Final

Environmental Assessment

For Issuing an Exempted Fishing Permit for the Purpose of Testing a Salmon Excluder Device in the Eastern Bering Sea Pollock Fishery

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Abstract: This Environmental Assessment analyzes alternatives on issuance of an exempted fishing permit for continued testing of a salmon excluder device in the Bering Sea pollock trawl fishery. The experiment would be conducted from the winter pollock A season in 2015 through the winter A season, 2016. The pollock trawl fishery catches up to 95 percent of the Chinook salmon taken incidentally as bycatch in the Bering Sea groundfish fisheries. Salmon excluder devices reduce salmon bycatch in the pollock fishery, reducing potential effects on the salmon stocks and the cost to the pollock fishing industry. This EFP would allow the development and testing of a new excluder design to reduce both Chinook salmon and chum salmon bycatch rates without significant negative effects on pollock fishing. The proposed action is not expected to have significant impacts on the human environment.

List of Acronyms and Abbreviations

ABC	acceptable biological catch
ADFG	Alaska Department of Fish and Game
AFSC	Alaska Fisheries Science Center
BSAI	Bering Sea and Aleutian Islands
CAS	Catch Accounting System
CFR	Code of Federal Regulations
Council	North Pacific Fishery Management Council
CP	catcher/processor
CV	catcher vessel
CWT	coded-wire tag
DPS	distinct population segment
E.O.	Executive Order
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	essential fish habitat
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESU	endangered species unit
FMA	Fisheries Monitoring and Analysis
FMP	fishery management plan
FONSI	Finding of No Significant Impact
FR	*Federal Register*
FRFA	Final Regulatory Flexibility Analysis

GOA	Gulf of Alaska
ID	Identification
IRFA	Initial Regulatory Flexibility Analysis
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
mt	metric ton
NEPA	National Environmental Policy Act
NMFS	National Marine Fishery Service
NOAA	National Oceanographic and Atmospheric Administration
NPFMC	North Pacific Fishery Management Council
PBR	potential biological removal
PSC	prohibited species catch
RFA	Regulatory Flexibility Act
RFFA	reasonably foreseeable future action
RIR	Regulatory Impact Review
SAFE	Stock Assessment and Fishery Evaluation
SAR	stock assessment report
SRKW	Southern Resident killer whales
TAC	total allowable catch
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service

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Executive Summary

The purpose of this action is to allow the continued development and testing of a salmon excluder device for the eastern Bering Sea pollock trawl fishery. Chinook salmon *(Oncorhynchus tshawytscha)* and non-Chinook salmon (primarily chum salmon, *O. keta)* are caught incidentally in Alaska groundfish fisheries, primarily in the walleye pollock (*Theragra chalcogramma)* trawl fishery. Salmon are a prohibited species in the groundfish fisheries (50 CFR 679.21) with annual limits placed on the number of Chinook and non-Chinook salmon taken in the Bering Sea and Aleutian Islands (BSAI) pollock trawl fisheries.

Chinook salmon bycatch in the Bering Sea pollock fishery is managed under a system of two prohibited species catch (PSC) limits (60,000 Chinook salmon and 47,591 Chinook salmon), allocations among the Bering Sea pollock fishery sectors, inshore cooperatives, and Community Development Quota (CDQ) groups, and other measures designed to minimize bycatch below the higher PSC limit. Attainment of a Chinook salmon PSC allocation closes directed fishing for pollock in the Bering Sea subarea.

The impetus to manage Chinook salmon bycatch with a PSC limit came in part from relatively high levels of Chinook bycatch in the Bering Sea pollock fishery in 2007 where a record number of Chinook salmon of 121,770 fish were taken. This high level of bycatch occurred even though the rate of Chinook salmon bycatch was reduced by the intercooperative agreement (ICA) salmon hot spot closures Amendment 84, November 28, 2007 (72 FR 61070, October 29, 2007). These PSC limit caps became effective in 2011 as part of Amendment 91 to the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area (Amendment 91, 75 FR 53026, August 30, 2014).

Non-Chinook salmon (chum salmon) bycatch numbers increased to a historic high of 705,558 chum bycatch in the BSAI pollock fishery in 2005. While the North Pacific Fishery Management Council (Council) is considering additional bycatch control measures for chum bycatch, potential solutions are complicated by the issue of how chum salmon bycatch reduction measures could affect the success of Amendment 91 measures in place to reduce Chinook bycatch. Additionally, based on available genetic stock of origin information for chums taken as bycatch, a significant proportion (as much as 59%) appear to be comprised of fish originating from Asia that overlap in their ocean phase with chum salmon from the Gulf of Alaska and western Alaska river systems (Vulstek Kondzela, Marvin, Whittle, and Guyon 2014).

Currently, chum bycatch in the Bering Sea is managed under the non-Chinook salmon PSC limit in the Catcher Vessel Operating Area, which is 42,000 fish between August 15 and October 14. Exceeding this limit triggers the closing of the Chum Salmon Savings Area (50 CFR part 679 Figure 9) for certain time periods to protect salmon. Currently, pollock fishery participants are exempt from these closures by voluntarily participating in an ICA for reducing chum salmon bycatch. Since the fall of 2006, members of the ICA are required to move out of salmon hot spots to reduce the rate of salmon bycatch. Pollock also occurs in these chum salmon bycatch hot spots, and closure of these areas may result in added expense to the pollock fishing industry.

Based on testimony to the Council in 2013 from representatives of all sectors of the pollock fishery, the majority of pollock fishermen in the Bering Sea are using salmon excluder devices on a regular basis as part of the overall set of steps taken by the fishery to reduce its salmon bycatch under the Chinook PSC limits and bycatch avoidance incentive programs in place in the fishery. An effective salmon excluder would allow fishermen to fish in areas with attractive pollock catch rates where some salmon are thought to be mixed in with the pollock. This would reduce fuel costs and downtime associated with relocating the vessel to different fishing areas, while controlling bycatch rates.

The “flapper style” excluder reported to be in the widest use in the Bering Sea pollock fishery (the design that was the main focus of exempted fishing permit (EFP) 11-01 has been shown in field tests to reduce Chinook catch rates by 25%-35%; however, the testing has also shown that the device fails to deliver significant reduction in chum salmon bycatch rates. Additionally, the performance of the “flapper style” excluder in reducing Chinooks has been variable in EFP trials as well as in fishermen’s reports. The flapper excluder requires fine tuning of weighting placed on the flapper panel to achieve the desired shape at regular towing speeds. The most likely explanation for variability in excluding Chinook salmon appears to be the relative differences in horsepower and fishing practices between vessels/fishermen. Outreach and tuning of the excluder is problematic as virtually every vessel needs to verify weighting.

While an excluder that works reasonably well for Chinook has been developed (subject to the limitations described above), performance for reducing chum salmon bycatch has lagged behind. A salmon excluder that is effective for both Chinook and chum salmon would preclude the need for fishermen to switch devices when one species was likely to be more prevalent in the catch. A single excluder for both species would also be the best approach for areas and times when both species could be expected to be taken as bycatch (e.g. mid to late fall months).

The primary objective of the research will be the development and testing of a new excluder design referred to as an over and under or (O/U) excluder. Preliminary trials in the Bering Sea (Fall 2012) and Gulf of Alaska (Fall 2013) suggest this device reduces both Chinook salmon and chum salmon bycatch rates without significant negative effects on pollock fishing. Additionally, early evidence suggests that some of the practical problems associated with fleet-wide adoption of the flapper excluder are lessened or perhaps eliminated to a large degree with the O/U excluder. These expectations for escapement performance and decreased need for vessel-specific tuning of the device are, however, based only on preliminary (although certainly suggestive) results.

To date, the only systematic testing of the O/U excluder in the Bering Sea in Fall 2012 involved a “beta” version of the device and testing in areas where there was only chum salmon and pollock catch rates were relatively low. This preliminary testing showed a 20% chum escapement rate with very low pollock escapement. It is important to keep this preliminary result in context as well given that the testing did not cover a broad set of the fishing conditions and vessel horsepower differences reflective of the Bering Sea pollock fishery. Likewise, in an EFP test of the O/U on a GOA pollock trawler (90 ft vessel) conducted in the fall of 2013, 40% Chinook escapement occurred with approximately 3% pollock escapement. The applicability of the result to the Bering Sea pollock fishery is questionable due to the towing speed and other aspects of this GOA test. However, there is the potential for effective performance for Chinook salmon provided one keeps in mind the context of the GOA testing in terms of vessel horsepower and towing speed differences. Perhaps most important from the results of the two tests on the O/U excluder was the reported ease with which the device attained the desired shape at towing speeds with little or no need to make adjustments in weighting an floatation (Gauvin, personal communication, February 14, 2014). This along with the preliminary results for salmon escapement underscore the potential benefit from the research described in the EFP application.

To facilitate the development and testing of salmon excluder devices, federal regulations require an EFP (50 CFR 679.6). The applicant has tested several salmon excluder designs in cooperation with the Alaska Fisheries Science Center, applying a peer reviewed and sound experimental design process. For this EFP application, the applicant for the EFP has worked with the Alaska Fisheries Science Center to develop a scientifically sound experiment to test the excluder device. Exemptions are needed from fishery regulations regarding total allowable catch, PSC limits, observers, and the closures of the salmon savings areas to permit the applicant to collect data required to meet the experimental plan for testing the device. Only one EFP application has been received that meets the experimental plan. Based on receipt of only one application that meets the needs of the experimental plan, the alternatives for this proposed action are limited to Alternative 1 (status quo) and issuing the EFP under Alternative 2 (preferred alternative).

The analysis of the proposed action determined that the experiment would have no significant impacts on target groundfish species, prohibited species, and marine mammals. The impact of future actions under Alternative 2 could potentially be beneficial economically to those involved in the pollock fishery. While the amount of future use of the salmon excluder device cannot be determined, more than half of the Bering Sea pollock trawl catcher vessels are estimated to use salmon excluders (Gauvin personal communication, February 14, 2014). Alternative 2 is preferred over the status quo because it would allow for the continued development and testing of the salmon excluder device in a scientific manner, potentially leading to the reduction of salmon bycatch in the pollock trawl fishery.

1 Introduction

The proposed action is the issuance of an exempted fishing permit (EFP) under 50 CFR 679.6 to Gauvin and Associates, LLC, to allow exemptions from certain fishery regulations under 50 CFR Part 679. These exemptions are necessary to facilitate the continued development and testing of a salmon excluder device for pollock trawl gear in the Bering Sea. The EFP would be effective from January 1, 2015 through June15, 2016, to provide for testing under fall and winter conditions and to allow for enough tows with the device to gather sufficient data to meet the statistical requirements of the experiment. Details of the exemptions provided by the EFP are in chapter 2, and the experimental design is detailed in Appendix A.

1.1 Project Area

The experiment is limited to the eastern Bering Sea management area in the locations commonly used by catcher vessels and catcher/processors to harvest pollock. Areas where the experiment will be conducted include locations in the Chum Salmon Savings Area (Figure 1). One of the reasons for issuing the EFP is to permit experimental trawling in the salmon savings area and Catcher Vessel Operating Area (CVOA), regardless of closure status. The applicant for the EFP provided Figures 1 and 3 to show the areas where fishing under the EFP is most likely to concentrate (Gauvin 2013). Fishing in the horseshoe area near Unimak Island may occur in the winter or fall (Figure 2). Fishing in the canyons near the Pribilof Islands is likely to occur in the fall when pollock are dispersed north (Figure 3).

Figure 1 Chum Salmon Savings Area. From Figure 9 to 50 CFR part 679.

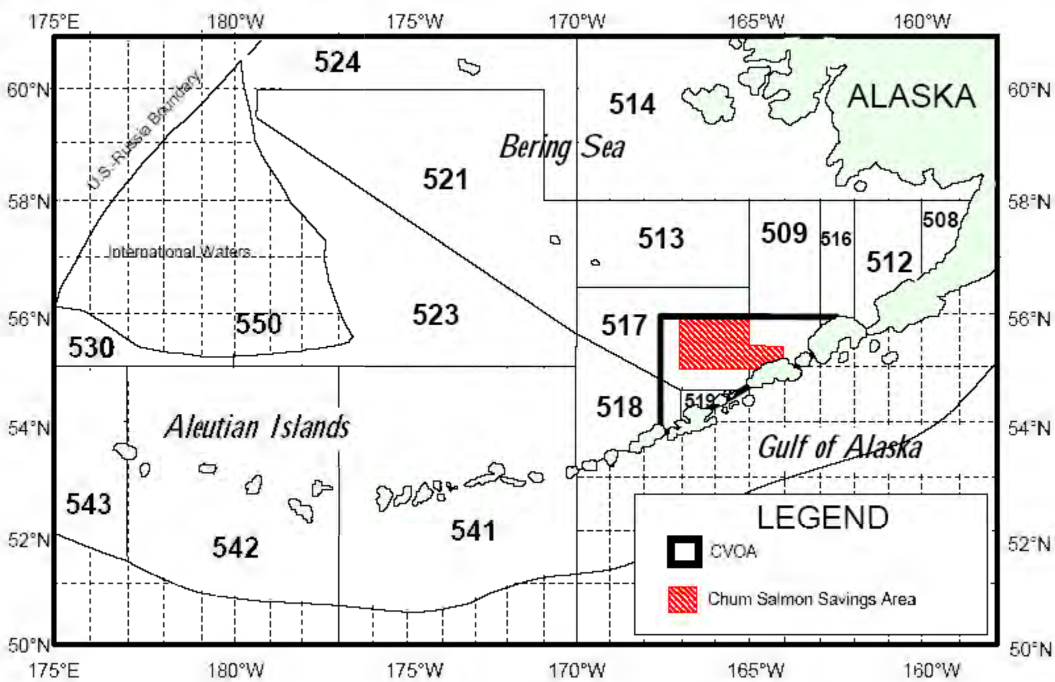


Figure 2 **Common pollock fishing areas adjacent to Unimak Pass (Gauvin 2010). Large island in center of figure is Unimak Island.**

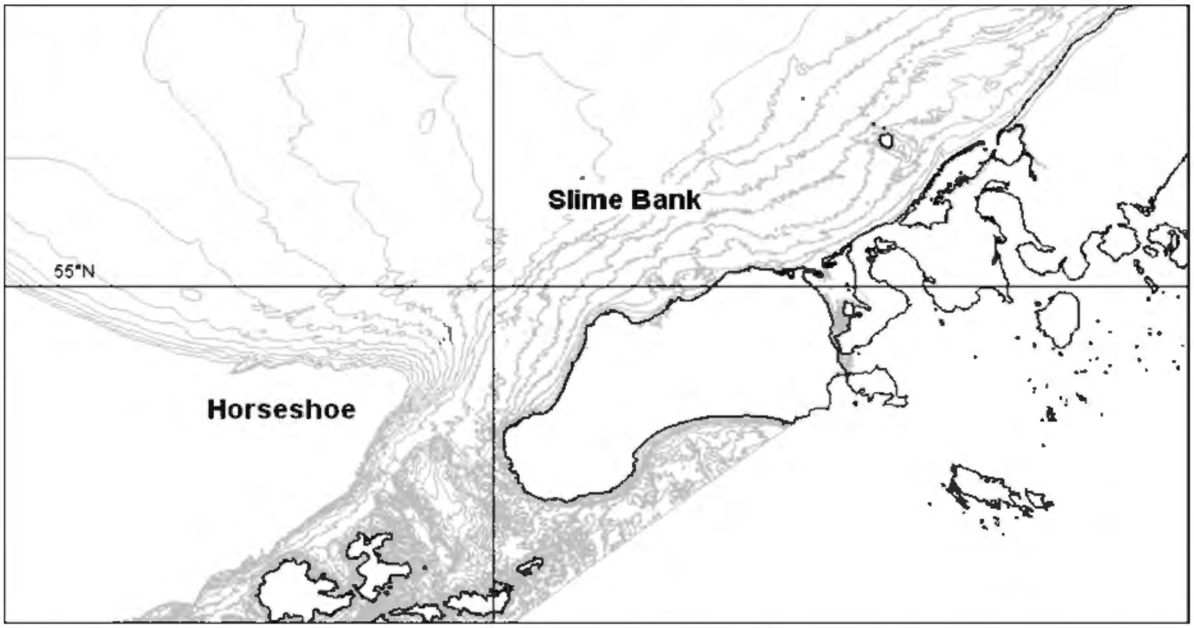
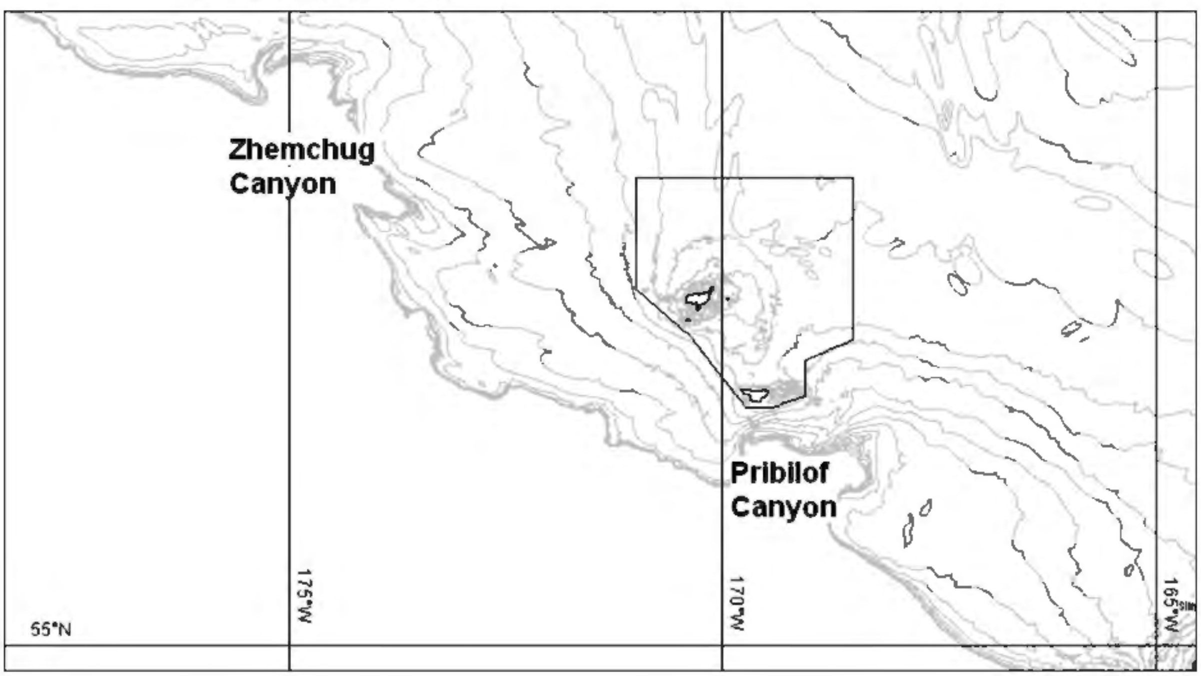


