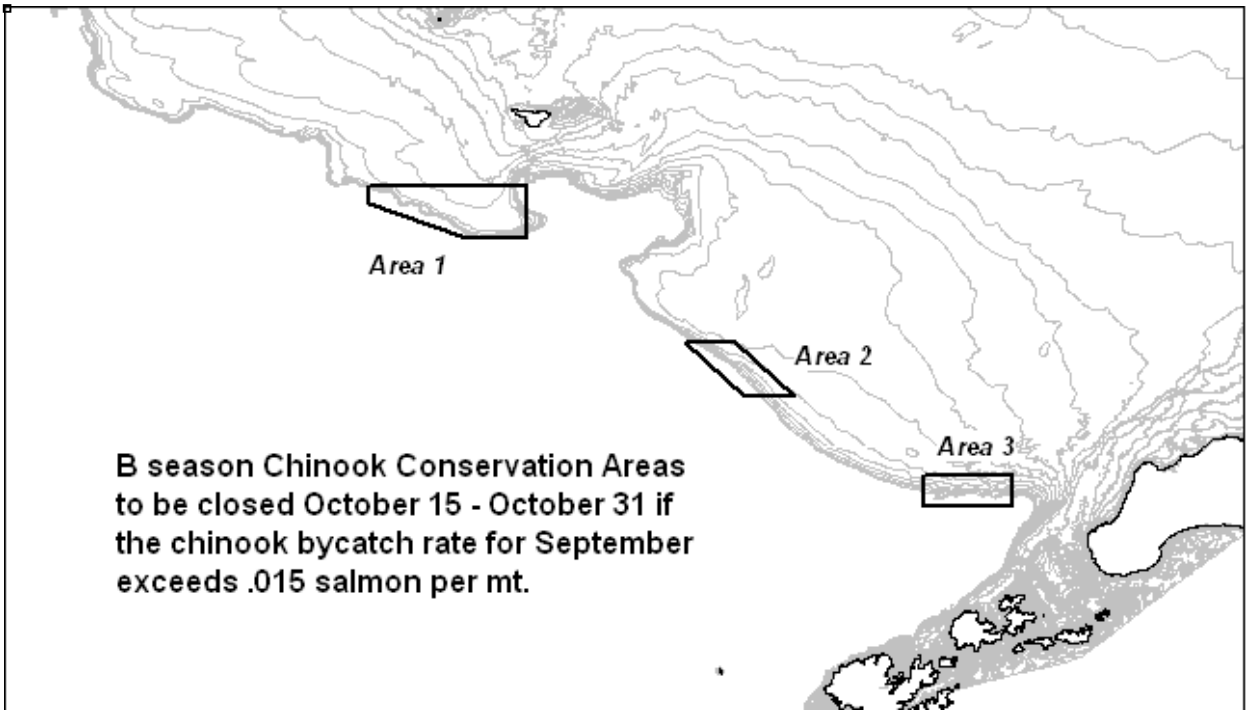

Figure 2. B-season Chinook Conservation Areas.

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 unanimously 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 2015

Table 1 shows the CP IPA 2015 “day-one” allocations of pollock and Chinook salmon PSC by vessel for 2015 A- and B-seasons. Table 2 shows transfers of pollock between CP IPA vessels in 2015. Note there were no transfers of Chinook salmon between CP IPA vessels in 2015. Table 3 shows 2015 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, 2015, Including CDQ Pollock and Chinook Allocated to the CP Fleet from CDQ Partners.

	A-season		B-season	
Vessel	Pollock (mt)	Chinook (n)	Pollock (mt)	Chinook (n)
American Dynasty	18,670	1,068	28,391	311
American Triumph	18,670	1,068	28,391	311
Northern Eagle	18,670	1,068	28,391	311
Northern Jaeger	18,670	1,068	28,391	311
Ocean Rover	18,670	1,068	28,391	311
Arctic Fjord	18,519	885	30,568	281
Arctic Storm	15,893	938	21,561	294
Northern Hawk	17,290	870	26,043	286
Alaska Ocean	21,962	1,247	33,415	400
Pacific Glacier	17,969	1,020	27,100	327
Starbound	14,951	743	28,229	210
Island Enterprise	11,558	603	15,708	153
Kodiak Enterprise	11,559	603	15,708	153
Seattle Enterprise	11,552	603	15,708	153
Ocean Peace	0	53	22	13
Katie Ann	0	0	0	0
Northern Glacier	0	0	0	0
Total 2015 Allocation			590,619*	16,728
Allocation Buffer			0	671**

* Total includes reallocation of 2,554 tons (03/25/15) and 4,000 tons (08/27/15) of Aleut Corp. DFA and 1,900 tons of CDQ pollock (03/05/15)

** Total includes an additional CDQ buffer

Table 2. Transfers of pollock between CP IPA vessels in 2015. There were no transfers of Chinook salmon during 2015.

Date	From vessel	To vessel	Amount (mt)	Species
3/15/15	American Triumph	American Dynasty	864	Coop pollock
3/19/15	Kodiak Enterprise	Island Enterprise	816	Coop pollock
3/25/15	Alaska Ocean	Pacific Glacier	456	Coop pollock
3/27/15	Seattle Enterprise	Island Enterprise	2,679	Coop pollock
3/28/15	Northern Eagle	American Dynasty	100	Coop pollock
3/29/15	Northern Jaeger	Ocean Rover	796	Coop pollock
8/7/15	Northern Jaeger	American Triumph	207	Coop pollock
8/17/15	Starbound	Alaska Ocean	3,000	Coop pollock
8/25/15	Island Enterprise	Kodiak Enterprise	1,925	Coop pollock
8/29/15	Kodiak Enterprise	Seattle Enterprise	533	Coop pollock
9/2/15	Starbound	Pacific Glacier	246	Coop pollock
9/7/15	Northern Jaeger	American Dynasty	748	Coop pollock
9/8/15	Starbound	American Triumph	42	Coop pollock
9/11/15	Northern Hawk	Alaska Ocean	88	Coop pollock
9/12/15	Alaska Ocean	Pacific Glacier	16	Coop pollock
9/16/15	Ocean Rover	American Triumph	100	Coop pollock
9/16/15	Northern Eagle	American Triumph	38	Coop pollock
9/16/15	Arctic Storm	Arctic Fjord	300	Coop pollock
2/24/15	Northern Jaeger	Ocean Rover	105	CDQ pollock
2/27/15	Northern Eagle	American Dynasty	26	CDQ pollock
3/13/15	Pacific Glacier	Alaska Ocean	32	CDQ pollock
3/13/15	Northern Eagle	Ocean Rover	25	CDQ pollock
7/1/15	Starbound	Seattle Enterprise	3,328	CDQ pollock
8/9/15	Starbound	Kodiak Enterprise	2,001	CDQ pollock
8/19/15	Starbound	Island Enterprise	682	CDQ pollock
8/24/15	Northern Jaeger	American Triumph	187	CDQ pollock
8/24/15	Northern Eagle	American Triumph	4	CDQ pollock
9/13/15	Northern Jaeger	Ocean Rover	56	CDQ pollock

Table 3. CP IPA Pollock Catch and Chinook Bycatch Performance by Season and Vessel, 2015.