Figure 3 **Common fishing areas along shelf break of Pribilof Islands (Gauvin 2010). The Pribilof Islands Area Habitat Conservation Zone is shown by the box, closed to trawling.**



1.2 Purpose and Need for Action

The purpose of this action is to allow the continued development and testing of a salmon excluder device for the eastern Bering Sea pollock trawl fishery. Chinook salmon *(Oncorhynchus tshawytscha)* and non-Chinook salmon (primarily chum salmon *O. keta)* are caught incidentally in Alaska groundfish fisheries, primarily in the walleye pollock (*Theragra chalcogramma)* trawl fishery. This action is needed to develop an additional method for reducing salmon bycatch in the Bering Sea pollock fishery. Salmon bycatch in the Bering Sea pollock fishery is a great concern to those who depend on salmon resources in Alaska and Canada, and further reduction in salmon bycatch is desired by those who use salmon resources and by the pollock fishing industry. Salmon are a prohibited species in the groundfish fisheries (50 CFR 679.21) with annual limits placed on the number of Chinook and chum salmon taken in the Bering Sea and Aleutian Islands (BSAI) trawl fisheries. Exceeding these limits triggers reductions in Chinook salmon allocations and the closing of the CSSA for certain time periods to allow for protected areas for the salmon.

In January 2011, NMFS implemented Amendment 91 to the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area (FMP), to manage Chinook salmon bycatch (75 FR 53026, August 30, 2010). Amendment 91 includes two Chinook salmon PSC limits, 60,000 Chinook salmon and 47,591 Chinook salmon. The 60,000 Chinook salmon PSC limit is available to those who participate in an industry-developed incentive plan agreement (IPA) that provides incentives for each vessel to avoid Chinook salmon bycatch. Sectors are also held to a Chinook salmon bycatch performance standard of 47,591 Chinook salmon. More details on Amendment 91 are in Section 1.3.2 and the final Environmental Impact Statement (EIS) on Bering Sea Chinook Salmon Bycatch Management in December 2009 (Amendment 91) EIS, (NMFS 2009a).

In 2007, Amendment 84 to FMP was implemented (72 FR 61070, October 29, 2007) to exempt pollock fishery participants, in a voluntary intercooperative agreement (ICA) for salmon bycatch reduction, from the salmon savings areas closures in the BSAI. In 2010, the ICA was amended to apply to non-Chinook salmon because Chinook salmon are managed under Amendment 91. The ICA requires participants to avoid areas of high salmon bycatch rates through a voluntary rolling hot spot program (VRHS) managed by Sea State, Inc. When the rate of chum salmon bycatch becomes too high, the ICA requires certain vessels to stay out of areas of high salmon bycatch, depending on the vessel's salmon bycatch rates. More details on the ICA are in section 1.3.2, 1.3.3, and in NMFS 2007a.

NMFS and the Council continue to develop and analyze alternative measures to reduce salmon bycatch. NMFS, the Council, users of salmon resources, and environmental organizations all agree that salmon bycatch amounts in the BSAI pollock fishery must be reduced to the extent practicable. This EFP would continue to address this need for action by supporting the development of an additional or supplemental method for reducing salmon bycatch. Specifically, the modifications applied to this excluder design improves the probability that incidental catch of chum salmon PSC will be reduced compared with previous designs.

1.3 Background

This section provides historical information regarding salmon bycatch in the pollock trawl fishery, costs of salmon bycatch, and efforts to date to reduce salmon bycatch.

1.3.1 Historical Salmon Bycatch Information

From 1991 through 2013, an annual average of 42,899 Chinook salmon and 134,265 non-Chinook salmon (over 95% chum salmon) were incidentally caught in BSAI groundfish trawl fisheries (Table 1). Bycatch is primarily of juvenile salmon that are one or two years away from returning to the river of origin as adults. The 2007 Chinook salmon bycatch was the highest on record since 1990 for all BSAI groundfish fisheries and is estimated at 129,568 fish. Chinook salmon bycatch in the BSAI has declined in recent years to 15,999 in 2013. Approximately 95 percent of this bycatch occurred in the pelagic trawl fishery for pollock. From 2003 through 2006, non-Chinook salmon bycatch numbers increased to a historic high of 709,388 in 2005 and since 2006 has declined substantially (Table 1).

Table 1 Bycatch of Pacific Salmon in BSAI Groundfish trawl fisheries. Numbers of Fish

Year	Chinook	Non-Chinook
1991	48,880	30,262
1992	41,955	41,450
1993	46,014	243,270
1994	43,821	94,548
1995	23,436	21,875
1996	63,205	78,060
1997	50,530	66,994
1998	55,431	65,697
1999	14,599	47,132
2000	8,223	59,327
2001	40,547	60,731
2002	39,684	82,483
2003	53,571	191,150
2004	59,964	450,541
2005	74,266	709,388
2006	87,084	325,183
2007	129,568	97,348
2008	24,105	16,877
2009	13,796	47,130
2010	12,383	14,423
2011	26,672	192,902
2012	12,937	24,320
2013	15,999	126,999
Average	42,899	134,265

Source: NMFS Alaska Region Catch Accounting System (1/14/13)

Pacific salmon support large commercial, recreational, and subsistence fisheries throughout Alaska. Chinook salmon commercial harvests since 1970 have ranged from 281,000 fish (2013) to 877,000 fish (1982). Commercial Chinook salmon harvests in 2012 were 347,000 fish (ADFG 2014a). Chum salmon harvests since 1970 have ranged from 4,323,000 fish (1975) to 24,376,491 fish (2000). Chum salmon commercial harvests in 2013 were approximately 18,578,000 fish (ADFG 2014a). Although reduced salmon runs may be attributable to changes in ocean conditions (Hare and Francis 1995; Kruse 1998), considerable public concern has been raised as to the effect of low salmon returns on fishery dependent communities in western Alaska. Responding to the crisis in the salmon industry, the Governor of Alaska declared a state emergency on several occasions in the early 2000s. In recent years of low Chinook salmon returns, the in-river harvest of western Alaska Chinook salmon has been severely restricted and, in some cases, river systems have not met escapement goals. Because of low Chinook salmon returns, the state of Alaska reduced the 2008 commercial Chinook salmon harvest to 89 percent below the recent five-year average. No commercial Chinook salmon fishery was allowed in 2009 on the Yukon River. The state also restricted subsistence harvests. On January 15, 2010, Secretary of Commerce Gary Locke declared a commercial fishery failure for the Yukon River Chinook salmon due to low salmon returns (U.S. DOC 2010). On September 13, 2012, Secretary of Commerce Rebecca Blank declared a commercial fishery failure for the Yukon and Kuskokwim rivers and in the Cook Inlet due to low Chinook salmon returns during the 2012 fishing year and previous years U.S. (U.S. DOC 2012).

Surplus fish beyond escapement needs and subsistence uses are made available for other uses. Commercial fishing for Chinook salmon may provide the only source of income for many people who live in remote villages. Chum salmon is also an important subsistence resource for western Alaska (NPFMC 2011). In response to these concerns and ongoing incidences of salmon bycatch, the Council is continuing to review salmon bycatch management measures to reduce salmon bycatch to the extent practicable, as required by the Magnuson-Stevens Fishery Conservation and Management Act, National Standard 9. NMFS prepared the final EIS on Bering Sea Chinook Salmon Bycatch Management in December 2009 (NMFS 2009a). Chapter 3 of the Final Regulatory Impact Review (RIR) for Bering Sea Chinook Salmon Bycatch Management provides an overview of the importance of subsistence harvests and commercial harvests (NPFMC 2009a).

Two Chinook salmon stocks from the Pacific Northwest that are listed under the Endangered Species Act (ESA) may be taken in the BSAI groundfish fisheries: the Lower Columbia River and the Upper Willamette River Chinook stocks. On January 11, 2007, the NMFS Northwest Region completed a supplemental biological opinion for the BSAI groundfish fisheries, including an incidental take statement (NMFS 2007b). The 2007 amount of Chinook salmon bycatch (124,421 for trawl fisheries) was well above the range of observation cited in the 2007 incidental take statement (36,000 to 87,500 Chinook salmon for all BSAI groundfish fisheries). Under section 7 of the ESA, NMFS Alaska Region requested consultation on the changes proposed under Amendment 91. A supplemental biological opinion was completed on December 2, 2009, and provides a new incidental take statement that reflects the expected take of ESA-listed Chinook salmon under the management measures of Amendment 91 (NMFS 2009a).

1.3.2 Salmon Bycatch Reduction Measures

Salmon are listed as a prohibited species in the groundfish fishery management plans, meaning that they must be avoided at all times. Regulations implemented in 1994 prohibited the discard of salmon taken as bycatch in BSAI groundfish trawl fisheries until the number of salmon has been determined by a NMFS certified observer (59 FR 18757, April 20, 1994). Subsequent regulations allowed for voluntary retention and processing of salmon for donation to NMFS qualified distributors of food to underprivileged individuals (Prohibited Species Donation Program) (50 CFR 679.26)). Amendment 91(75 FR 53026, August 30, 2010) implemented new salmon retention requirements for catcher vessels, motherships and catcher/processors, to support salmon PSC limits under the salmon bycatch program (see Chapter 2, (NMFS 2009a). To ensure compliance with Amendment 91, these included an increase in observer coverage requirements for catcher vessels delivering to inshore processors so that one observer is required on all of these vessels, regardless of vessel length. Amendment 91 also implemented an actual count, or census, of all salmon bycatch be used as a basis for determining Chinook salmon bycatch by all vessels participating in the Bering Sea pollock fishery under the program.

Chum Salmon Savings Area (CSSA) and Chinook Salmon Savings Area (CHSSA)

Chinook salmon bycatch in the Alaska groundfish fisheries is generally higher in the winter and chum salmon bycatch is higher in the summer although this trend is not without exceptions. Based on this seasonal pattern, the Council has adopted extensive seasonal cap and closure measures to control salmon bycatch in the trawl fisheries (Witherell and Pautzke 1997). Starting in 1994, regulations established the CSSA, which is an area with historically high non-Chinook salmon bycatch (Figure 1) (50 CFR 679.21(e)(7)(vii)). In 1995, regulations established the Chinook Salmon Savings Areas (CHSSA) and mandated year-round accounting of Chinook salmon bycatch in the trawl fisheries (60 FR 61215, November 29, 1995). This prohibited species catch limit was divided between the CDQ and non-CDQ fisheries. The savings areas were adopted based on historic observed salmon bycatch rates and were designed to avoid areas with high levels of salmon bycatch.

The Council started considering revisions to salmon bycatch management in 2004, when information from the fishing fleet indicated that it was experiencing increases in Chinook salmon bycatch following the regulatory closure of the CHSSA. This indicated that, contrary to the original intent of the savings area closures, Chinook salmon bycatch rates appeared to be higher outside of the savings area than inside the area. While, upon closure, the non-CDQ fleet could no longer fish inside the Chinook Salmon Savings Area, vessels fishing on behalf of the CDQ groups were still able to fish inside the area because the CDQ groups had not yet reached their portion of the Chinook salmon prohibited species catch limit. Much higher salmon bycatch rates were reportedly encountered outside of the closure areas by the non-CDQ fleet than experienced by the CDQ vessels fishing inside. Further, the closure areas increased costs to the pollock fleet and processors.

Amendment 91

NMFS issued regulations to implement Amendment 91 to the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area (FMP) (75 FR 53026, August 30, 2010). Amendment 91 (NMFS 2009a) is an innovative approach to managing Chinook salmon bycatch in the Bering Sea pollock fishery that combines a PSC limit on the amount of Chinook salmon that may be caught incidentally with an incentive plan agreement (IPA) and performance standard designed to minimize bycatch to the extent practicable in all years. Under Amendment 91, the pollock fleet is prevented from exceeding the 60,000 Chinook salmon PSC limit in every year. Each year, NMFS will allocate the 60,000 Chinook salmon PSC limit to the mothership sector, catcher/processor sector, inshore cooperatives, and CDQ groups if an IPA is formed and approved by NMFS. The sector-level performance standard of 47,591 Chinook salmon is a tool to ensure that each sector does not fully harvest its Chinook salmon PSC allocation in most years. For a sector to continue to receive Chinook salmon PSC allocations under the 60,000 Chinook salmon PSC limit, that sector may not exceed its portion of 47,591 in any three years within seven consecutive years. If a sector fails this performance standard, it will permanently be allocated a portion of the 47,591 Chinook salmon PSC limit. All vessels choosing to not participate in an IPA would fish under a much lower portion of the 60,000 Chinook salmon PSC limit and would be ineligible to participate in management measures intended to offer flexibility to vessels harvesting pollock.

The IPA component and the performance standard, Amendment 91, as implemented by the final rule, has apparently contributed to a greater reduction of Chinook salmon bycatch over time than the PSC limits alone. Under this program, NMFS monitors all salmon bycatch by each vessel in the pollock fishery through a census, 100 percent observer coverage, and an expanded biological sampling program. Annual reports and the proposed economic data collection program are designed to evaluate whether and how incentive plans influence a vessel's operational decisions to avoid Chinook salmon bycatch. If information becomes available to indicate that Amendment 91 is not providing the expected Chinook salmon savings, NMFS will work with the Council to take additional actions to minimize Chinook salmon bycatch to the extent practicable. Amendment 91 applies only to management of the Bering Sea pollock fishery and does not affect the management of pollock fisheries in the Aleutian Islands or the status of pollock fishing in the Bogoslof District.

Amendment 91 also removed from regulations the 29,000 Chinook salmon PSC limit in the Bering Sea, the CHSSA in the Bering Sea, exemption from Chinook Salmon Savings Area closures for participants in the VRHS ICA, and Chinook salmon as a component of the VRHS ICA. The final rule did not change any regulations affecting the management of Chinook salmon in the Aleutian Islands or non-Chinook salmon in the BSAI.

Amendment 84

Amendment 84 to the FMP became effective November 28, 2007 (72 FR 61070, October 29, 2007). This amendment allows vessels participating in the directed fisheries for pollock in the Bering Sea to use their ICA to reduce salmon bycatch using the VRHS. The VRHS uses real-time salmon bycatch information to avoid areas of high chum bycatch rates. Parties to the ICA include all pollock fishing vessels, at least one third-party group representing western Alaskans who depend on salmon and have an interest in salmon bycatch reduction, and at least one private firm retained to facilitate bycatch avoidance behavior and information sharing. The VRHS uses a system of base bycatch rates, assignment of vessels to tiers based on bycatch rates relative to the base rate, a system of closures for vessels in certain tiers, and monitoring and enforcement through private contractual arrangements. Vessels participating in the salmon bycatch ICA are exempted from closures of the CSSA in the Bering Sea.

A salmon bycatch reduction ICA using the VRHS was approved by NMFS in January 2008, and an amendment to apply the ICA to non-Chinook salmon was approved in December 2010. Amendment 84 requires that parties to the ICA be the American Fisheries Act (AFA) cooperatives or the CDQ groups. All AFA cooperatives and CDQ groups participate in the VRHS ICA.

Under the ICA, the pollock fleet has developed its own private-sector arrangements to monitor salmon bycatch rates and relay the information back to the fishing vessels while they are at sea. Observer data and other reports are transmitted to analysts associated with the private firm, Sea State, Inc. Some of these reports are transmitted immediately from sea; some are transmitted at the time catcher vessels make their shoreside deliveries. Sea State, Inc., processes the data, identifies locations with high salmon bycatch rates, and informs the fishing vessels. Sea State, Inc., in cooperation with the ICA manager of United Catcher Boats, is authorized by the agreement to restrict fishing operations in high salmon bycatch rate areas if salmon catch exceeds a threshold level (there are limits on the total area that may be restricted in a week). Fishing operations are required, by the terms of their contract in the ICA, to limit their fishing activity in an area that is closed. The vessel limitations differ among the cooperatives; cooperatives whose skippers have been fishing with little salmon bycatch are limited less than those that have had higher bycatch. Cooperatives with high salmon bycatch may be prohibited from fishing in the restricted areas for a full week. The ICA is a contract imposing binding obligations on the cooperatives.

Irrespective of Sea State, Inc., reports, vessel operators will often conduct "test fishing" upon entering new areas. Test fishing involves taking short tows to see if salmon bycatch rates are high. Test fishing adds to the cost of fishing activity.

Additional Non-Chinook Salmon Bycatch Management Measures

The Council is continuing to evaluate management alternatives for non-Chinook bycatch and prepared a Preliminary Draft Environmental Assessment for Bering Sea Non-Chinook Salmon Bycatch Management and Preliminary Review Draft Regulatory Impact Review for Bering Sea Non-Chinook Salmon Bycatch Management (NPFMC 2011). The documents provide a preliminary analysis of alternative ways to manage chum salmon bycatch, including replacing the current CSSA and VHRS ICA in the Bering Sea with salmon bycatch limits or new regulatory closures. While additional bycatch control measures for chum bycatch are under consideration by the Council, potential solutions are complicated by how chum salmon bycatch reduction measures could affect the success of Amendment 91 measures in place to reduce Chinook bycatch. Additionally, based on available genetic stock of origin information for chum taken as bycatch, the majority appear to be comprised of hatchery origin fish from Asia that overlap in their ocean phase with wild chum salmon from western Alaskan river systems.

1.3.3 Costs Associated with Salmon Bycatch

The closures of areas to reduce salmon bycatch have the potential to impose significant costs on pollock fishermen operating in the Bering Sea. Costs would be imposed by closures of the salmon savings areas and salmon hot spots because closed areas often reduce fishing efficiency and can increase fuel usage by shifting fishing to more remote areas or areas with lower target catch rates. There are also the costs imposed by the PSC limits. In addition, there are the costs (e.g. higher fuel costs and potentially lower fishing efficiency) imposed on the industry as it takes steps to control its salmon bycatch. Furthermore, handling salmon bycatch creates costs for inshore fisheries.

Closed areas prevent the fleet from determining where to fish based on pollock distribution. Pollock also occurs in the salmon savings areas and in the salmon hot spots, and closure of these areas may result in added expense to the pollock fishing industry by moving the fleet to potentially less productive fishing grounds, decreasing catch per unit effort (CPUE). The ICA for reducing non-Chinook salmon bycatch is a voluntary program, which so far has included all pollock catcher vessels. If a vessel owner chooses not to participate in the ICA, then the salmon savings area closures would apply to that vessel.

Non-Chinook (chum) salmon bycatch is a problem during the summer. The Chum Salmon Savings Area (CSSA) is closed to pollock fishermen from August 1 to August 31, irrespective of the level of non-Chinook salmon bycatch. In addition, the CSSA will close immediately if fishermen reach a non-CDQ threshold of 37,506 fish in the catcher vessel operational area (CVOA) between August 15 and October 14.[1]

The pollock fishery vessels not participating in the VRHS also have to operate within a non-Chinook salmon cap of 42,000 fish in the CVOA between August 15 and October 14 (§ 679.21). In 2005, the pollock fishery exceeded the non-Chinook limit of 42,000 fish by taking 54,088 fish in the CVOA between August 15 and October 14. The CSSA falls completely inside the CVOA. Since no catcher/processors are allowed to fish in the CVOA during the B season (June through October)[2] the

[1] The chum PSC cap is 42,000 fish, 10.7% of which is allocated to the CDQ groups, and the remainder of which (37,506 fish) is allocated to the AFA.

[2] The BSAI pollock A season is from January to April, and the pollock B season is from June through November.

restriction on savings area fishing would have fallen entirely on catcher vessels. All vessels and CDQ groups that are participating in the Bering Sea pollock fishery in 2011, except one vessel, participate in the ICA.

Under Amendment 91, the sector-level performance standard of 47,591 Chinook salmon is a tool to ensure that each sector does not fully harvest its Chinook salmon PSC allocation in most years. For a sector to continue to receive Chinook salmon PSC allocations under the 60,000 Chinook salmon PSC limit, that sector may not exceed its portion of 47,591 in any three years within seven consecutive years. If a sector fails the performance standard, it will permanently be allocated a portion of the 47,591 Chinook salmon PSC limit. The IPAs under Amendment 91 contain management measures for Chinook salmon pollock fisheries in the Bering Sea that include identification of bycatch avoidance areas, Chinook salmon conservation areas, and pollock fishing prohibitions for vessels with poor bycatch performance.

By forcing catcher vessels off their preferred fishing grounds, the VRHS closures, CSSA closures, bycatch avoidance areas, and Chinook salmon conservation areas can reduce revenues or increase costs. Even if catcher vessels can continue to harvest as many pollock as before, they may face increased travel costs if the closures force them to move to new fishing grounds (which may be further from their delivery ports). Vessel operators may have to fish for pollock in areas where CPUE is lower, or they may be forced to fish on pollock stocks of lower quality (maybe on smaller fish). Pollock quality and its ex-vessel price can be reduced if fishermen on catcher vessels are forced by closures to fish further from delivery ports. Increased running time and increased time between harvest and processing can reduce the desirability of pollock. The quality of surimi grades for shoreside-processed pollock begin to decline as the time between harvest and delivery increases. Processors producing fillets prefer larger pollock than processors producing surimi. Any vessel fishing for a processor with a size preference may be forced off of desirable sized pollock and forced to fish for unsuitably sized pollock by an area closure (NMFS 2008a). Reductions in salmon bycatch rates during normal fishing activities (prior to closures) may reduce fishing costs for the industry because fewer salmon would need to be handled and disposed of as required by the fisheries regulations (50 CFR 679.21).

Costs of Present Management Measures

Based on anecdotal information from Incentive Plan Agreement reports, over half of the Bering Sea pollock trawl operations are now using salmon excluders. NMFS has no regulations requiring the use of these devices in Alaska groundfish fisheries. The voluntary use of salmon excluders by pollock trawlers in the Bering Sea suggests that vessel owners believe they are benefiting from the use of these devices. While the cost and benefits of excluder use are difficult to quantify, documentation of salmon exlcuders in previous experiments demonstrate that they involve costly modification of trawl gear, and increased operational costs for participants in the pollock fishery. Presumably operators would either not install or would remove these devices if they did not realize a cost-offsetting benefit for their use.

Some reasons for the frequent voluntary use of salmon excluders are as follows: An effective salmon excluder device would reduce bycatch thereby lessening the potential for exceeding the PSC limits and reduce the potential for constraints being placed on the trawl fisheries due to exceeding salmon PSC limits. Salmon excluders may mitigate or reduce costs of triggered or “hot spot” closure areas for salmon by allowing fishermen to utilize these areas with a lower bycatch rates hence lowering the probability that hotspots closures are needed or that thresholds for triggered closures are attained.

Voluntary or contractually obligated changes in fishing patterns impose costs on pollock fishermen similar to those costs involved in caps and the closures of the CSSA (borne by both catcher processors and catcher vessels). Reductions in salmon bycatch rates associated with successful development of the salmon excluder device will reduce the costs of this system and make it more cost effective. Excluder devices would reduce the salmon catch associated with initial inadvertent discovery of hot spots. Excluder devices also will slow the rate of salmon catch in hot spots in the interval between the time the hot spot is identified and the time the fleet can be notified of the salmon hotspot and directed away from it or restricted from fishing on it. It may be possible to fish in areas that would otherwise have to be closed if the excluder device lowers salmon bycatch rates sufficiently. Finally, some salmon bycatch would take place in normal fishing operations outside of hot spots. Successful development of an excluder device would reduce salmon bycatch associated with these operations.

Cost of Salmon Bycatch to Salmon Fisheries

Salmon caught by the pollock fleet will not return to their natal waters and will not become available to the fisheries exploiting those waters. Returning salmon are used in subsistence, commercial, and recreational fisheries and for escapement and investment in future stocks. Changes in trawl technology that reduce bycatch rates will increase the numbers of salmon returning to these uses. Reductions in salmon bycatch in the pollock fishery will not translate directly into one-to-one increases in salmon available for United States inshore uses for two reasons: the increased return to United States fisheries will be less than the reduction in trawl salmon harvest since many of the bycaught salmon originate in Canada or Asian waters and because many of the salmon may die from natural causes between the time they escape the trawl and the time they would otherwise have returned to those waters.

Fishing Industry Concerns Regarding Salmon Bycatch in Groundfish Fisheries

Trawl skippers have informally developed and tested excluder devices for bottom trawls for many years and considerable success has been attained with excluders to reduce halibut catches and footrope modifications to reduce catches of crab. While success with halibut and crab bycatch reduction through gear modification has been demonstrated Gauvin, 2013b, those modifications to bottom nets are mostly based on the principle of sorting out unwanted catches by size or avoiding capture based on differences in size between the target and the species being avoided.

The nature of the bycatch problem with salmon is complex and inherently difficult due to the unpredictable nature of salmon locations and movements. From a practical perspective, the pollock industry believes that one of the biggest problems with salmon avoidance is that areas of salmon concentration are often transitory. By the time such concentrations are identified, a relatively large number of salmon may have already been taken and salmon may have already moved to other locations. Overall, hotspot avoidance and other approaches have provided some success, but these efforts can only achieve success to the degree that salmon movements (and hence bycatch) follow some sort of predictable pattern (UCBA 2003).

The challenges of salmon bycatch avoidance itself, particularly in the context of the restrictive bycatch management measures in place, create costs for the pollock industry. This situation will undoubtedly be even more acute if salmon populations increase or environmental conditions change in the future to increase the overlap of Chinook and chum salmon feeding and migration routes with pollock fishing grounds. The potential effects of existing management controls on salmon bycatch are provided in the RIR for Bering Sea Chinook Salmon Bycatch Management for Amendment 91 (NMFS 2009a) and the Preliminary Review Draft Regulatory Impact Review for Bering Sea Non-Chinook Salmon Bycatch Management (NPFMC 2009 and 2011).

One further complication is that salmon avoidance is not the only constraint facing the pollock industry. The decision of where to fish is affected by other constraints. An important constraint on where pollock vessels might fish in order to avoid salmon are regulations to minimize competition between pollock removals and Steller sea lions (50 CFR 679.22). To avoid harvesting more than the allowable amount of pollock in Steller sea lion protection areas, fishing areas must be selected outside of Steller sea lion protection areas, even when salmon bycatch was relatively low in those areas. In some cases, this tradeoff can mean higher bycatch rates of salmon.

In addition, to be effective and to avoid injuring salmon (e.g. descaling), salmon escapement has to occur without the salmon contacting any components of the net itself. Salmon excluders function entirely based on differences in swimming characteristics of pollock and salmon. Developmental work on salmon excluders started in 2003; however, 10 years of work on salmon excluders may be a relatively short development horizon for a device that works through behavioral and swimming ability differences alone. The inherent difficulty of excluding salmon from a pollock net needs to be considered in assessing the progress to date and the remaining challenges outlined as part of this EFP.

1.3.4 Why Use an Exempted Fishing Permit to Develop a Salmon Bycatch Reduction Device and Evaluate Its Performance?

EFPs are an effective way to develop bycatch reduction gear by allowing for systematic testing under a rigorous experimental design. In the experience of the fishing industry, informal efforts to test net modifications in an *ad hoc* manner are not efficient because a fisherman typically work independently and tend not to test modification concepts systematically. While fishermen often possess a strong grasp of technical aspects of fishing gear in combination with the ingenuity for adaptation, the coordinated and systematic approach of testing gear modifications through an EFP and collaboration of science and industry is a more productive way to develop bycatch reduction devices.

EFPs are advantageous because of the relatively high cost of chartering large research vessels like those used in the Bering Sea pollock fishery. Additional fishing opportunities can be used to help fund research and development costs of conservation engineering without significant biological effects on stocks. In addition, there are benefits to evaluating gear modifications under the most realistic fishing scale and conditions. Research charters can be a difficult and potentially very expensive and possibly less effective way to recreate actual fishing conditions compared to an EFP test. The EFP also allows for the collection of data in context of the experimental design that would not otherwise be allowed under the groundfish regulations. For these reasons, an EFP is considered the best method for developing a salmon excluder device

1.3.5 Salmon Excluder for the Pollock Fishery: Evolution and Key Results

An EA for EFP 08-02 to support the development of a salmon excluder device (NMFS 2008b) and the final report for the work under EFP 08-02 (Gauvin et al. 2010) and the EA for EFP 11-01 and the final report for that work (Gauvin 2013a) detail the steps leading up to the application for this EFP and continuing changes to the excluder designs. The pollock industry, and in particular John Gruver of United Catcher Vessels Association, with Dr. Craig Rose of the Alaska Fisheries Science Center and gear manufacturers have used video images of salmon behavior in a pollock trawl net and flume tank (test tanks with water flow to test shaping parameters) to develop an excluder that would permit the escapement of salmon without the loss of pollock.

Field testing through EFPs has been used during the development process to obtain systematic information about performance. EFP 08-02 and 11-01 resulted in the current flapper excluder designed to allow escapement during towing. This design is based on installing the flapper in the straight tube section just ahead of the packing tube or codend. Weight is placed on the forward part of the flapper panel and floatation on the aft section of the escapement hole is used to achieve lift and additional room for escapement. The flapper excluder from EFP 11-01 (Figure 4) achieved between 24% and 50% Chinook salmon escapement by number with pollock (groundfish) escapement in the range of one-half to one and one-half percent by weight (Gauvin 2013a). The flapper excluder from EFP 11-01 achieved escapement rates between 3% and 11 % for chum salmon with highly variable performance during testing. Thus far, results for chum salmon have been less stable during experimental trials, leading to the conclusion that less is known about factors affecting escapement rates for chum salmon, and overall chum salmon have not responded as well as Chinook salmon to each excluder design that has been developed.

At the final stage of work on EFP 11-01 and in response to the low effectiveness of excluders for chum salmon to date, which had all been based on escapement out the top of the net, Mr. Gruver decided to work on a new design that would allow escapement out the top and the bottom of the trawl. As was described in the final report for the Bering Sea salmon excluder (Gauvin 2013a), this new prototype salmon excluder with escapement ports on the upper and bottom portions of the net used both added floatation and weighting to achieve a scoop on the bottom and a top of the net. It was hoped that the bottom escapement ports would work more efficiently for chum salmon, which tend to behave differently than Chinook salmon when entrapped, and without high loss rates for pollock. After flume testing of this new design, the focus of testing for this EFP would be to evaluate its effectiveness for improving escapement by chum salmon as well as one season of trials to see if the new design would be at least as effective as the flapper excluder for Chinook salmon. This testing will occur from the B season, fall 2015 through the A season to mid-June 2016. The figure below illustrates the new excluder design allowing escapement out the top as well as out the bottom of the trawl (hence the name "over and under" or the O/U excluder).

Figure 4 Depicts previously tested flapper excluder tested in 2011 and 2012 (Gauvin 2010).