	A-season			B-season		
Vessel	Pollock (mt)	Chinook (n)	Rate (n/mt)	Pollock (mt)	Chinook (n)	Rate (n/mt)
Alaska Ocean	21,538	285	0.013	36,485	259	0.007
American Dynasty	19,660	336	0.017	29,330	198	0.007
American Triumph	17,820	479	0.027	28,777	244	0.008
Arctic Fjord	18,508	283	0.015	30,869	144	0.005
Arctic Storm	15,844	98	0.006	21,305	67	0.003
Island Enterprise	15,053	227	0.015	14,467	406	0.028
Kodiak Enterprise	10,742	157	0.015	17,123	108	0.006
Northern Eagle	18,473	180	0.010	28,367	190	0.007
Northern Hawk	17,183	414	0.024	26,053	143	0.005
Northern Jaeger	16,974	228	0.013	27,986	129	0.005
Ocean Rover	19,596	380	0.019	28,340	149	0.005
Pacific Glacier	18,393	286	0.016	27,360	211	0.008
Seattle Enterprise	8,823	161	0.018	21,545	289	0.013
Starbound	14,946	307	0.021	18,945	87	0.005
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	
Tracy Anne	0	0		0	0	
Neahkanie	0	0		0	0	
Sea Storm	0	0		0	0	
Muir Milach	0	0		0	0	
Totals	233,553	3,821	0.016	356,952	2,624	0.007

Grand Totals	Pollock A+B (mt)	Chinook A+B (n)	Rate A+B (n/mt)
	590,505	6,445	0.011

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 2011-2015 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 five 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 2006-2015.

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	
2007	0.100	0.017	0.066	
2008	0.027	0.002	0.012	0.028
2009	0.021	0.002	0.010	
2010	0.024	0.000	0.009	
2011	0.010	0.006	0.008	
2012	0.013	0.000	0.005	
2013	0.018	0.001	0.008	0.009
2014	0.020	0.002	0.009	
2015	0.016	0.008	0.012	

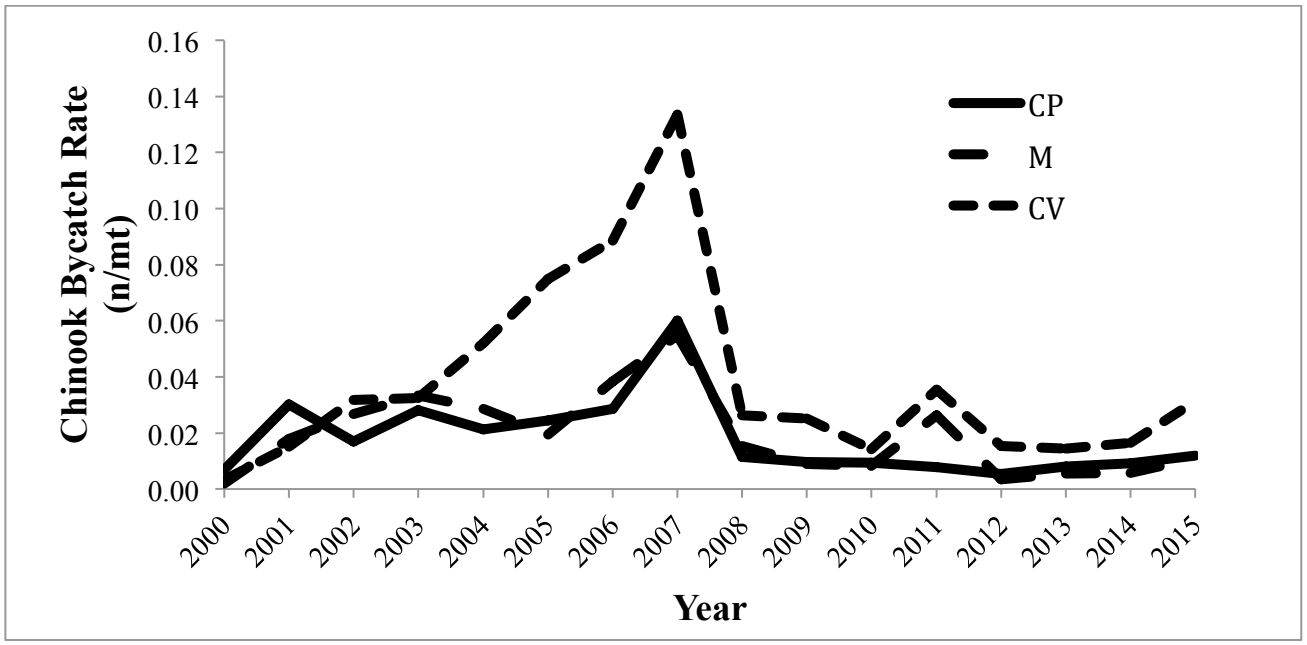

Figure 3. Chinook bycatch rates by year for the Catcher Processor (CP), Catcher Vessel (CV), and Mothership (M) pollock fishing sectors in the Bering Sea.

Figure 3 shows Chinook bycatch rates in the Bering Sea since 2000 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 2000.

Figure 4 shows the range of vessel bycatch performance each year since 2001, 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.**

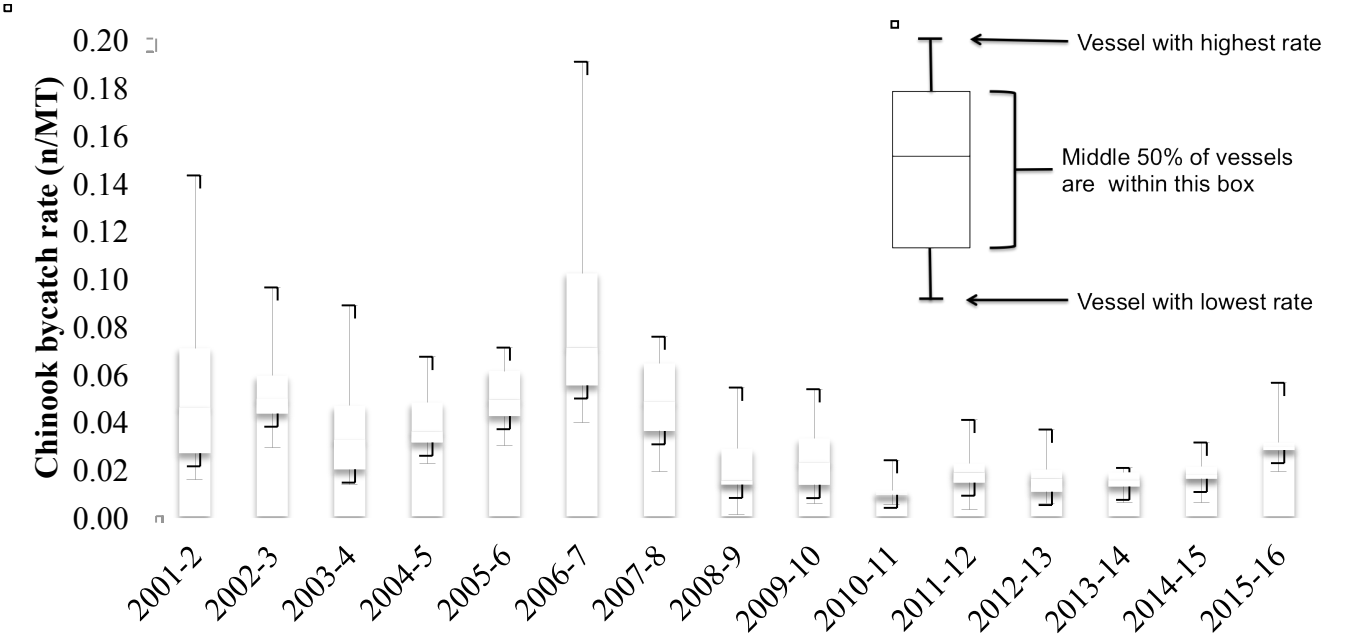

Figure 4. September-February CP Vessel Chinook Bycatch Rate Distribution by year 2001-2016.