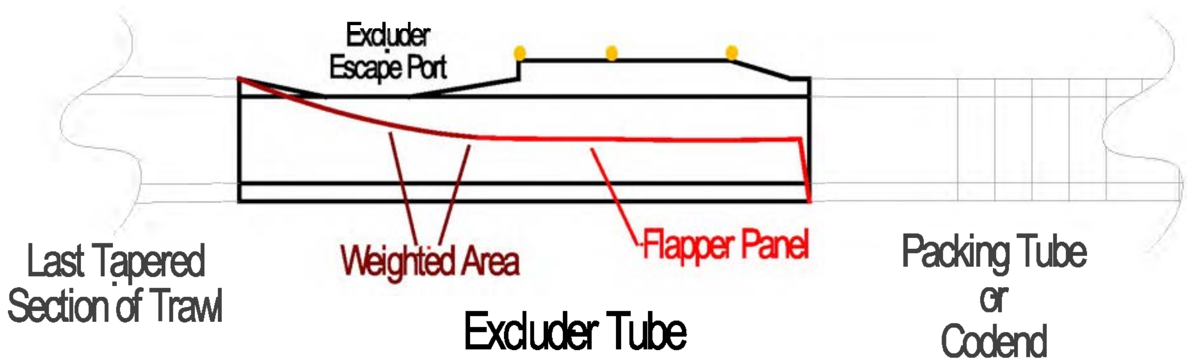
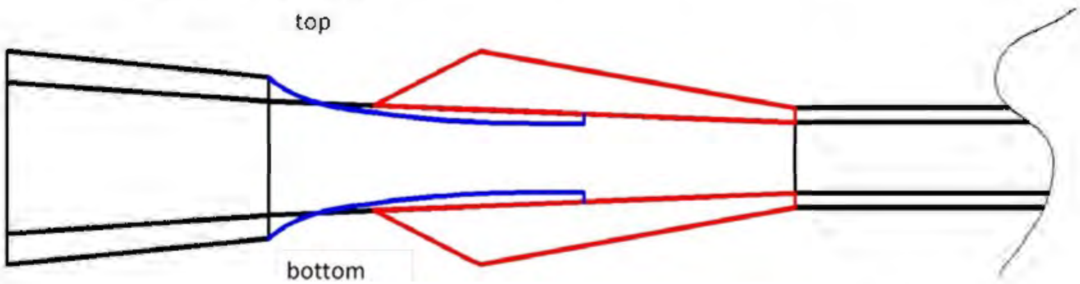


Figure 5 Depicts modified over/under flapper excluder in preparation for winter 2014 (Gauvin 2012).



The performance of each successive phase of salmon excluder testing has informed future designs and expectations of target groundfish catch, and PSC removals. For example, groundfish and PSC catch data from EFP 08-02 were used to inform the Environmental Assessment for EFP 11-01. Three pollock vessels participated in EFP 11-01, the F/V Pacific Prince, F/V destination, and F/V (SB). The EFP performance data from these vessels in terms of groundfish catch, Chinook salmon PSC, non-Chinook salmon PSC, and halibut PSC are summarized in Table 2. Over the period of 2011 and 2012, pollock represented approximately 97.2 percent (5,705 mt) of the total groundfish catch of 5,868 mt from EFP 11-01. Halibut PSC represented a small percent of the total catch of groundfish and non-groundfish catch from EFP 11-01. Over the period of 2011 and 2012, 0.15 percent (8.9 mt) of the combined groundfish and non-groundfish catch. These percentages of pollock, and halibut catch from Table 2 are likely to represent the best available data for determining probable groundfish and halibut catch for future testing of salmon excluders in the BS pollock fishery.

Table 2 Lists the overall groundfish in metric tons (mt), salmon numbers, and percent non-groundfish by weight caught during each phase of the EFP 11-01.

	Year, season and vessel sampled					
Species	**2011 B/ F/V Starbound**	**2012 A/ F/V Starbound**	**2012 A/ F/V Destination**	**2012 B/F/V Destination**	**2012 B/ F/V Pacific Prince**	**Totals**
Groundfish (mt)	1,945	1,246	1,219	313	1,145	5,868
Chinook (no.)	59	236	223	47	20	585
Non-Chinook (no.)	2,165	0	0	249	517	2,931
Pollock (mt)	1,913	1,218	1,199	307	1,068	5,705
Halibut (mt)	0.332	4.431	0.297	0.32	3.48	8.86
Percent non-groundfish	0.46%	0.39%	0.03%	0.13%	0.68%	0.38%

Source: John Gauvin, personal communication, January 2013.

1.4 Related Documents

The National Environmental Policy Act (NEPA) documents listed below have detailed information on the groundfish fisheries, and on the natural resources and the economic and social activities and communities affected by those fisheries. These documents contain valuable background for the action under consideration in this Environmental Assessment (EA). The Council on Environmental Quality (CEQ) regulations encourage agencies preparing NEPA documents to incorporate by reference the general discussion from a broader EIS and concentrate solely on the issues specific to the EA subsequently prepared. According to the CEQ regulations, whenever a broader EIS has been prepared and a NEPA analysis is then prepared on an action included within the entire program or policy, the subsequent analysis shall concentrate on the issues specific to the subsequent action. The subsequent EA need only summarize the issues discussed and incorporate discussions in the broader EIS by reference (see 40 CFR 1502.20).

Alaska Groundfish Programmatic Supplemental EIS (PSEIS)

In June 2004, NMFS completed the PSEIS that described the impacts from alternative groundfish fishery management programs on the human environment (NMFS 2004). NMFS issued a Record of Decision on August 26, 2004, with the simultaneous approval of Amendments 74 and 81 to the groundfish FMPs. This decision implemented a policy for the groundfish fisheries management programs that is ecosystem-based and is more precautionary when faced with scientific uncertainty. For more information on the PSEIS, see the Alaska Region website at: http://www.alaskafisheries.noaa.gov/sustainablefisheries/seis/default.htm.

The PSEIS brings the decision-maker and the public up to date on the current state of the human environment, while describing the potential environmental, social, and economic consequences of alternative policy approaches and their corresponding management regimes for management of the groundfish fisheries off Alaska. In doing so, it serves as the overarching analytical framework that will be used to define future management policy with a range of potential management actions. Future amendments and actions will logically derive from the chosen policy direction set for the preferred alternative identified in the PSEIS.

The PSEIS provides a detailed description of the impacts of fishing on the human environment and past, present, and future actions that may result in cumulative effects in combination with impacts of the groundfish fisheries. This EA will incorporate by reference information from the PSEIS that has remained unchanged since 2004.

Alaska Groundfish Harvest Specifications EIS

In January 2007, NMFS completed an EIS analyzing the impacts of various harvest strategies for the Alaska groundfish fisheries (NMFS 2007c). Except for the no action alternative, the alternatives analyzed would implement the preferred management strategy contained in the PSEIS. This document contains an analysis of the effects of the alternative harvest strategies on target groundfish species, non-target species, prohibited species, marine mammal, seabirds, habitat, ecosystem relationships, and social and economic concerns. This EIS is based on the latest information regarding the status of each of these environmental components and provides the most recent consideration of reasonably foreseeable future actions to consider in the cumulative effects analysis. The EIS provides the latest overall analysis of the impacts of the groundfish fisheries on the environment and is a substantial reference for this EA. This document is available from the NMFS Alaska Region website at
http://www.alaskafisheries.noaa.gov/analyses/specs/eis/default.htm.

Environmental Impact Statement/Regulatory Impact Review for Bering Sea Chinook Salmon Bycatch Management, Final Rule Implementing Amendment 91 to the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area (Amendment 91 EIS)

This EIS (NMFS 2009a) contains the most recent information regarding the bycatch of Pacific salmon in the Bering Sea pollock fishery. The EIS provides an evaluation of the environmental effects of alternative measures to minimize Chinook salmon bycatch in the Bering Sea pollock fishery. The RIR provides an evaluation of the social and economic effects of these alternatives. This document is available from the NMFS Alaska Region website at
http://www.alaskafisheries.noaa.gov/sustainablefisheries/bycatch/default.htm

Preliminary Draft Environmental Assessment for Bering Sea Non-Chinook Salmon Bycatch Management and Preliminary Review Draft Regulatory Impact Review for Bering Sea Non-Chinook Salmon Bycatch Management

This February 2011 document (NPFMC 2011) provides a preliminary analysis of alternative ways to manage chum salmon bycatch, including replacing the current CSSA and voluntary rolling hotspot system intercooperative agreement (VHRS ICA) in the Bering Sea with salmon bycatch limits or new regulatory closures based on current salmon bycatch information. This document provides the latest information on the effects of the Bering Sea pollock fishery on chum salmon. This document is available from the Council website at
http://www.alaskafisheries.noaa.gov/npfmc/current_issues/bycatch/ChumbycatchEA211.pdf and
http://www.alaskafisheries.noaa.gov/npfmc/current_issues/bycatch/ChumRIR211.pdf

Environmental Assessment/Regulatory Impact Review /Final Regulatory Flexibility Analysis (EA/RIR/FRFA) for Modifying existing Chinook and chum salmon savings areas, Final Rule Implementing Amendment 84 to the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area

This October 2007 document (NMFS 2007a) contains recent information regarding the bycatch of Pacific salmon in the BSAI groundfish fisheries and the effects of the VRHS for reducing salmon bycatch on the human environment. A thorough description of the effects of the pollock fishery on salmon is contained in this document and will be incorporated by reference in this EA. This document is available from the NMFS Alaska Region website at
http://www.alaskafisheries.noaa.gov/analyses/amd84/Am84_EARIRFRFAfr.pdf.

Steller Sea Lion Interim Final Rule (2010), Steller Sea Lion Protection Measures Supplemental EIS (2001) and FMP Biological Opinion (2010)

A supplemental EIS (SEIS) was completed in 2001 to evaluate the impacts of groundfish fishery management measures in the Gulf of Alaska and BSAI on Steller sea lions (NMFS 2001). The purpose of the SEIS was to provide information on potential environmental impacts from implementing a suite of fisheries management measures to protect the western population of Steller sea lions. Fisheries management measures were designed to not jeopardize the continued existence of the western population of Steller sea lions nor adversely modify its critical habitat. The Steller sea lion protection measures were implemented by emergency rule in 2002 and by final rule making in 2003 (68 FR 204, January 2, 2003). The EIS may be found on the NMFS Alaska Region website at:
http://www.alaskafisheries.noaa.gov/sustainablefisheries/seis/sslpm/default.htm.

For the 2011 fishing year, NMFS issued an interim final rule to implement Steller sea lion protection measures to insure that the BSAI management area groundfish fisheries are not likely to jeopardize the continued existence of the western distinct population segment (DPS) of Steller sea lions or adversely modify its designated critical habitat (JAM) (75 FR 77535, December 13, 2010). These management measures dispersed fishing effort over time and area to provide protection from potential competition for important Steller sea lion prey species in waters adjacent to rookeries and important haulouts. The intended effect of this interim final rule is to ensure the Alaska groundfish fisheries are not likely to cause JAM for the endangered western DPS of Steller sea lions, as required under the Endangered Species Act (ESA), and to conserve and manage the groundfish resources in accordance with the Magnuson-Stevens Act. No changes to the Bering Sea pollock fishery management were in the interim final rule. An EA determined that this action would not have significant environmental impacts. This document is available from the NMFS Alaska Region website at
http://alaskafisheries.noaa.gov/analyses/ssl/sslprotections_earir1210.pdf

A biological opinion documenting the program level Section 7 formal consultation on the effects of the Alaska groundfish fisheries on Steller sea lions, humpback whales, sperm whales, and fin whales was completed November 24, 2010 (NMFS 2010b). The biological opinion concluded that the fisheries were likely to jeopardize the continued existence of the western DPS of Steller sea lions and were likely to adversely modify their designated critical habitat. The biological opinion contained a reasonable prudent alternative (RPA) designed to remove the likelihood the fisheries would jeopardize the western DPS of Steller sea lions or adversely modify their designated critical habitat.

This RPA was implemented for the 2011 fishing year (75 FR 77535; December 13, 2010). NMFS issued an interim final rule to implement Steller sea lion protection measures to insure that the BSAI management area groundfish fisheries are not likely to jeopardize the continued existence of the western DPS of Steller sea lions or adversely modify its designated critical habitat (75 FR 77535; December 13, 2010). These management measures primarily disperse fishing effort over time and area to provide protection from potential competition for important Steller sea lion prey species in waters adjacent to rookeries and important haulouts. The protection measures focused on the Atka mackerel and Pacific cod fisheries in the Aleutian Islands. No changes were made to the Bering Sea pollock fishery under this RPA Subsequent Steller Sea Lion analyses, Steller Sea Lion Protection Measures EIS/RIR/IRFA (NMFS 2014a) and 2014 biological opinion (NMFS 2014b), are project-level actions focused on the Aleutian Islands and do not address the Bering Sea pollock fishery.

Environmental Assessment for issuing an exempted fishing permit for the purpose of testing a salmon excluder device in the eastern Bering Sea pollock fishery (2011)

The EA was completed in 2011 to analyze alternatives on the issuance of an exempted fishing permit for continued testing of a salmon excluder device in the Bering Sea pollock trawl fishery. The primary objective of the research was the development and testing of an excluder that reduces Chinook and chum salmon bycatch rates without significant negative effects on pollock fishing (NMFS 2011).

The overall results from the 2011-2012 tests of salmon excluder devices in the Bering Sea were that the flapper excluder is effective for reducing Chinook salmon but the effectiveness of the device was not improved by the addition of artificial light. Additionally, the flapper excluder did not have significant reduction in Chum salmon catch (Gauvin 2013a). Research to continue the improvement of the salmon excluder device is proposed in this analysis.

1.5 Public Participation

The notice of receipt of an application for the exempted fisheries permit was published in the *Federal Register* before the June 2014 Council meeting (79 FR 29741 May 23, 2014) with a 15 day public comment period. NMFS provided the U.S. Coast Guard, the State of Alaska, the International Halibut Commission, the NMFS Northwest Regional Office, and the Council copies of the application and draft EA for consultation purposes. The application is on the agenda for the Council's June 2014 meeting. The applicant plans to present this project and the EA to the Council's Scientific and Statistical Committee (SSC), the Advisory Panel (AP), and the Council at its June 2014 meeting.

2 Alternatives Considered

The CEQ regulations implementing NEPA require a range of alternatives to be analyzed for a federal action. The alternatives analyzed may be limited to a range of alternatives that could reasonably achieve the need that the proposed action is intended to address.

The purpose of this action is to allow the continued development and testing of a salmon excluder device for pollock trawl gear in the eastern Bering Sea. The applicant has worked closely with the Alaska Fisheries Science Center (AFSC) in the development of the experimental design, and this design has been approved by the AFSC (DeMaster 2011). The experimental design requires the applicant's exemption from several groundfish fisheries regulations at 50 CFR part 679 including:

§ 679.7(a)(2): Persons are prohibited from conducting any fishing contrary to notification of in season actions, closures, or adjustments under §§ 679.20, 679.21, 679.22, and 679.25. Groundfish taken under the EFP will not be applied to the Total Allowable Catch (TAC) limit specified in the annual harvest specifications (§ 679.20(a)). The EFP would allow for the harvest of up to 7,500 mt of groundfish (2,500 mt for each of three seasons). The EFP will allow for the harvest of salmon in the salmon savings areas, even though they may be closed. The salmon harvested will not count towards these annual PSC limits (see below). As the Council and NMFS have approved for past EFP experiments dedicated to bycatch reduction, groundfish and prohibited species taken during the experiment would not be counted against the annual TAC and PSC caps (65 FR 55223, September 13, 2000).

§ 679.21(e)(1)(vii), (e)(3)(i)(A)(3) and (f)(2): Salmon taken during the experiment would not be counted against the bycatch limits established for Chinook and non-Chinook salmon. The salmon taken during the experiment would create an additional burden on the pollock trawl industry, if the EFP salmon is counted toward the salmon bycatch limits and triggers closure of the salmon savings areas for those vessels that may not be participating in the ICA for salmon bycatch. The EFP would allow for the take of up to 1,450 Chinook salmon (250 in one fall season and 600 in each of two winter seasons) and 3,000 non-Chinook salmon (2,500 in one fall season and 250 in each of two winter seasons). These amounts are based on the estimated amount of salmon needed by the applicant to meet the experimental design without constraining fishing under the EFP (Gauvin 2013a). Taking of the salmon during the experiment is crucial for determining the effectiveness of the device. The potential exists that the amount of salmon bycatch taken by the pollock trawl industry during the EFP period will approach or exceed the salmon bycatch limits. Any vessel owner participating in the ICA for salmon bycatch (i.e., the VRHS) or the IPA that may also fish under the EFP would need to ensure the ICA allows for participation in the EFP and that the salmon taken during EFP fishing would not be used in calculating the closure areas for the ICA and IPA participants. Any incidental halibut taken during the EFP period will not accrue to the PSC limit for the pollock/Atka mackerel/other species PSC limit which can close the nonpelagic trawl gear fishery if this PSC limit is reached.