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 2013-2015 (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 2015 A-season only and a further narrowing of the distribution around the mean. (Note the different scale on the y-axis.)

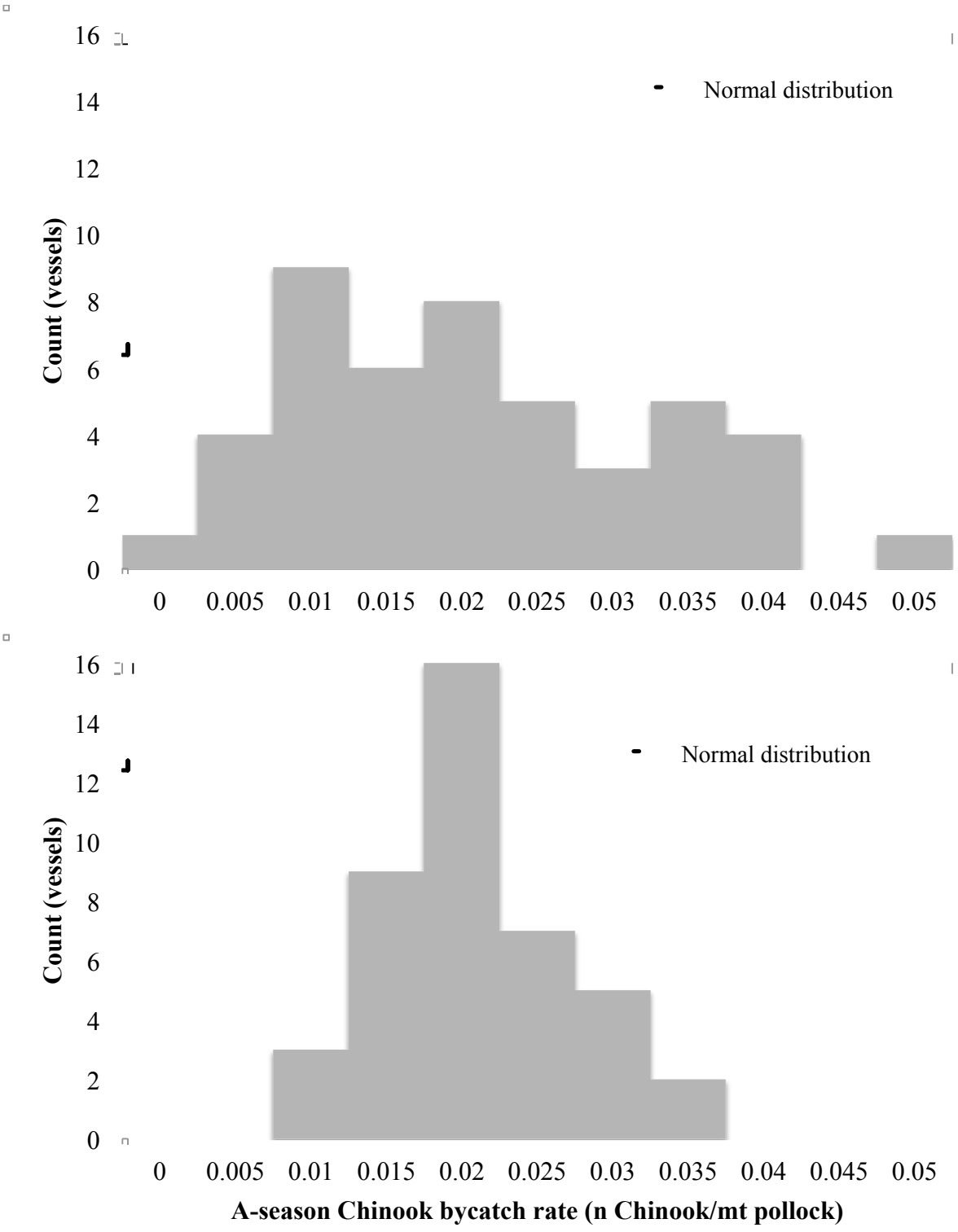

Figure 5. Upper panel: A-Season CP Vessel Chinook Bycatch Rate Frequency Distribution for 2008-2010 with a variance of 0.006 and Lower panel: Distribution for 2013-2015 with variance equal to 0.0004.

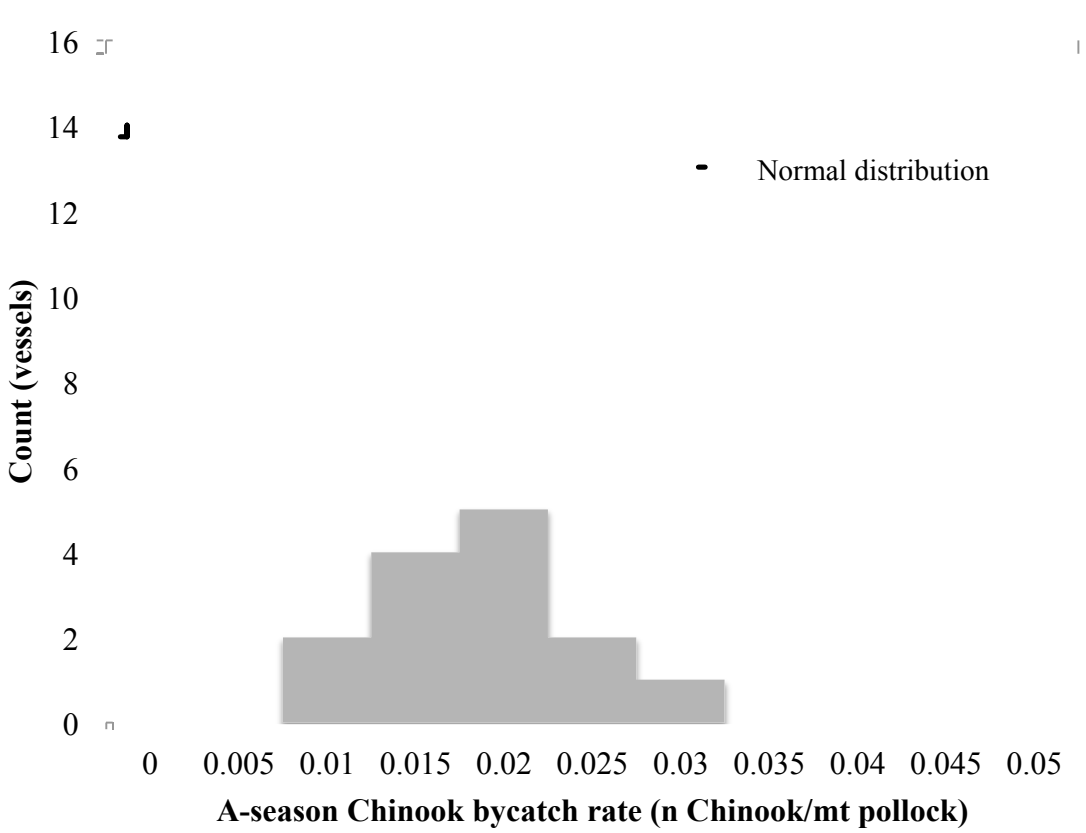

Figure 6. A-Season CP Vessel Chinook Bycatch Rate Frequency Distribution for 2015.