§ 679.21(e)(7)(vii), and § 679.22(a)(5)(ii), (a)(7)(ii), and (a)(10): Exemptions from closures of the Chum Salmon Savings Area, the Bering Sea Pollock Restriction Area, and the Catcher Vessel Operating Area would be in the EFP. The experiment must be conducted in areas of salmon concentration to ensure a sufficient sample size. These areas have high concentrations of salmon and provide an ideal location for conducting the experiment and ensuring the vessel encounters enough salmon to support the experiment.

§ 679.22(a)(7)(vii): The closure of the Steller Sea Lion Conservation Area (SCA) is based on sector specific limits of no more than 28 percent of the annual TAC taken before April 1. This section also requires the closure of the SCA to vessels greater than 99 feet length overall (LOA) to provide for harvesting by vessels in the inshore sector under 99 feet LOA. In order to conduct the experiment where salmon are likely to occur, the EFP will include an exemption from closure of the SCA, as long as the total amount of pollock harvest by all sectors remains below the 28 percent of the annual pollock TAC amount before April 1.

§ 679.50: Vessels harvesting pollock are required to have NMFS certified observers for harvest sampling and monitoring purposes. Sampling under the EFP would be conducted using "sea samplers" who are NMFS trained observers performing sampling and monitoring duties for purposes of the EFP. The sea samplers would account for the groundfish and salmon catch to ensure compliance with the amounts of groundfish and salmon limits specified in the EFP. Whole haul sampling would be used as well as extensive length measurement to allow the research to evaluate if escapement is comprised of larger, more valuable pollock. Because the sea sampler duties under the EFP differ from those duties normally performed by NMFS observers under § 679.50 and § 679.51 the EFP would include an exemption from observer regulations. During EFP fishing, authorized vessel will also be exempt from the observer program fee collection at § 679.55.

To accomplish the purpose of this proposed action, within the boundaries of the groundfish regulations (50 CFR parts 600 and 679) and ensuring the use of the carefully developed experimental design, an EFP under 50 CFR 679.6 would be required. Therefore, the alternatives for this action are limited to:

Alternative 1 (Status Quo): No EFP is issued. Exemptions from the regulations to facilitate the continued development and testing of the salmon excluder device would not be granted.

Alternative 2: An EFP is issued (Preferred Alternative). The testing of the salmon excluder device would be permitted with exemptions from §§ 679.7(a)(2) (regarding 679.20(a); 679.21(e)(1)(vii), (e)(7)(vii), (f)(2); and 679.22(a)(10)); 679.21(e)(1)(vii) and (e)(7)(vii); 679.22(a)(5)(ii), (a)(7)(ii), (a)(7)(vii) and (a)(10); and 679.50. The EFP would allow the applicant to conduct the experiment as designed in cooperation with the AFSC. Details of the experiment are contained in Appendix A. An EFP is needed for this action to ensure the testing of the device follows an experimental protocol that requires the harvesting of pollock and salmon in sufficient quantities to meet the statistical requirements of the experimental design (Appendix A). Therefore, pollock and salmon harvesting may be required in locations of known high levels of salmon bycatch, which may be closed to pollock fishing at the time of the experiment.

The experiment will be conducted during fall and winter seasons starting in 2015 (A season), and continuing through the fall of 2015 (B season), and resuming for the 2016 season in January (A season), ending in June 2016. Over the period of the entire experiment the applicant requests a total of 7,500 mt of pollock, 1,450 Chinook salmon PSC, and 3,000 non-Chinook salmon (mostly chum salmon) to be caught during experimental fishing (Table 3). In the Bering Sea pollock trawl fishery, Chinook salmon are the predominant salmon PSC species caught during the A season from January through April, and chum salmon are the predominant salmon PSC species caught during the B season in the fall (Table 3).

Pollock vessels used in the BSAI trawl fishery that either processes at sea or delivers to a shoreside processor or mothership will be engaged through a Request for Proposal process for the work. The trawl net will be modified to add the salmon excluder device and a recapture device, camera system, or both to provide for data collection. The EFP would be subject to modifications pending any new relevant information regarding the 2015-2016 fisheries, including pollock harvest specifications.

Table 3 Projected Groundfish and Salmon Allowances for 2015/2016 Salmon Excluder EFP

Field work season	Metric tons of groundfish (in pollock target)	Number of Chinook salmon	Number of non-Chinook salmon
Winter 2015 A Season	2,500	600	250
Fall 2015 B Season	2,500	250	2,500
Winter 2016 A Season	2,500	600	250
Total	7,500	1,450	3,000

Analysis will primarily focus on the estimation of the proportions of pollock and salmon excluded from the catch through the device. The experiment is designed to estimate these values for the combination of all tows, representing the value of the device in ordinary fishery conditions. Variability of escape rates between tows will be examined for indications of conditions affecting excluder performance. Combined size composition data will be tested for differences between retained and escaping fish. Groundfish harvested by the vessels selected for the EFP testing will be retained for sale to the extent allowed under § 679.20(e) and (f) with pollock designated as the target species. Tissue from salmon harvested during the study will be provided for genetic testing to determine region of origin. If the salmon is of acceptable quality, it will be donated under the Prohibited Species Donation Program (§ 679.26); otherwise it will be discarded as required by § 679.21(b). Results will be presented by the applicant in preliminary and final reports made available to managers, trawlers, scientists, the Council, and the public.

3 Methodology for Impacts Analysis

Analysis of the potential cumulative effects of a proposed action and its alternatives is a requirement of NEPA. An environmental assessment or environmental impact statement must consider cumulative effects when determining whether an action significantly affects environmental quality. The Council on Environmental Quality (CEQ) regulations for implementing NEPA define cumulative effects as:

> *the impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7)*

For the most part, the discussion of past and present cumulative effects is addressed with the analysis of direct and indirect impacts for each resource component below. The cumulative impact of reasonable foreseeable future actions is addressed in each section for the environmental components.

General Significance Criteria

This section describes the criteria by which the impacts of the proposed action are analyzed for each of the following resource categories: groundfish, prohibited species, and marine mammals.

Evaluation criteria have been developed recently for each of these categories within the Habitat Areas of Particular Concern (HAPC) EA (NMFS 2006a) and in the Groundfish Harvest Specifications EA (NMFS 2006b). The analysis used in this EA adopts the significance criteria used in the HAPC EA (NMFS 2006a), the 2006–2007 Groundfish Harvest Specifications EA (NMFS 2006b), and the Salmon Excluder Device EA (NMFS 2011) because of the similar type of action analyzed and the latest methods of analyzing significance of effects provided by these analyses.

The reference point condition, where used, represents the state of the environmental component in a stable condition or in a condition judged not to be threatened at the present time. For example, a reference point condition for a fish stock would be the state of that stock in a healthy condition, able to sustain itself, successfully reproducing, and not threatened with a population-level decline. The following section describes the significance criteria used to evaluate the proposed alternatives.

4 Status of and Impacts on the Affected Environment

The environmental impacts generally associated with fishery management actions are effects resulting from (1) harvest of fish stocks, which may result in changes in food availability to predators and scavengers, changes in the population structure of target fish stocks, and changes in the marine ecosystem community structure; (2) changes in the physical and biological structure of the marine environment as a result of fishing practices, for example, effects of gear use and fish processing discards; and (3) entanglement/entrapment of non-target organisms in active or inactive fishing gear. An analysis of the effects associated with pollock harvest on the human environment is discussed in the Amendment 91 EIS (NMFS 2009a). This EA adopts much of the environmental status description in this EIS because it provides a recent, detailed description.

Information provided by the applicant for the EFP indicates that harvesting of target groundfish species (primarily pollock) and prohibited species (salmon) is required for testing the salmon excluder device. Potential effects on the environment can occur with the removal of target and prohibited species during groundfish harvesting. Pollock and salmon are also prey species of marine mammals, including Steller sea lions, warranting further analysis of potential effects on marine mammals. The successful development of a salmon excluder device may affect the efficiency of the pollock fisheries to avoid bycatch and prosecute a fishery with fewer restrictions. Because of the limited amounts of harvest, manner of testing, gear type used, and the short duration of the testing, other components of the environment are not likely to be impacted and further analysis is not needed.

Table 4 shows the components of the human environment and whether Alternative 2 may have an impact on the component beyond status quo, Alternative 1, and require further analysis. Extensive environmental analysis on all environmental components is not needed in this document because the proposed action is not anticipated to have environmental impacts on every component. Analysis is included for those environmental components on which Alternative 2 may have an impact beyond impacts analyzed for Alternative 1 in previous NEPA analyses (NMFS 2004, 2007b, and 2009a).

Table 4 Resources potentially affected by Alternative 2 beyond Status Quo

Essential Fish Habitat	Ecosystem	Groundfish	Marine Mammals	Seabirds	Non-Target Species	Prohibited Species
N	N	Y	Y	N	N	Y

N = no impact anticipated by the alternative on the component.
Y = an impact is possible if the alternative is implemented.

Essential Fish Habitat

The potential harvest of target species under this proposed action is 0.19% of the BSAI pollock TAC in 2014 and 0.39% of the projected BSAI pollock TAC in 2015 (section 4.2.2). The EFP participants will use pelagic trawl gear in the Bering Sea subarea for testing the salmon excluder device. The areas trawled will be areas previously trawled for pollock. The evaluation of the potential effects of pelagic trawling on benthic habitat is detailed in the EIS for Essential Fish Habitat Identification and Conservation (NMFS 2005a) and the EFH 5-year Review for 2010 (NMFS 2010a). A recent analysis of pelagic trawl gear on Essential Fish Habitat (EFH) was done for Amendment 91 (NMFS 2009a). The conclusions from this analysis found the alternatives would have impacts on EFH similar to those found in the EFH EIS.

However, the best available information does not identify any effects of fishing as significantly adverse. In other words, effects may occur from fishing, however these effects do not exceed the minimal and temporary limits established by 50 CFR 600.815(a)(2). A focused analysis of EFH was completed for the previous 2011 EFP (NMFS 2011). The EA for that EFP concluded that that no new impacts to EFH were likely to occur in comparison with groundfish fishing for the Bering Sea, authorized for 2011 and 2012.

Continuing groundfish fishing activity over the next few years is potentially the most important source of additional annual adverse impacts on marine benthic habitat in the action area. The size of these impacts would depend on the size of the fisheries, the protection measures in place, and the recovery rates of the benthic habitat. However, a number of factors will tend to reduce the impacts of fishing activity on benthic habitat in the future. These include the trend towards ecosystems management. Ecosystem sensitive management will increase understanding of habitat and the impacts of fisheries on them, protection of EFH and HAPC, and institutionalization of ecosystems considerations into fisheries governance. Because of the type of gear, amount of fishing, and the location of the fishing in previously trawled areas, the EFP would have no impact on EFH beyond those analyzed in the EIS for Amendment 91 (NMFS 2009a), the EIS for EFH Identification and Conservation (NMFS 2005a), and the EA for the 2011 version of the salmon excluder device (NMFS 2011).

Ecosystem

A relatively recent analysis of pelagic trawl gear on ecosystem relationships was done for Amendment 91 (NMFS 2009a). The conclusions from this analysis summarized trends from North Pacific Groundfish Stock Assessment and Fishery Evaluation (SAFE) reports Ecosystem Consideration chapters relevant to the Bering Sea and Chinook salmon bycatch management. No significant adverse impacts of fishing on the ecosystem relating to predator/prey interactions, energy flow/removal, or diversity were noted, either in observed trends or ecosystem level modeling results. No BSAI groundfish stock or stock complex is overfished, and no BSAI groundfish stock or stock complex is being subjected to overfishing. Recent exploitation rates on biological guilds are within one standard deviation of long-term mean levels. An exception was for the forage species of the Bering Sea (dominated by walleye pollock), which had relatively high exploitation rates during 2005–2007 as the stock declined. The 2008- and 2009-recommended catch levels are again within one standard deviation of the historical mean. This is a more direct measure of catch with respect to food-web structure than are trophic level metrics.

Seabirds

Alaska pollock fishery's impacts on seabirds were analyzed in the Amendment 91 EIS (NMFS 2009a), which evaluates the impacts of the pollock fishery on seabird takes, prey availability, and seabird ability to exploit benthic habitat. Seabirds may be directly affected by pelagic trawl vessels by striking the third wire on the trawl or by striking the vessel. Because the amount of harvest under the EFP is a small fraction of the overall harvest of the pollock TAC, and harvesting is limited to between one and two vessels, it is likely that the additional interaction overall with seabirds would be minimal and any potential effects would not be discernable from status quo.

Non-Target Species

Catch data from the final report for EFP 11-01 were used to project seasonal amounts of non-target catch including, non-pollock groundfish catch, non-groundfish catch, and PSC for this proposed EFP. For example, catch of pollock, other groundfish and salmon PSC by season for 2011 and 2012 provide data on the proportions of other groundfish, halibut, non-groundfish, Chinook salmon PSC, and non-Chinook salmon PSC for a given amount of pollock target species (see Table 2 and Table 5). These proportional catches also vary, particularly for salmon PSC, by the specific pollock season in which EFP fishing occurred in 2011 and 2012 (see Table 2). These proportions of target to non-target catch were applied to new pollock fishing for the three seasons for proposed 2015 and 2016 EFP fishing.

Because fishing under the EFP would take primarily pollock (2,500 mt in each season of the 2015 A season, 2015 B season, and 2016 A season), the above methodology suggests that approximately 50–80 mt of species other than pollock and salmon may be expected to be taken each season during the proposed EFP (see Table 2 and Table 5), including approximately 12 mt of halibut, 1,450 Chinook salmon, and 3,000 chum salmon. Herring, halibut, Tanner crab, and Chinook and chum salmon are prohibited species. Since the pollock fishery is primarily pelagic, the bycatch of non-target species is small relative to the magnitude of the fishery (NPFMC 2007a) and (NPFMC 2009a). In the 2011-2012 EFP, squid represented the largest component of the pollock bycatch of non-target species and squid are known to be a relatively short-lived as well as being fast-growing and relatively fecund animals. The catch of other non-target groundfish species in the pollock fishery represent less than 1% of the total pollock catch (NPFMC 2007a) and (NMFS 2009a). For purposes of this EA, other species taken in the groundfish fisheries include species of invertebrates and fish not managed under the FMP and forage fish species. The amounts of other species (e.g., squid, jellyfish) are expected to be taken under the EFP are so small that any effects on non-target species would not be discernable from the status quo.

Table 5 EFP 11-01 salmon and groundfish accounting by species, season and vessel (SB= Starbound, Dest = Destination, PP=Pacific Prince). Catcher vessels: Fish Ticket amounts for groundfish (mt), sea sampler counts for salmon; Starbound (CP): estimates for groundfish from partial haul sampling, sea sampler counts for salmon.

Species (mt)	2011 B/SB	2012 A/SB	2012 A/Dest	2012 B/Dest	2012 B/PP	Totals	% of total
King Salmon (no.)	59	236	223	47	20	585	na
Chum Salmon (no.)	2,165	0	0	249	517	2,931	na
Pollock	1,913	1,218	1,199	307	1,068	5,705	96.9%
Halibut	0.332	4.431	0.297	0.320	3.480	8.860	0.15%
Herring	0.002	0.000	0.000	0.000	3.370	3.372	0.06%
Cod	12.291	8.271	10.783	1.950	5.250	38.545	0.65%
Arrowtooth flounder	4.380	1.972	0.600	1.230	3.010	11.192	0.19%
Kamchatka flounder	0.383	0.141	0.000	0.000	0.000	0.524	0.01%
Flathead sole	10.209	5.167	5.529	0.670	2.880	24.455	0.42%
Bering flounder	0.000	0.007	0.000	0.000	0.000	0.007	0.00%
Rock sole	0.565	5.813	0.943	0.040	0.230	7.591	0.13%
Yellowfin sole	0.000	0.369	0.001	0.000	0.000	0.370	0.01%
Rex sole	1.098	2.750	0.790	1.100	4.600	10.338	0.18%
Alaska plaice	0.000	0.006	0.001	0.000	0.000	0.007	0.00%
Greenland turbot	0.002	0.003	0.000	0.000	0.000	0.005	0.00%
Pacific Ocean Perch	0.001	0.154	0.005	0.040	11.560	11.759	0.20%
Northern rockfish	0.002	0.000	0.000	0.000	0.000	0.002	0.00%

Species (mt)	2011 B/SB	2012 A/SB	2012 A/Dest	2012 B/Dest	2012 B/PP	Totals	% of total
Redstripe rockfish	0.000	0.006	0.000	0.000	0.000	0.006	0.00%
Dusky rockfish	0.000	0.000	0.001	0.000	0.000	0.001	0.00%
Shortraker rockfish	0.000	0.011	0.000	0.000	0.000	0.011	0.00%
Atka mackerel	0.000	0.000	0.013	0.000	0.850	0.863	0.01%
Octopus	0.000	0.000	0.000	0.000	0.000	0.000	0.00%
Squid	0.000	0.178	0.001	0.290	47.060	47.529	0.81%
Shark	0.970	0.129	0.000	0.400	0.110	1.609	0.03%
Sculpin	0.691	0.476	0.043	0.010	0.050	1.270	0.02%
Alaska skate	1.048	2.751	0.000	0.000	0.000	3.799	0.06%
Bering skate	0.051	0.037	0.000	0.000	0.000	0.088	0.00%
Aleut skate	0.072	0.157	0.000	0.000	0.000	0.228	0.00%
Skate unidentified	0.000	0.000	1.451	0.050	0.510	2.011	0.03%
Sablefish	0.000	0.000	0.000	0.000	0.030	0.030	0.00%
Jellyfish	8.407	0.256	0.099	0.060	0.880	9.701	0.16%
Prowfish	0.015	0.000	0.000	0.000	0.000	0.015	0.00%
Starfish	0.001	0.002	0.000	0.000	0.000	0.003	0.00%
Poacher	0.004	0.003	0.001	0.000	0.000	0.008	0.00%
Miscellaneous	0.002	0.000	0.000	0.000	0.000	0.003	0.00%
Eulachon	0.002	0.000	0.000	0.000	0.000	0.002	0.00%
Lumpsucker	0.165	0.159	0.023	0.010	0.000	0.357	0.01%
Snailfish	0.000	0.022	0.000	0.000	0.020	0.042	0.00%
Sponge	0.000	0.001	0.000	0.000	0.000	0.001	0.00%
Tanner crab	0.000	0.003	0.000	0.000	0.000	0.003	0.00%
Totals (mt)	1,953.7	1,251.3	1,219.6	313.2	1,152.4	5,890.1	100.0%
Total groundfish (mt)	1,944.8	1,246.4	1,219.2	312.8	1,144.6	5,867.7	
Groundfish excludes prohibited and non-allocated species							

The current, detailed status of each target species category, biomass estimates, and ABC specifications for the BSAI are presented annually both in summary and in detail in the annual BSAI SAFE report (NPFMC 2013b). The SAFE reports for the 2013 groundfish fisheries are available through the AFSC's website at http://www.afsc.noaa.gov/refm/stocks/assessments.htm.

4.1 Status of Managed Groundfish Species

Designated target groundfish species and species groups in the BSAI are walleye pollock, Pacific cod, yellowfin sole, Greenland turbot, arrowtooth flounder, rock sole, other flatfish, flathead sole, sablefish, Pacific ocean perch, other rockfish, Atka mackerel, squid, and other species. This EA adopts by reference and summarizes the status of the stock information in the SAFE reports (NPFMC 2013b). For detailed life history, ecology, and fishery management information regarding groundfish stocks in the BSAI see section 3.3., in the PSEIS (NMFS 2004) and the Alaska Groundfish Harvest Specifications EIS (NMFS 2007c).

For those stocks with enough information, none are considered overfished or approaching an overfished condition. Overall, the status of the stocks continues to appear relatively favorable. The BSAI Plan Team met in November 2013 to finalize the SAFE report and to forward acceptable biological catch (ABC) and overfishing level (OFL) recommendations to the Council for action at its December 2013 meeting. The ABC, OFL, and TAC amounts for each target species or species group for 2014 and 2015 were recommended by the Council and these were approved by the Secretary of Commerce on March 4, 2014 (79 FR 12110, correction 79 FR 21151, April 15, 2014).

The 2013 bottom trawl survey biomass estimate for pollock was 4.575 million t, up 31 percent from the 2012 estimate, but still below average for the 1987–2013 time series. While the acoustic trawl survey selectivity estimates vary inter-annually, they have general stabilized since the early 1990s as the acoustic-trawl and bottom trawl methods have become more standardized. Euphausiids, which are among the most important prey items for pollock in the Bering Sea, peaked in abundance in 2009, which may have contributed to the survival of the 2008 year class of eastern Bering Sea pollock. According to the status determination of the SAFE Report, the pollock stock in the eastern Bering Sea is not being subjected to overfishing, is not overfished, and is not approaching an overfished condition (NPFMC 2013b).

Multiple sources of information indicate that eastern Bering Sea pollock biomass is increasing. The density of euphausiids, a key item in the diet of pollock, increased for several years, peaking in 2009 and then decreasing with 2012 values were similar to those of 2006. Between 2009 and 2012, pelagic forager biomass, primarily pollock and capelin, increased 70% with possible top-down effects of euphausiid biomass (Zador 2013).

Table 6 2014 and 2015 Overfishing Level (OFL), Acceptable Biological Catch (ABC), and Total Allowable Catch (TAC), of Selected Groundfish in the BSAI.

Species	Area	2014			2015		
		OFL	ABC	TAC	OFL	ABC	TAC
Pollock	EBS	2,795,000	1,369,000	1,267,000	2,693,000	1,258,000	1,258,000
Pacific cod	BS	299,000	255,000	246,897	319,000	272,000	251,712
	AI	20,100	15,100	6,997	20,100	15,100	6,487
Sablefish	BS	1,584	1,339	1,339	1,432	1,210	1,210
Yellowfin sole	BSAI	259,7000	239,800	184,000	268,900	248,300	187,000
Greenland Turbot	BS	n/a	1,659	1,659	n/a	2,478	2,478
Arrowtooth flounder	BSAI	125,642	106,599	25,000	125,025	106,089	25,000
Northern Rock Sole	BSAI	228,700	203,800	85,000	216,310	190,100	85,000
Flathead sole	BSAI	79,633	66,293	24,500	77,023	64,127	25,129
Alaska plaice	BSAI	66,800	55,100	24,500	66,300	54,700	25,000
Pacific Ocean Perch	BS	n/a	7,684	7,684	n/a	7,340	7,340
Northern Rockfish	BSAI	12,077	9,761	2,594	11,943	9,652	3,000
Blackspotted/ Rougheye Rockfish	EBS/EAI	n/a	177	177	n/a	201	201
Shortraker Rockfish	BSAI	493	370	370	493	370	370
Atka Mackerel	EAI/BS	n/a	21,652	21,652	n/a	21,769	21,769
Squid	BSAI	2,624	1,970	310	2,624	1,970	325
Skate	BSAI	41,849	35,383	26,000	39,746	33,545	26,000
Shark	BSAI	1,363	1,022	125	1,363	1,022	125
Octopus	BSAI	3,450	2,590	225	3,450	2,590	225
Sculpin	BSAI	56,424	42,318	5,750	56,424	42,318	5,750

4.2 Effects on Target Species

The significance criteria used to evaluate the effects of the action on target species are in Table 7. These criteria are adopted from the significance criteria used in the HAPC EA (NMFS 2006a).

Table 7 Criteria Used to Estimate the Significance of Effects on the FMP Managed Target Stocks.

Effect	Criteria			
	Significantly Negative (-)	Insignificant (I)	Significantly Positive (+)	Unknown (U)
Stock Biomass: Potential for increasing and reducing stock size	Changes in fishing mortality are expected to jeopardize the ability of the stock to sustain itself at or above its MSST.	Changes in fishing mortality are expected to maintain the stock's ability to sustain itself above MSST.	Changes in fishing mortality are expected to enhance the stock's ability to sustain itself at or above its MSST.	Magnitude and/or direction of effects are unknown.
Fishing mortality	Reasonably expected to jeopardize the capacity of the stock to yield sustainable biomass on a continuing basis.	Reasonably expected not to jeopardize the capacity of the stock to yield sustainable biomass on a continuing basis.	Action allows the stock to return to its unfished biomass.	Magnitude and/or direction of effects are unknown.
Spatial or temporal distribution	Reasonably expected to adversely affect the distribution of harvested stocks either spatially or temporally such that it jeopardizes the ability of the stock to sustain itself.	Unlikely to affect the distribution of harvested stocks either spatially or temporally such that it has an effect on the ability of the stock to sustain itself.	Reasonably expected to positively affect the harvested stocks through spatial or temporal increases in abundance such that it enhances the ability of the stock to sustain itself.	Magnitude and/or direction of effects are unknown.
Change in prey availability	Evidence that the action may lead to changed prey availability such that it jeopardizes the ability of the stock to sustain itself.	Evidence that the action will not lead to a change in prey availability such that it jeopardizes the ability of the stock to sustain itself.	Evidence that the action may result in a change in prey availability such that it enhances the ability of the stock to sustain itself.	Magnitude and/or direction of effects are unknown.

The potential direct and indirect effects of the pollock fishery on target groundfish species are detailed in the Amendment 91 EIS (NMFS 2009a). Direct effects include fishing mortality for each target species and spatial and temporal concentration of catch. Indirect effects include the changes in prey composition and changes in habitat suitability. Indirect effects are not likely to occur with either alternative because the proposed action does not change overall fishing practices that indirectly affect prey composition and habitat suitability. Temporal concentration of harvest is not likely because the EFP would occur during fall and winter seasons from A and B seasons for 2015 through A season 2016 using up to two vessels. Spatial concentration also is not as likely because the harvest during the experiment occurs in various locations that are known for high chum and Chinook salmon bycatch rates but are also common pollock trawling areas. These potential areas cover many square miles, (Figure 2 through Figure 3). The only potential direct effect on target species is fishing mortality on groundfish species during the testing of the salmon excluder devices.

4.2.1 Alternative 1 – Status Quo Effects on Target Species

The effects of pollock fishing on groundfish under Alternative 1 are described in detail in the Amendment 91 EIS (NMFS 2009a). The status quo pollock fishery impacts on groundfish stocks is not expected to (1) jeopardize the capacity of the stocks to produce maximum sustainable yield on a continuing basis, (2) alter the genetic sub-population structure such that it jeopardizes the ability of the stocks to sustain themselves at or above the minimum stock size threshold (MSST) or experience overfishing, (3) decrease reproductive success in a way that jeopardizes the ability of the stocks to sustain themselves at or above the MSST, (4) alter harvest levels or distribution of harvest such that prey availability would jeopardize the ability of the stocks to sustain themselves at or above the MSST or experience overfishing, or (5) disturb habitat at a level that would alter spawning or rearing success such that it would jeopardize the ability of the stock to sustain itself at or above the MSST or prevent overfishing. Therefore the impacts of Alternative 1 are likely insignificant.

If the EFP is not issued, an effective salmon excluder device is less likely to be developed, and the pollock fisheries may continue to experience rates of salmon bycatch that could potentially result in the restriction of pollock fishing. Alternatively, the industry may attempt to move forward with excluder development absent reliable results from scientifically controlled testing. The downside to this might be that a great deal of effort and resources are invested in a new excluder design which could be misdirected if the excluder design that is thought to be effective is later found to be ineffectual for reducing salmon bycatch or if pollock loss rates are unacceptable. Less pollock may be taken under this alternative when the CSSA and the CVOA are closed or as vessels are prohibited from fishing in high salmon bycatch areas under the IPA or ICA for salmon bycatch. Also the pollock, and other groundfish that are estimated to be taken during the testing of the salmon excluder device under Alternative 2 will not be harvested under the status quo, but this amount is less than one percent of the annual TAC for pollock. The amount of fish harvested under the EFP in relation to the total harvest is very small and any effects are not likely discernable, as further explained below under Alternative 2.

4.2.2 Alternative 2 – Issue the EFP Effects on Target Species

The EFP applicant estimated that total harvest of allocated groundfish species is 7,500 mt spread over three seasons. Approximately 97–99% (7,275–7,425 mt) is expected to be pollock and 1–3% (50 to 80 mt for each year of the EFP) is expected to be other groundfish species such as Pacific cod and flatfish according to data provided from the final report of EFP 11-01. The 2014 and 2015 pollock TACs approved by the Council for the Eastern Bering Sea (EBS) are 1,267,000 mt and 1,258,000 mt, respectively. On January 28, 2014 NMFS indicated that it had transferred pollock from the Aleutian Islands TAC to the Bering Sea TAC[3]. Additionally, the 2014 ABC recommended by the SSC and Council was 1,369,000 met which far exceeds the expected catch of the 2014 TAC and the 2,500 mt of groundfish taken in the EFP (expected to be 97-99% pollock). The OFL for EBS pollock in 2014 was set at 2,795000 which substantially buffers any potential for overfishing to occur from harvest of the pollock fishery TAC and EFP catch allowance in 2014. Although TAC is set at ABC for 2015, is consistent with the convention in the annual groundfish specification process which sets pollock ABC and TAC for future years, the overfishing level for 2015 set in the 2014-2015 groundfish specifications was 2,693,000 mt. This, again, creates a very large buffer to prevent the pollock fishery and EFP from removing pollock at a level that results in overfishing of the BS/AI pollock stock. To insure a sufficient amount of groundfish catch for the EFP between the TAC and ABC for EBS pollock, one requirement for issuance of this EFP permit would be for the EBS pollock TAC to be set equal to or less than 5,000 mt below the pollock ABC for 2015, and for the 2016 TAC to be set 2,500 mt below ABC.

In summary, the amount of harvests under the EFP in relation to the total harvest of pollock in the Bering Sea is quite small and therefore it is highly unlikely that the EFP harvest would have any discernable effects on the pollock stock or on other species that may depend on pollock. Also, typically, due to management constraints, the total pollock catch in any year is considerably lower than the pollock TAC: in 2012, the TAC was set at 1,212,400 mt, and total catch was 1,202,560 mt, in 2011, the TAC was set at 1,266,400 and the total catch was 1,197,760 mt; in 2010, the TAC was set at 813,000 mt and the total catch was 810,753 mt; in 2009, the TAC was set at 815,000 and the total catch was 810,743 mt; and in 2008, the TAC was 1,000,000 mt and the total catch was 990,578 mt. However, in 2013 the TAC was set to 1,262,000 mt and the total catch was 1,269,713 mt.

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[3] http://alaskafisheries.noaa.gov/cm/info_bulletins/bulletin.aspx?bulletin_id=9219

Compared to the catch of pollock targeted during EFP fishing, small amounts of Pacific cod, arrowtooth flounder, yellowfin sole, Northern rock sole, Pacific ocean perch, and skates may be taken during EFP activities. The BSAI TACs are below the ABCs for Pacific cod, yellowfin sole, Greenland turbot, arrowtooth flounder, Northern rock sole, flathead sole, and Alaska plaice (Table 6). The anticipated harvest of 50–80 mt of groundfish other than pollock per for each year of testing would likely have no effect on these stocks because the gap between ABC and TAC for these species is over 100 mt. If the harvest of species other than pollock is evenly distributed among the seasons of testing under the EFP, 25 mt to 150 mt of other groundfish species would be taken each calendar year of testing. For any of these species 50 mt to 80 mt per year would be a small portion of the annual TAC. The TAC for sablefish, Greenland turbot, Pacific ocean perch, blackspotted rougheye, shortraker rockfish, and Atka mackerel is set at ABC in 2014. Out of these species, Pacific ocean perch, Greenland turbot, and Atka mackerel are the only fish that have been caught under previous EFP studies for the salmon excluder device. In 2011 and 2012, under EFP 11-01, total catch of sablefish, Pacific Ocean Perch, Greenland turbot, blackspotted/rougheye, shortraker, and Atka mackerel over the three field seasons of that EFP were: 0.03 mt, 11.8 mt, 0 mt, 0.01 mt, and 0.87 mt respectively. Using the previous EFP as a predictor for catches in this EFP, it is clear that incidental catches of those species are likely to be at levels that are not significant. Because of the expected underharvest by the fishery, the expected total catch including that authorized under the EFP is not expected to exceed the ABC; therefore, there are no effects beyond those analyzed in the Amendment 91 EIS (NMFS 2009a).

Because the amount of all groundfish anticipated to be harvested during the experiment is very small in relation to the annual harvest, and in most cases well below the ABCs, it is not likely that harvesting these groundfish species under Alternative 2 will have any discernable effects on these groundfish stocks. Alternative 2 impacts on groundfish stocks are not expected to affect (1) stock's ability to sustain itself above MSST, (2) the capacity of the stock to yield sustainable biomass on a continuing basis, (3) the distribution of harvested stocks either spatially or temporally such that it has an effect on the ability of the stock to sustain itself; therefore; the impacts of Alternative 2 are likely insignificant.