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 2015 during the time period where Chinook are 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 2015—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.

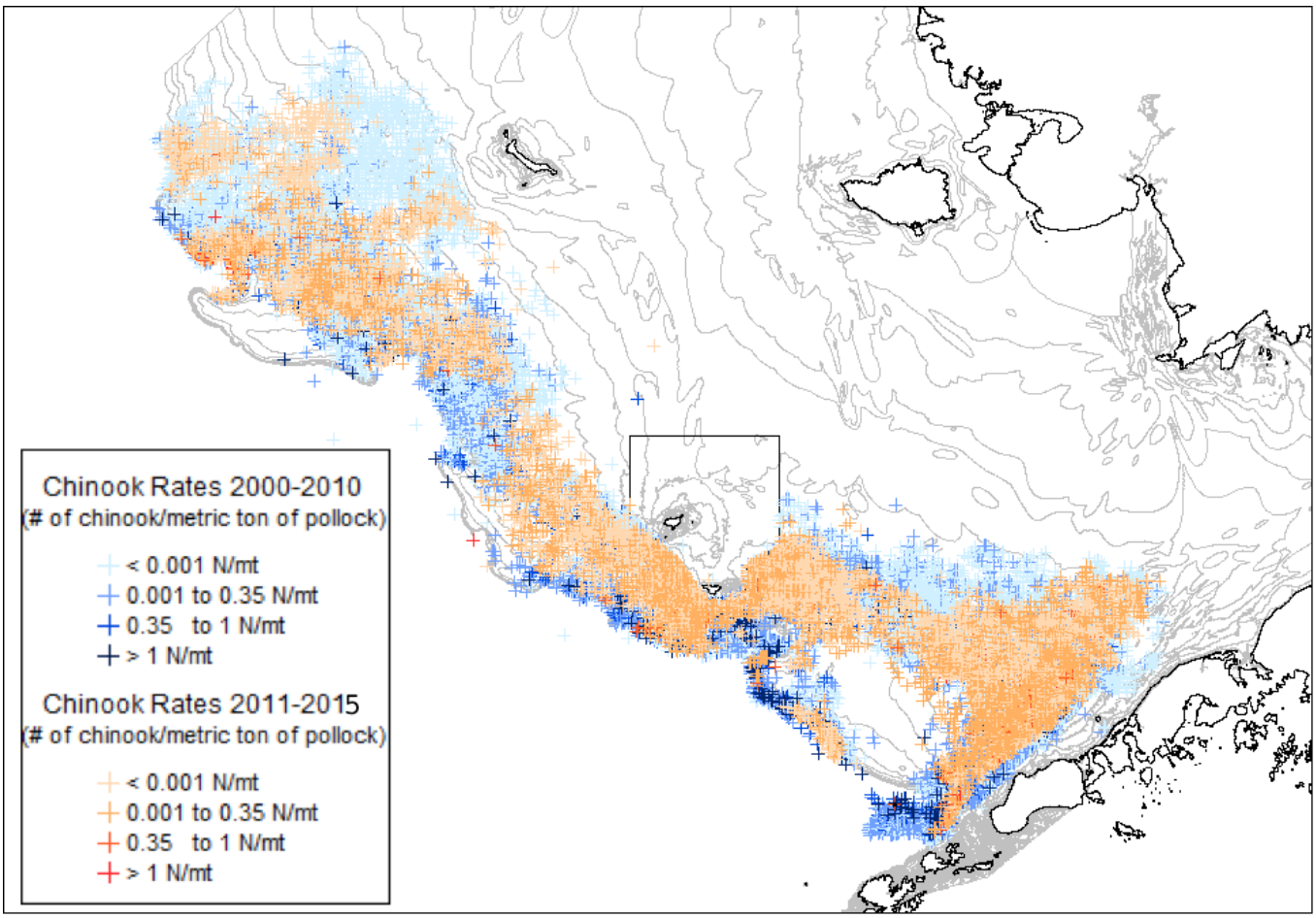

Figure 7. Pollock CP trawl locations between September 1st and February 28th for the years 2000-2010 (blue), 2011-2015 (orange). Darker color indicates higher Chinook bycatch rates.

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.

Under the RHS program, several BAA were designated for the CP fleet during the 2015 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.

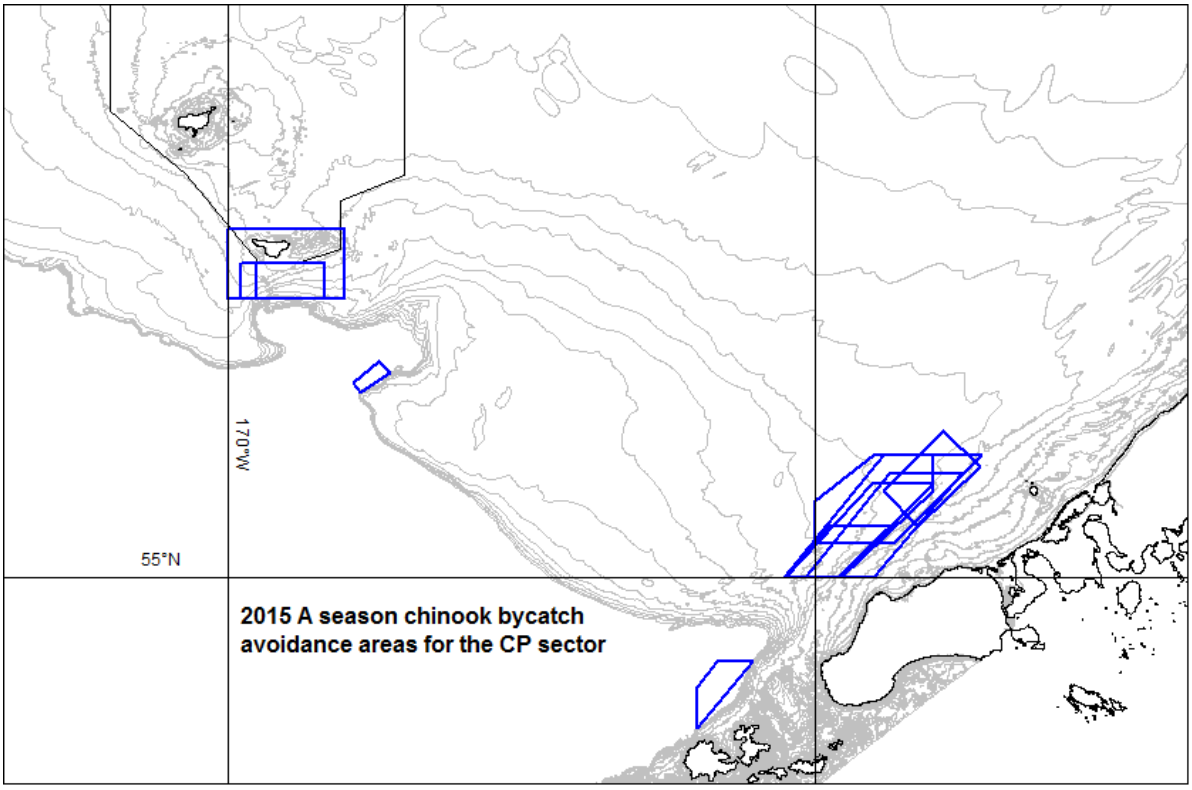

Figure 8. Chinook bycatch avoidance areas for the CP sector, A-season, 2015.

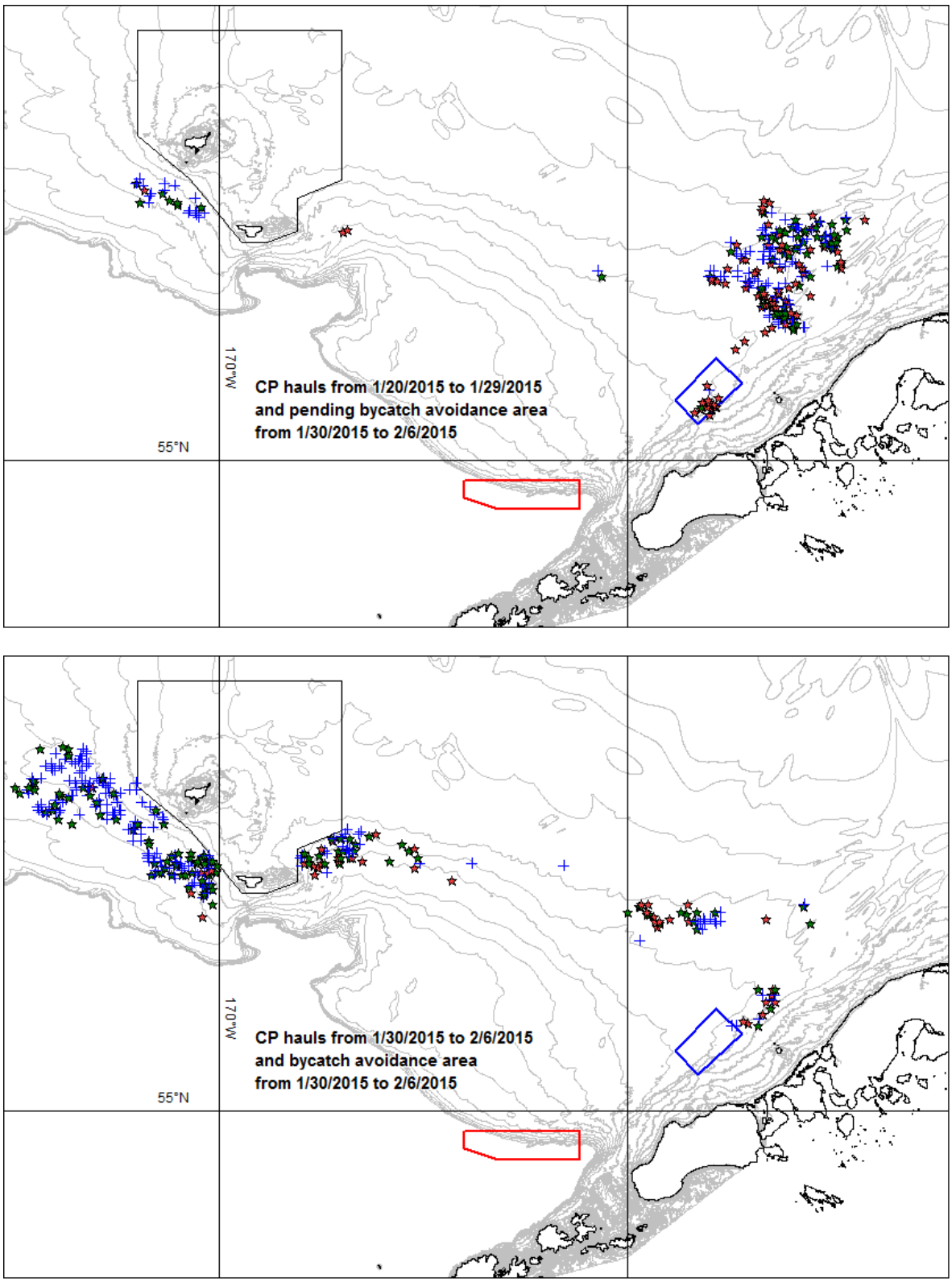

Figure 9. Shows CP movement caused by BAAs for the week of 1/30/15.
Top panel: Only 14 trawls triggered BAA. Bottom Panel: Only 4 vessels were required to fish outside the BAA, however all trawls occurred outside the BAA.

Table 5 shows the A-season weeks of 2015 and the number of vessels excluded from designated bycatch avoidance areas during each week. There were a total of eleven CP BAA during the 2015 A-season and one CP BAA for the B-season, however no vessels were prohibited from fishing in the BAA. There were also no vessels subject to an extended (2-week) fishing prohibition during 2015.

Table 5. Number of CP vessels excluded from designated bycatch avoidance areas during the 2015 A-season.

Week	1/29	2/05	2/12	2/19	2/26	3/05	3/12	3/19	3/26	4/02
Number of CPs excluded from BAAs	4	1	0	4	7	2	1	0	0	0

NEW 2015 IPA Amendments

The CP IPA No. 2 was amended in December 2014 for implementation in 2015. Two primary amendments were new for the 2015 fishing year: an incentive for a vessel to avoid appearing in the worst ten percent of bycatch performance three seasons in a row and the required use of a salmon excluder. New amendments were proactively adopted to address ongoing concerns of low Chinook salmon returns to Western Alaska river systems in recent years.

The disincentive to chronic vessel poor bycatch performance 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. The disincentive to 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 these four seasons, six unique vessels have been designated an “outlier”, three in 2014-A and one in each season since.

The amended incentive plan agreement also requires all vessels to use a salmon-excluder trawl for all trawls made during the A-season, and for all trawls made during September and October during the B-season. The periods during which vessels must use salmon-excluder trawls were determined from analysis of catch records, and reflect the periods when Chinook salmon are likely to be encountered by the fishery. A salmon-excluder trawl is defined as a pelagic trawl that contains at least one clear opening no smaller than one square meter in size, located in the aft (small mesh) portion of the trawl, and designed specifically to allow salmon to escape the trawl with a minimum of injury. Experiments measuring the effectiveness of salmon excluder trawls are described below.