4.2.3 Cumulative Effects

CEQ regulations require that the analysis of environmental consequences include a discussion of the action's impacts in the context of all other activities (human and natural) that are occurring in the affected environment and impacting the resources being affected by the proposed action and alternatives. This cumulative impact discussion should include incremental impacts of the action when added to past, present, and reasonably foreseeable future actions. A discussion of the reasonably foreseeable future actions that may affect resource components and that also may be affected by the Bering Sea pollock fishery is in section 3.4 of the Amendment 91 EIS (NMFS 2009a). The Amendment 91 EIS also includes, relevant past and present actions are identified and integrated into the impacts analysis for each resource component in Chapters 4 through 8.

A discussion of the cumulative effects of the groundfish fisheries, including the Bering Sea is in the Alaska Groundfish Harvest Specifications EIS (NMFS 2007c). The past and current cumulative effects are discussed in the PSEIS (NMFS 2004). Each of these discussions are incorporated by reference. For target species, several future actions were identified as reasonably foreseeable future actions. The reasonably foreseeable future actions that may impact target species are—

- ecosystem-sensitive management;
- fisheries rationalization;
- traditional management tools;
- actions by other state, federal, and international agencies; and
- private actions.

The following reasonably foreseeable future actions may have a continuing, additive, and meaningful relationship to the direct and indirect effects of the alternatives on target species. This analysis builds on the analysis of the impacts of each of these actions on target species in the Amendment 91 EIS (NMFS 2009a).

Ecosystem-sensitive management

Ecosystem-sensitive management is likely to benefit target species. The specific actions that will be taken to implement an ecosystem policy for fisheries management are unknown at this time; therefore, the significance of cumulative effects of ecosystem policy implementation on mortality, spatial and temporal distribution of the fisheries, changes in prey availability, and changes in habitat suitability are unclear. However, these actions may enhance the ability of stocks to sustain themselves at or above MSST, as ways are found to introduce ecosystem considerations into the management process.

As noted in section 3.4.1 of the Amendment 91 EIS (NMFS 2009a), an increased understanding of interactions between ecosystem components is reasonably foreseeable. This coupled with another reasonably foreseeable action, increased integration of ecosystem considerations into fisheries decision-making, is likely to result in fishery management that reduces potential adverse impacts of the proposed action on target stocks. An example of the ways new information may change our perspectives was suggested at a workshop on multi-species and ecosystem-based management held at the February 2005 Council meeting. Multi-species and ecosystem projections of biomass impacts from eliminating fishing mortality for 20 years were compared to similar estimates made with single-species models. A report of the discussions noted that, "Results… were similar for top predators such as Pacific cod and Greenland turbot. However, results for walleye pollock, a key forage species, were different when predator/prey interactions were included. Both the multi-species and ecosystem models predicted much more modest increases in pollock biomass than did the single-species model, as predation increased to compensate for the increase in food supply." Predation here refers to cannibalism of juvenile pollock by larger adult pollock.

The reasonable foreseeable future actions that will most impact the pollock fisheries and pollock stocks are changes to the management of the fisheries due to increasing protection of ESA-listed and other non-target species. The Council is considering action on management measures to minimize chum salmon bycatch in the pollock fishery. Because any revised chum salmon bycatch measures will also regulate the pollock fishery, there will be a synergistic interaction with the management measures under Amendment 91. Analysis on the chum salmon action is currently underway.

Rationalization

Fisheries rationalization makes large changes to the way the fisheries are managed and primarily affects the allocation of harvest amounts. The future effects on target species are minimal because rationalization would not change the setting of TACs, which control the impacts of the fisheries on fishing mortality. However, to the extent rationalization improves fishing practices and the manageability of the fisheries, it could reduce the adverse effects of the proposed action on target species.

Traditional management tools

Future harvest specifications will primarily affect fishing mortality, as the other significance criteria for target species (temporal and spatial harvest, prey availability, and habitat suitability) are primarily controlled through regulations in 50 CFR part 679. The setting of harvest levels each year is controlled to ensure the stock can produce maximum sustainable yield (MSY) on a continuing basis and to prevent overfishing. Each year's setting of harvest specifications include the consideration of past harvests and future harvests based on available biomass estimates. In-season managers close species to directed fishing as fishermen approach TACs, prohibit retention of species when a TAC has been reached, and introduce fishing restrictions, or actual fishery closures, in fisheries in which harvests approach OFL. The 2 million mt optimum yield in the BSAI also contributes significantly to preventing overharvests. The controls on fishing mortality in setting harvest specifications ensure the stocks are able to produce MSY on a continuing basis.

Because of improved fish stock information, the number of TAC categories with low values of ABC/OFL are increasing which tends to increase the likelihood that closures of directed fisheries to prevent overfishing will occur. In recent years management of species groups has tended to separate the constituent species into individual ABCs and OFLs. While managing the species with separate ABCs and OFLs reduces the potential for overfishing the individual species, the effect of creating more species categories can increase the potential for incurring management measures to prevent overfishing, such as fishery closures. Managers closely watch species with fairly close amounts between the OFL and ABCs during the fishing year, and the fleet will adjust behavior to prevent incurring management actions. A large proportion of the groundfish fleet now carries vessel monitoring systems (VMS) due to VMS requirements introduced in connection with the Steller sea lion protection measures, EFH/HAPC protection measures, and the Crab Rationalization Program. The entire pollock fleet now carries VMS due to VMS requirements introduced in connection with the AFA. In-season managers currently use VMS intensively to manage fisheries so that harvests are as close to TACs as possible. VMS has also become a valuable diagnostic tool for addressing situations with unexpected harvests. It was used as a diagnostic tool in July 2006 to investigate the sources of a sudden and unexpected bycatch of squid in the pollock fishery. As agency experience with VMS grows, it should allow in-season managers to more precisely match harvests to TACs, reducing potential overages, and maximizing the value of TACs to industry. Extension of VMS will be associated with larger costs for vessels that will adopt it.

Other government actions

The Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) expects that reasonably foreseeable future activities include development of oil and gas deposits over the next 15–20 years in federal waters off Alaska. Potential environmental risks from the development of offshore drilling include the impacts of increased vessel offshore oil spills, drilling discharges, offshore construction activities, and seismic surveys. Adverse environmental impacts resulting from exploration and development in the future could impact salmon, halibut, and herring stocks. The extent to which these impacts may occur is unknown.

Private actions

Fishing activities by private fishing operations, carried out under the authority of the Bering Sea pollock fishery, are an important class of private action. The impact of these actions has been considered under traditional management tools.

A private action not treated above is the Marine Stewardship Council (MSC) environmental certification of fisheries. The MSC developed standards for sustainable fishing and seafood traceability. They ensure that MSC-labeled seafood comes from, and can be traced back to, a sustainable fishery. The MSC certified BSAI and GOA pollock, Pacific cod, flatfish, halibut, and sablefish. Certification will have to be renewed in the future. If the MSC environmental certification has important marketing benefits, this will increase industry incentives to address the environmental issues connected with the fishery. In this context, it may tend to lengthen industry's time horizon, and increase its interest in target stock sustainability. More information on the MSC certification program may be found at http://eng.msc.org/.

Increasing economic activity in and off Alaska may affect future fisheries. The high levels of traffic between the West coast and East Asia raise concerns about pollution incidents or the introduction of invasive species from ballast water. Pollution issues were highlighted in December 2004 when the M/V *Selendang Ayu* wrecked on Unalaska Island and again in July 2006 with the M/V *Cougar Ace* accident. Alaskan economic development can affect the coastal zone and species that depend on the zone. However, Alaska remains relatively lightly developed compared to other states in the nation. Marine transportation associated with that development may be more of a concern than in other states, due to the relatively greater importance of marine transportation to Alaska's economy.

The development of aquaculture may affect prices for, and the harvest of, some species. For example, the development of sablefish aquaculture may reduce wild sablefish prices and reduce interest in sablefish harvests in high-operating-cost areas in the BSAI where sablefish TACs are currently not fully harvested. More direct impacts, through development of finfish aquaculture in waters off Alaska, do not appear to be likely at this time.

4.2.4 Summary of Effects

The direct, indirect, and cumulative effects of the alternatives are not expected to (1) jeopardize the capacity of the stocks to produce maximum sustainable yield on a continuing basis, (2) alter the genetic sub-population structure such that it jeopardizes the ability of each stock to sustain itself at or above the minimum stock size threshold or experience overfishing, (3) decrease reproductive success in a way that jeopardizes the ability of each stock to sustain itself at or above the minimum stock size threshold, (4) alter harvest levels or distribution of harvest such that prey availability would jeopardize the ability of each stock to sustain itself at or above the minimum stock size threshold or experience overfishing, and (5) disturb habitat at a level that would alter spawning or rearing success such that it would jeopardize the ability of each stock to sustain itself at or above the minimum stock size threshold or experience overfishing. **For these reasons, impacts to target species are predicted to be insignificant for target species evaluated under Alternatives 1 and 2.**

4.3 Status of Prohibited Species Stocks

Prohibited species taken incidentally in the pollock fishery include: Pacific salmon (Chinook, coho, sockeye, chum, and pink salmon), steelhead trout, Pacific halibut, Pacific herring, and Alaska king, Tanner, and snow crabs. In order to control bycatch of prohibited species in the BSAI pollock fishery, the Council annually specifies PSC limits for some prohibited species. The status of the prohibited species in the BSAI is detailed in the SAFE report (NPFMC 2013b). During catch sorting, these species or species groups are to be returned to the sea with a minimum of injury except when their retention is required by other applicable law.

Under the proposed action, salmon, halibut, and herring are the only PSC species that are expected to be taken because the EFP fishing uses pelagic trawl gear in a manner that meets the trawl performance standard at 50 CFR 679.7, greatly reducing the bycatch of other PSC species. Status information regarding salmon, halibut, and herring is provided in this section. Most of the herring taken in the groundfish fisheries is taken by the pelagic trawl gear used by the Bering Sea pollock fishery (NMFS 2009a). Of all PSC species used in the pelagic trawl pollock fishery, salmon is the most common PSC species taken (NMFS 2009a).

4.3.1 Salmon

The EIS/RIR for Bering Sea Chinook Salmon Bycatch Management has the latest status information for salmon that may be taken in the Bering Sea pollock fishery (NMFS 2009a). The EIS details the status of Chinook salmon stocks in Chapter 5 and the status of non-Chinook salmon stocks in chapter 6. The preliminary draft EA/RIR for Bering Sea Non-Chinook Salmon Bycatch Management (NPFMC 2011) includes information on non-Chinook salmon stocks and is currently being updated for review. This section provides recent and relevant information since the Amendment 91 EIS.

Salmon species primarily taken in the pollock fishery are Chinook and chum salmon. Table 8 shows the estimated number of salmon measured by the observer program in 2012 in the BSAI groundfish fisheries (Balsiger 2013). Because the number of salmon measured for lengths by species is in proportion to the number of each species observed caught, this information indicates the proportion of salmon species observed taken in the BSAI groundfish fisheries. Because the taking of coho, sockeye, and pink salmon is a relatively rare event in the BSAI groundfish fisheries, the proposed action is not likely to result in a substantial portion of these species being taken. This analysis will focus on Chinook and chum salmon.

Table 8 Estimated Number of Salmon Measured and Sampled by Observers in 2012.

Region	Species Name	# Measured	Total Salmon
BSAI	CHUM SALMON	819	717
BSAI	CHINOOK SALMON	1,157	1,122
BSAI	COHO SALMON	7	na
BSAI	SOCKEYE SALMON	13	na
BSAI	PINK SALMON	42	na

Source: Balsiger 2013

4.3.1.1 Chinook Salmon Status

Two analyses of stock of origin were completed and distributed in the form of NOAA Technical reports in 2013 and 2014. For 2014, the first is for Chinook (Guthrie et al. 2014) and the second is for chum salmon (Vulstek et al. 2014).[4] Summarizing the results of these reports, in both analyses, 2012 genetic samples collected by fishery observers were used. Collections used stratified random sampling designs to characterize stock of origin for salmon taken as bycatch in the Bering Sea and Gulf of Alaska pollock trawl fisheries. The results for Chinook salmon taken as bycatch in the Bering Sea pollock fishery are as follows: 63% from coastal and western Alaska origin; 11% for Northern Alaska Peninsula; 10% for Canada; 7% Pacific Northwest states. The results for chum salmon from 2011 observer data using a similar but less frequent sampling protocol were as follows: 18% for Eastern Gulf of Alaska/Pacific

[4] Both reports are available at: http://www.npfmc.org/salmon-bycatch-overview/bering-sea-chinook-salmon-bycatch/.

Northwest; 59% Asian (Eastern and North Asian combined); 14% for Western Alaska, 7% Yukon River drainage (upper and lower river); and 2% for Southwest Alaska.

North Pacific Chinook salmon are the target of subsistence, commercial, and recreational fisheries. Approximately 90 percent of the subsistence harvest is taken in the Yukon and Kuskokwim river systems. For more information on state management of salmon subsistence fisheries, refer to the ADF&G website at www.adfg.alaska.gov/index.cfm?adfg=fishingSubsistence.main and the Alaska Subsistence Salmon Fisheries 2007 Annual Report at www.subsistence.adfg.state.ak.us/techpap/TP346.pdf. The majority of the Alaska commercial catch is made in Southeast, Bristol Bay, and the Arctic-Yukon-Kuskokwim areas. Fish taken commercially average about 18 pounds. The majority of the catch is made with troll gear or gillnets.

The Chinook salmon is the most highly prized sport fish on the west coast of North America. In Alaska it is extensively fished by anglers in the Southeast and Cook Inlet areas. The Alaska sport fishing harvest of Chinook salmon is over 76,000 annually, with Cook Inlet and adjacent watersheds contributing over half of the catch. Unlike non-Chinook species, Chinook salmon rear in inshore marine waters and are, therefore, available to commercial and sport fishermen all year.

Directed commercial Chinook salmon fisheries in Alaska occur in the Yukon River, Nushagak District, Copper River, and the Southeast Alaska troll fishery. In all other areas of Alaska, Chinook are taken incidentally and mainly in the early portions of the sockeye salmon fisheries. Catches in the Southeast Alaska troll fishery have been declining in recent years, due to United States/Canada treaty restrictions and declining abundance of Chinook salmon in British Columbia and the Pacific Northwest. Chinook salmon catches were moderate to high in most regions between 1984–2004 (Eggers 2004). However, western Alaska Chinook salmon stocks declined sharply in 2007 and have remained depressed since. In recent years of low Chinook salmon returns, the in-river harvest of western Alaska Chinook salmon has been severely restricted and, in some cases, river systems have not met escapement goals.

The Yukon River Chinook salmon run has experienced a dramatic decline in run size since 1998. The cause of this drastic drop in abundance remains largely unknown. Though parent year escapement objectives were generally achieved throughout the drainage, Chinook salmon returns since 2007 have been much lower than expected (ADFG 2013a). The Yukon River Chinook stocks have been classified as stocks of concern (Eggers 2004), and this classification was continued as a stock of yield concern in February 2007, based on the inability, despite the use of specific management measures, to maintain expected yields, or harvestable surpluses, above the stocks' escapement needs since 1998 (Bue and Hayes 2007). In December 2009, Alaska Department of Fish and Game (ADF&G) recommended continuing this classification as a stock of yield concern.

The 2013 preliminary cumulative passage estimate data from the Yukon River Pilot Station Sonar was approximately 114, 500 Chinook salmon, which was below the historical average[5]of 145,500 fish and below the average of 128,000 for years with late run timing[6] (ADFG 2013a). This is the lowest estimated number for the Pilot Station Sonar since 2001. While escapement goals were generally met throughout the Alaska portion of the Yukon drainage over the 5 years period from (2005–2009) an increasing number of Yukon tributaries are not making escapement goals since 2009. For example, in 2013 only three of seven tributaries (including the Eagle sonar station that is used to estimate escapement across the Canadian

[5] Average includes years 1995, 1997, 1999, 2002-2008, and 2010-2012.
[6] Years with late run timing used for comparison include 1999, 2001, 2006, 2010 and 2012.

boundary with Alaska) achieved escapement goals. No commercial Chinook salmon fishery was authorized in the Lower Yukon River in 2013 for the sixth year in a row.

In the Yukon River there have been subsistence schedule restrictions for multiple years, no directed commercial fisheries and restrictions and bag limits in the sport fisheries (ADFG 2013a). Combined commercial and subsistence harvests show a substantial decrease in Chinook salmon yield from the 10-year period (1989–1998) to the recent 5-year (2004–2008) average (Howard et al. 2009).