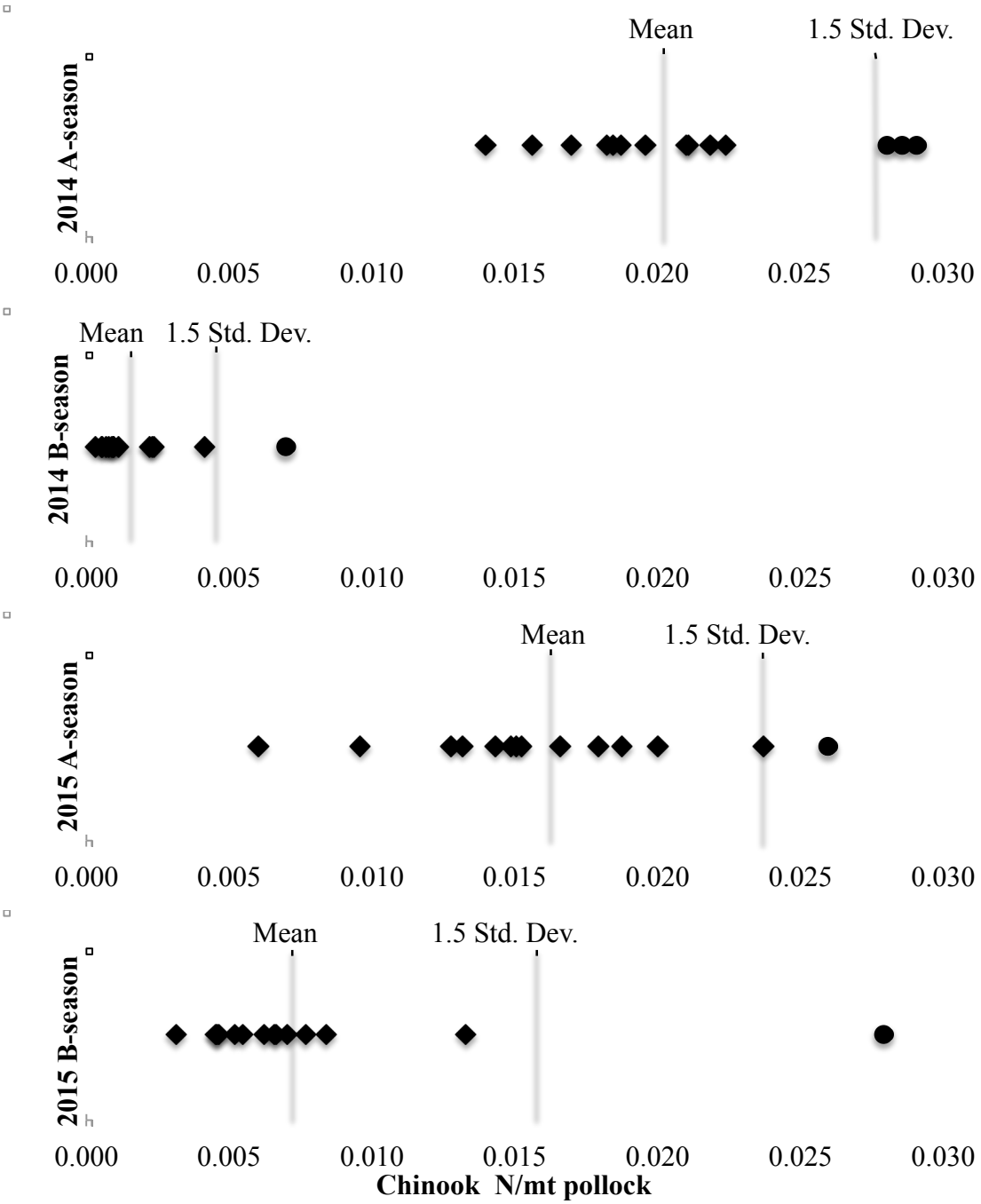

Figure 10. Fleetwide Chinook bycatch ratio distribution for 2014-2015 fishing seasons. Circles denote outlier vessels.

Figure 10 above shows the relative performance of the fleet for the 2014 and 2015 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 the minimum being one vessel. During the 2014 B-season, the vessel with the worst bycatch performance had a rate of just 0.007 while the worst vessel in the 2015 B-season had a rate of 0.028. The high rate of the worst vessel in the 2015 B-season relative to the fleet was due to fishing effort that occurred late in the

B-season when Chinook abundance was highest. The new disincentive to chronic poor bycatch performance has proven effective in its first full year of implementation—no vessel has been a repeat outlier in the past four 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.

Use of New Gear Technologies

During 2015 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.

Efforts began with the testing of a prototype titanium trawl camera from MacMarine Incorporated (MMI) aboard the F/T Northern Jaeger during the Pacific hake fishery in May. The camera incorporated a 4-LED array and a Mobius ActionCam HD wide-angle lens camera and DVR combination. The Mobius was developed by a group of radio-controlled aircraft enthusiasts and is expected to be available in its current form for several years.

Hake fishing occurred in deep, clear water (250 fathoms) and the Mobius delivered sharp 720p video with the capability to track fish movements 10-15 meters away with the use of an auxiliary light (Figure 11 top panel). Unfortunately the port seals on the pressure tube failed on the fourth deployment. The MMI prototype was then brought to the Sexton Corporation, a maker of custom underwater housings located in Salem Oregon. Sexton agreed to design and manufacture a prototype aluminum camera based on the MMI prototype and employing the Mobius ActionCam HD, and two prototype, dual-LED-array cameras were delivered in July. In addition, during the 2014 B-season it was determined that chum salmon are attracted to camera light, and so a modified Swan Net USA salmon-excluder flapper-panel was constructed to determine whether chum salmon escapes could be produced using camera light. The modified flapper panel (Jaeger flapper) incorporated a second escape port located just aft of the camera light location (Figure 11 bottom panel).

The Sexton trawl cameras and the Jaeger flapper were evaluated aboard the F/T Northern Jaeger during August-September. Initial trials of the Sexton cameras revealed that LED light inside the pressure tube entered the camera port such that the video could not be used to evaluate salmon escapes. Makeshift Styrofoam light baffles were made by the vessel crew to limit the LED light entering the camera port and with this modification video was obtained to evaluate salmon escapes. Trials of the Jaeger flapper revealed that the second escape port was poorly formed and constructed out of a web that promoted consistent "gilling" of small pollock, which served to obstruct further an already too-small escape path. Nevertheless several conclusions were made concerning its performance. First, as with trials of other small, "scoop-shaped" escape ports located in a trawl top panel, the second escape port (with light) produced many small-pollock escapes (Figure 12). Second, the trials confirmed that chum salmon are attracted to the camera light and that it is possible to entice chum salmon to escape the trawl through a small, poorly formed escape port clogged with gilled pollock (Figure 13).

The Sexton cameras were returned for remanufacture during October to address several design failures, and the remanufactured prototypes were returned during December in preparation for a second

field trial during the 2016 pollock A-season. In the meantime, MMI designed an improved port housing that will incorporated into a trawl camera to be tested during 2016. In December the PCC approved a 2016-2017 gear research budget that contained funding for Swan Net USA to redesign the Jaeger flapper, and the reworked version is slated for evaluation during the 2016 pollock B-season.

During the 2014 B-season a series of experiment protocols was developed to conduct escape experiments aboard PCC vessels while engaged in commercial fishing operations. The experiments involve placing a trawl camera on top of the trawl about 2 meters forward of the salmon-excluder escape port. The camera light serves to attract salmon to the escape port, and the camera records the number of salmon that escape. The number of salmon escapes is then combined with the known salmon bycatch to determine an escape fraction. Because the camera location is outside of the trawl, the deck crew is able to quickly deploy and retrieve the camera during fishing operations.

During the 2015 B-season the F/T Starbound implemented the experiment protocols using trawl cameras borrowed from the Alaska Fishery Science Center and salmon lights developed by WESMAR in Woodinville, Washington. Experiments were conducted over six fishing trips although one of the cameras failed during trip five, and so only results from the first four trips are comparable. For these experiments the camera light was used to attract salmon to the escape port. After the camera failure, activities on trips five and six involved mainly trials to investigate salmon behavior in response to various placements of the WESMAR salmon light in the vicinity of the escape port.

Table 6 shows preliminary results from the experiments on the F/T Starbound. For just about every escape, a chum first appears swimming near the leading edge of the escape port, and the first move it makes is to swim toward the camera light. Virtually every chum did this. Large chum generally swim forward, arriving very close to the light, and many bump it before escaping. The camera light appears to draw the chum out of the escape port and far enough forward that even those that can't seem to swim forward far enough to reach the light end up "drifting" upward and aft, passing over the top of the escape port — a vertical escape.

Results from the all the experiment trials 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. A 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.

Table 6. Salmon light experiment results by fishing trip, F/T Starbound, 2015 B-season.

Trip Date (d/m)	Observed Trawls (n)	Trip Longitude (° ‘ W)	Av. Bottom Depth (fathom)	Av.Trawl Duration (hrs)	Chum Bycatch (n)	Chinook Bycatch (n)	Salmon Escapes (n)	Escape Fraction (n/n)
6-11/06	23	174 00 - 177 00	77	3.8	59	6	16	0.27
22-30/06	27	167 30 - 172 00	81	4.4	122	3	38	0.23
3-11/07	20	168 00 - 174 30	70	4.3	90	0	80	0.47
14-22/07	22	167 30 - 172 00	74	4.0	482	6	65	0.12

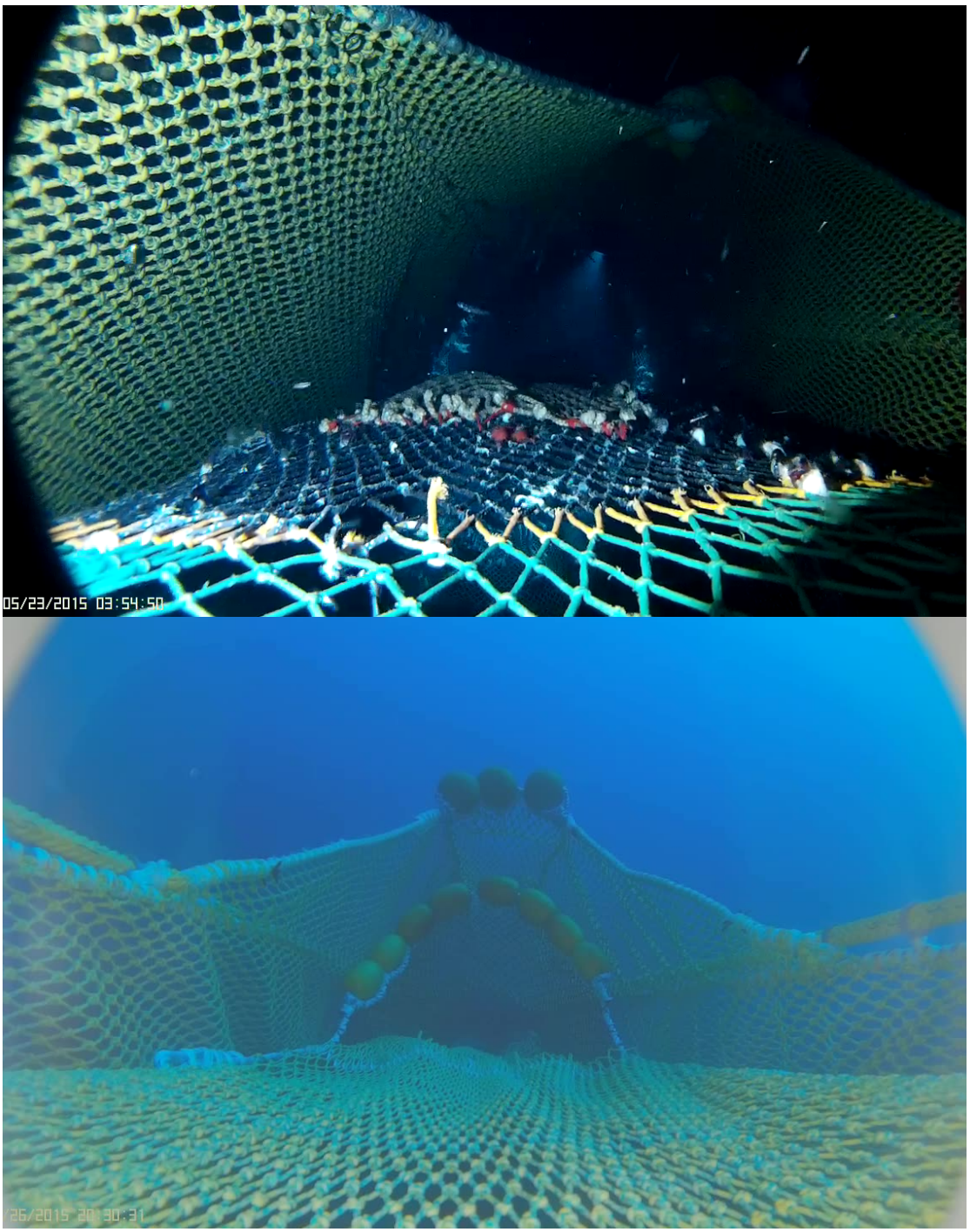

Figure 11. Swan design salmon excluder, view aft with auxiliary light during hake fishery (top) and Jaeger flapper trials during pollock B-season (bottom).

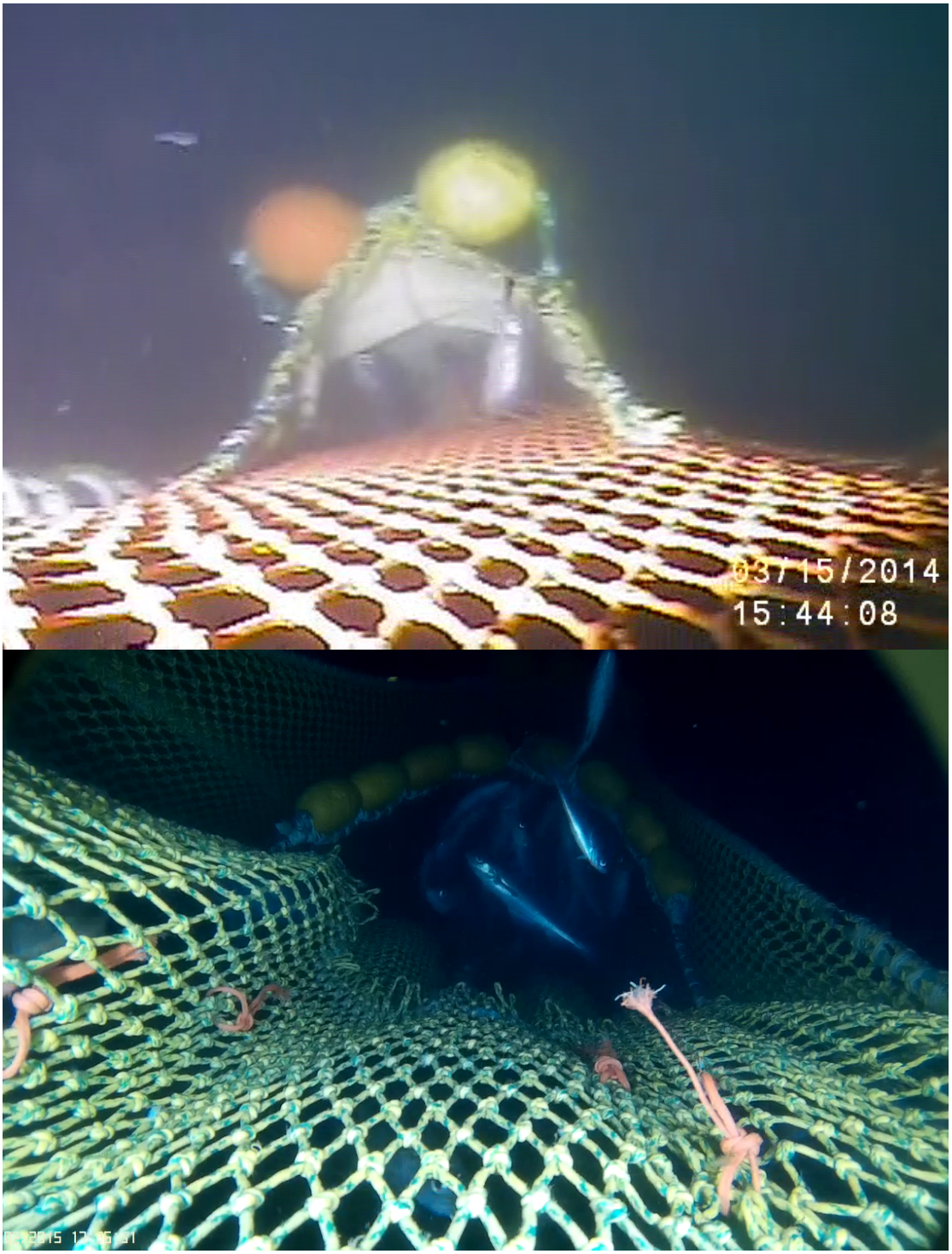

Figure 12. Small pollock escaping from a scoop-shaped escape port on the trawl top panel (top, F/T Northern Hawk) and from the second escape port of the Jaeger flapper (bottom, F/T Northern Jaeger).

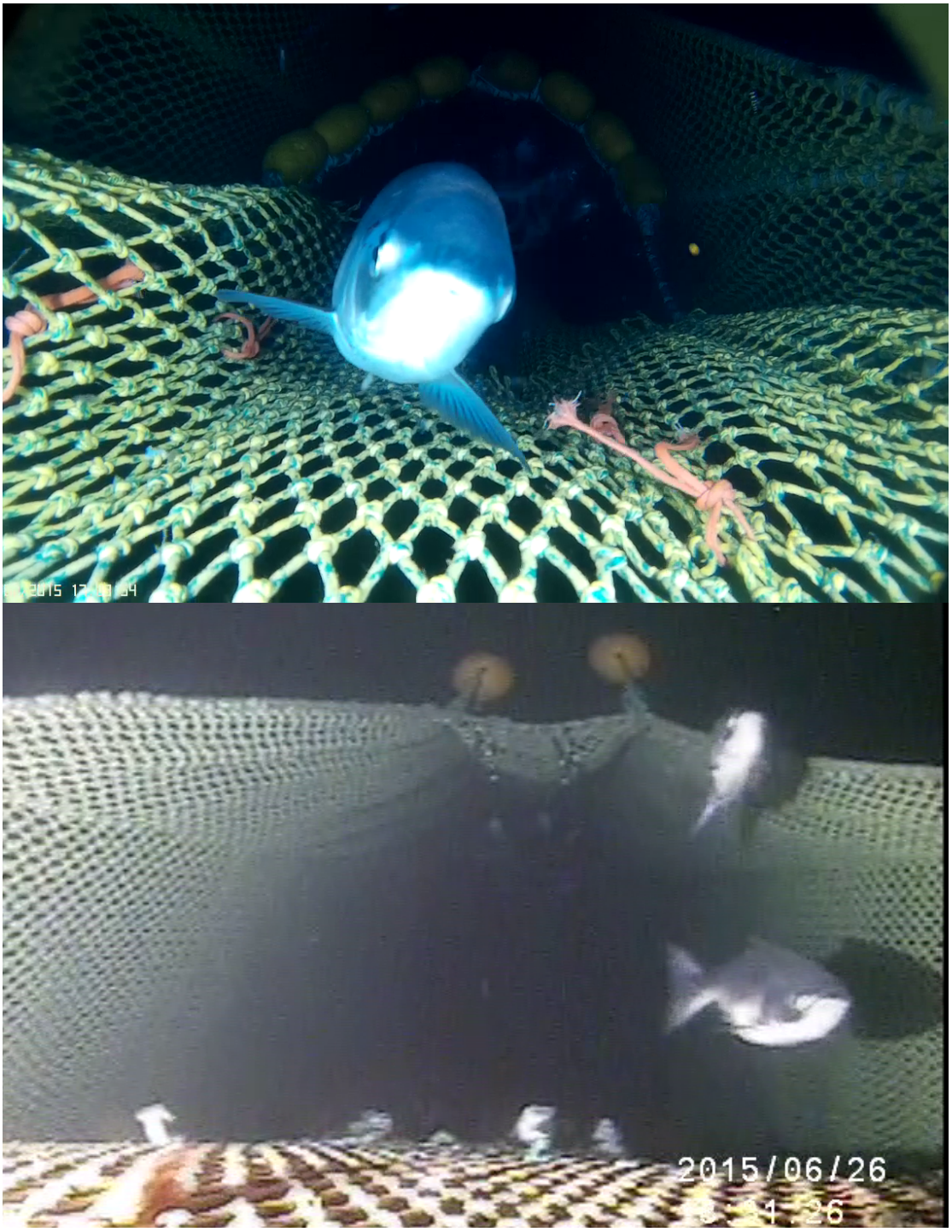

Figure 13. Chum salmon escaping the trawl via the second escape port of the Jaeger flapper (top) and during experiments on the F/T Starbound (bottom).