Kuskokwim River Chinook salmon abundance is generally on a decline following a period of exceptionally high abundance years in 2004, 2005, and 2006 that ranged from 360,000 to 425,000 fish (NMFS 2009a). In 2010, Chinook salmon abundance in the Kuskokwim River was poor and escapements were below average at all monitored locations. Kogrukluk River Chinook estimated escapement was within the escapement goal range, while Kwethluk, Tuluksak, and George rivers did not achieve the lower end of their respective Chinook escapement goal ranges (ADFG 2010a). Total commercial harvest of Kuskokwim River Chinook salmon was above most recent 10-year (2000–2009) and 5-year (2005–2009) averages, with a preliminary harvest of 3,370 fish (ADFG 2010b). Chinook salmon harvest and catch rates were below the recent 10-year average in Kuskokwim Bay. The preliminary estimated 2012 total run of Chinook salmon in the Kuskokwim River was the lowest on record, which goes back to 1976. The preliminary 2012 subsistence Chinook salmon harvest estimate was the smallest Chinook salmon subsistence harvest estimate in our dataset, which goes back to 1990 (ADFG 2013b).

The primary managed Bristol Bay Chinook salmon stocks are in the Nushagak River, although management occurs on rivers within each of the districts comprising Bristol Bay. The harvest of Bristol Bay Chinook salmon was 31,400, which is 48% of the average harvest for the last 20 years (ADFG 2010b). Escapement into the Nushagak River was 36,625; this is the first time since enumeration began, in 1980, that the minimum escapement goal of 40,000 was not met. Sport fishing was closed completely and subsistence fishing was reduced to 3 days per week in the Nushagak River. The preliminary commercial harvest estimate for Bristol Bay Chinook salmon in 2011 is 41,000 fish (ADFG 2010c). Projections are based on the most recent 5-year average and the observed mean percent error (MPE) of 28% during that same time period. ADFG did not forecasting a total run for 2011, 2012 and 2013 due to uncertainties in methods used for estimating Chinook salmon abundance. However, a commercial fishery on Chinook salmon occurred in 2014 and is projected to occur in 2014 (ADFG 2013c). In 2013, new research will begin to attempt to address these uncertainties.

Weak Chinook salmon runs occurred throughout Norton Sound in 2013 requiring inseason restrictions and early closures to southern Norton Sound subsistence fisheries. In 2013, in Norton Sound, Chinook salmon had the poorest run on record and precluded commercial fishing directed on Chinook salmon for the sixth consecutive season; restrictions and early closures to the Chinook salmon subsistence and sport fisheries in Shaktoolik (Subdistrict 5) and Unalakleet (Subdistrict 6) were also implemented to meet escapement needs (ADFG 2013d). The primary assessment tools for gauging Chinook salmon run strength are the Unalakleet River test net and floating weir, enumeration towers on Kwiniuk, Niukluk, and North rivers, aerial surveys, and inseason subsistence catch reports (ADFG 2010d).

4.3.1.2 Chum Salmon Status

Stock composition for Chum salmon in the Bering Sea is currently available by aggregate groupings (micro-satellite baseline): East Asia, North Asia, Western Alaska (includes lower Yukon), Upper/Middle Yukon, Southwest Alaska, and Pacific Northwest (includes stocks from Prince William Sound to Washington State). Aggregations were developed based on a combination of genetic characteristics and relative contributions to the mixture. To determine the stock composition mixtures of chum salmon in the Bering Sea, a number of genetics analyses have been completed (i.e., Guyon et al. 2010, Marvin et al. 2011, Gray et al. 2011, McCraney et al. 2010, Guthrie et al. 2013, and Guthrie et.al. 2014). These studies have shown that genetic samples collected from chum salmon bycatch in the Bering Sea were predominantly from Asian stocks. Substantial contributions were also from western Alaska and the Pacific Northwest. There appeared to be a higher contribution from East Asia and lower contribution from Western Alaska in more recent years (Guthrie et al. 2013). Overall, the estimate of AEQ chum salmon mortality in the Bering Sea pollock fishery from 1994–2010 ranged from about 16,000 fish to just over 540,000 (NPFMC 2011). Additional funding and research focus is being directed towards both collection of samples from the eastern Bering Sea trawl fishery for Chum salmon species as well as the related genetic analyses to estimate stock composition of the bycatch. Updated information will be provided in the EA for Bering Sea Non-Chinook Salmon Bycatch Management.

Chum salmon fisheries in Alaska occur in 11 management regions which are detailed on the ADFG website at http://www.cf.adfg.state.ak.us/region3/finfish/salmon/salmhom3.php. These include chum salmon fisheries in the Arctic-Yukon-Kuskokwim (AYK) management area and target hatchery runs in Prince William Sound and Southeast Alaska. Chum salmon runs to AYK rivers have fluctuated in recent years. Chum salmon in the Yukon River and in some areas of Norton Sound had been classified as stocks of concern (Eggers 2004). In response to the guidelines established in the Sustainable Salmon Policy, the BOF discontinued the Yukon River summer and fall chum salmon as stocks of concern during the February 2007 work session (Bue and Hayes 2007).

The BASIS (Bering-Aleutian Salmon International Survey) study has observed significant increases in juvenile chum in the Bering Sea through 2005. Further, bycatch of adult chum in Bering Sea trawl fisheries has increased. Although not all of these fish are bound for western Alaska, higher bycatch may be an indicator of favorable ocean conditions, and chum ocean survival may have increased significantly.

Yukon summer chum salmon runs have exhibited steady improvements since 2001 with the drainage wide optimum escapement goal (OEG) of 600,000 fish exceeded annually (Bergstrom et al. 2009). In 2006, a large number of 5-year-old summer chum salmon returns were observed throughout the AYK Region. Since 2007, run abundance has shifted to near average levels and has allowed for subsistence harvests and a near average available yield for commercial harvests (Bergstrom et al. 2009). Summer chum runs have provided a harvestable surplus the last 7 years (2003–2009), and since 2007, there has been a renewed market interest for summer chum salmon in the lower river Districts 1 and 2. In 2010, a surplus of summer chum salmon was anticipated above escapement and subsistence needs; however, the extent of a directed chum commercial fishery is dependent on the strength of the Chinook salmon run. The ADFG took an unprecedented action to cancel the commercial period on a short notice to avoid harvesting a significant number of Chinook salmon because test fishery information showed an abrupt drop in the summer chum entering the river. The summer chum salmon harvest of 232,888 in 2010 was 193% above the 2000-2009 average harvest of 79,438 fish (ADFG 2010e). The summer chum salmon harvest of 485,587 in 2013 was 220% above the 2003 to 2013 average harvest of 151,776 chum salmon. In 2010, monitored summer chum salmon escapements ranged from above average to below the recent 5-year average at all monitored locations (ADFG 2010e), and in 2013 all monitored escapements were at or above the 5-year average (ADFG 2013a).

In 2013 the post season commercial harvest of Yukon fall chum salmon was 238,051fish. The fall chum harvest was above the most recent 5-year (2008–2012) and 10-year (2003–2012) averages. The fall chum salmon harvest was the fifth largest since 1990. The Yukon fall chum salmon run size for 2013 was forecast to be 1,029,000 fish with a range of 906,000 to 1,152,000 fish. For the Yukon fall chum salmon stocks, considerable uncertainty has been associated with these run projections, particularly recently because of unexpected run failures (1997 to 2002) which were followed by a strong improvement in productivity from 2003 through 2006 (Bue and Hayes 2007). Weak salmon runs prior to 2003 have generally been attributed to reduced productivity in the marine environment and not a result of low levels of parental escapement. The preliminary forecast for Yukon fall chum salmon is between 802,000 and 1,040,000 fish (ADFG 2014b).

Throughout the Kuskokwim area in 2010 and 2013, chum abundance was considered very good, and amounts necessary for subsistence use is expected to have been achieved throughout the area. Kuskokwim River chum salmon are an important subsistence species, as well as the primary commercially targeted salmon species on the Kuskokwim River in June and July (NMFS 2007a). Kuskokwim River chum salmon were designated a stock of concern under yield concern in September 2000, and this designation was discontinued in February 2007. Since 2000, chum salmon runs on the Kuskokwim have been improving. Total commercial harvests of chum salmon in 2010 was above most recent 10-year (2000-2009) and 5-year (2005-2009) averages, with a commercial harvest of 103,000fish (ADFG 2010a). In 2013 the Kuskokwim River commercial chum harvest was 122,965 fish (ADFG 2014b).

In Bristol Bay, the 2010 chum salmon harvest was 1.09 million fish was 15% above the 20-year average (ADFG 2010b), declined to 872,000 in 2013 (ADFG 2014c). Naknek-Kvichak and Nushagak Districts harvested above their 20-year averages in 2010; however, Egegik, Ugashik and Togiak Districts harvested below their 20-year averages. Approximately 523,000 chum salmon were harvested in the Nushagak District in 2013 (ADFG 2014b).

The 2013 forecasted commercial chum salmon harvest range was 40,000–70,000. However, the chum salmon run was much stronger than expected in southern Norton Sound and below average in northern Norton Sound, except for Subdistrict 1 (Nome) and Port Clarence District, which had well above average runs. Total Norton Sound chum salmon catches for 2013 were 119,000 fish. Commercial chum salmon fishing was delayed until July in Subdistricts 5 and 6 to protect Chinook salmon, but the Subdistrict 6 chum salmon harvest was still the third highest on record.

Highlights of the 2013 Norton Sound District commercial salmon fishery included the highest chum salmon harvest in over 25 years, and the third year out of the last four years that the exvessel value exceeded one million dollars. Also, Subdistrict 4 (Norton Bay) had record harvests of both chum and coho salmon, Subdistrict 2 (Golovin) had the second highest coho salmon harvest, and Subdistrict 3 (Elim) had the fourth highest coho salmon harvest. Disappointments in 2013 were persistent severe weather and high surf conditions that kept fishermen on the beach throughout much of August in Subdistrict 5 (Shaktoolik) and to a lesser extent in Subdistrict 6 (Unalakleet), and weak Chinook salmon runs that occurred throughout Norton Sound requiring inseason restrictions and an early closure to southern Norton Sound subsistence fisheries (ADFG 2014b)

Chum salmon also is harvested in the Kotzebue area. In 2013, 319,062 chum salmon were caught in the Kotzebue area (ADFG 2013e). In summary, strong commercial and test fish catches in July indicated a very large chum salmon run that led to additional commercial fishery openings. Subsistence and escapement goals were met. This was higher than the strong 2010 season commercial harvest of 270,343 chum salmon, which was the highest since 1995 (ADFG 2010f).

4.3.2 Pacific Halibut

On an annual basis, the International Pacific Halibut Commission (IPHC) assesses the abundance of Pacific halibut and sets annual harvest limits for the commercial setline fishery (IFQ fishery). The stock assessment is based on data collected during scientific survey cruises, information from commercial fisheries, and an area-specific harvest rate that is applied to an estimated amount of exploitable biomass. This information is used to determine a biological limit for the total area removals from specific regulatory areas. The biological target is known as the "Constant Exploitation Yield" (CEY) for a specific area and year. Removals from sources other than the IFQ fishery are subtracted from the CEY to obtain the "Fishery CEY". These removals include bycatch mortality greater than 26 inches in total length (discard), halibut killed by lost and abandoned gear, halibut harvested for personal use, and sport catch. U26 halibut bycatch is accounted for in the setting of the harvest rate, which is applied to the total exploitable biomass calculated by the IPHC on an annual basis. Finally, the amount of halibut recommended for the IFQ fishery may be different from the Fishery CEY level due to other considerations by the IPHC.

The IPHC holds an annual meeting where IPHC commissioners review IPHC staff recommendations for harvest limits and stock status (e.g., CEY). The IPHC stock assessment model uses information about the age and sex structure of the Pacific halibut population, which ranges from northern California to the Bering Sea. The most recent halibut stock assessment was developed by IPHC staff for its 2014 Annual IPHC meeting (http://iphc.int/publications/bluebooks/IPHC_bluebook_2014.pdf). According to the 2013 stock assessment, the Pacific halibut stock has been declining continuously over much of the last decade, primarily as a result of recruitment strengths that are much smaller than those observed through the 1980s and 1990s, as well as decreasing size-at-age. In the last few years, female spawning biomass is estimated to have stabilized near 200 million pounds. The 2014 estimate of exploitable biomass consistent with the IPHC's current harvest policy is 170.29 million pounds. The long time-series model provided several alternative reference points for comparison: the stock is currently estimated to be at 38% of the long-term average equilibrium spawning biomass, and 34% of the current stock size projected in the absence of fishing. It is also estimated to be considerably larger (187%) than the spawning biomass estimate from the late 1970s. The application of the IHPC's current harvest policy results in the Blue Line of the decision table with a coast-wide total CEY of 33.49 million pounds.

Based on the biomass estimates from the 2013 stock assessment, 2014 catch limits for the directed halibut fishery in the Bering Sea (IPHC statistical areas 4C, 4D, and 4E were reduced by approximately 35% (from 1.93 million pounds in 2012 to 1.26 million pounds in 2014). According to information in the 2013 stock assessment, IPHC scientists now believe that the halibut biomass in the Bering Sea, including the trend in abundance for sub-legal fish, is declining.

The 2014 and 2015 halibut PSC limit for the BSAI is allocated between the trawl fishery and the non-trawl fisheries. The trawl fishery has a halibut PSC limit that may not exceed 3,675 mt (§ 679.21(e)(1)(iv)). The non-trawl fishery has a halibut PSC limit that may not exceed 900 mt. The Bering Sea pollock fishery is currently exempted from fishery closures due to reaching a halibut PSC limit. Regulations at 50 CFR 679.21(e)(7)(i) exempt vessels using pelagic trawl gear and targeting pollock from being closed due to reaching their bycatch allowance or seasonal apportionment. This exemption allows the pollock fishery to continue fishing even if their allowance of halibut PSC (for the combined pollock/Atka mackerel/other species fisheries) has been reached. As a result, NMFS balances the halibut PSC limit in the pollock trawl fishery against halibut PSC limits in the non-pollock trawl fishery categories. This process ensures the overall BSAI trawl PSC limit is not exceeded.

4.3.3 Pacific Herring

Information regarding the status of herring is available in section 7.1 of the Alaska Groundfish Harvest Specifications EIS (NMFS 2007c). Information on the impacts of the Bering Sea pollock fishery on herring are in section 7.3 of the Amendment 91 EIS (NMFS 2009a). Pacific herring are managed by the State of Alaska on a sustained yield principle. Pacific herring are surveyed each year and the State's guideline harvest levels (GHLs) are based on an exploitation rate of 20 percent of the projected spawning biomass. These GHLs may be adjusted in-season based on additional survey information to ensure long-term sustainable yields. The ADFG has established minimum spawning biomass thresholds for herring stocks that must be met before a commercial fishery may occur.

The most recent herring stock assessment for the eastern Bering Sea stock was conducted by ADFG in December 2005. For 2008 and 2009, the herring biomass in the eastern Bering Sea was estimated to be 172,644 mt. In 2014 it is estimated to be approximately 217,000 mt for the eastern Bering Sea (ADFG 2013f). Additional information on the life history of herring and management measures in the groundfish fisheries to conserve herring stocks can be found in section 3.5 of the PSEIS (NMFS 2004).

The PSC limit for herring bycatch is set at 1 percent of the estimated herring biomass. The Pacific herring PSC limit in 2013 was 2,648 mt for all BSAI trawl fisheries. The BSAI pollock trawl fishery in 2013 took 959 mt of herring. For 2013, the BSAI trawl fishery took 37% of the herring PSC limit of which 97% was taken in the pollock fishery.[7] Herring taken in the BSAI groundfish fisheries are from the Bering Sea area and are not likely to include herring from the Gulf of Alaska (http://www.cf.adfg.state.ak.us/geninfo/finfish/herring/herrhome.php).

Herring commercial fisheries are managed by the ADFG in eight areas of the AYK area. In 2011 (the most recent year published on the ADFG website, approximately 20,200 mt of herring were harvested in the AYK area. Projections from postseason escapement estimates suggest that the 2012 spawning biomass for northeastern Bering Sea herring stocks (Security Cove to Norton Sound Districts) was aproximately112,000 tons, with an anticipated allowable harvest of approximately 20,000 tons (ADFG 2014c). The preliminary biomass for 2014 is less than 2011. From Security Cove to Norton Sound the spawning biomass is estimated to be approximately 72,051 mt (ADF&G 2013f).

4.4 Effects on Salmon, Halibut and Herring

The significance criteria used to evaluate the effects of the action on nontarget and prohibited species are in Table 9. These criteria are from the 2006–2007 groundfish harvest specifications environmental assessment/final regulatory flexibility analysis (EA/FRFA) (NMFS 2006b).

[7] NMFS Inseason Management data at http://alaskafisheries.noaa.gov/2013/car120_psc_bsai_with_cdq.pdf

Table 9 Criteria Used to Estimate the Significance of Impacts on Nontarget and Prohibited Species.

No impact	No incidental take of the nontarget and prohibited species in question.
Adverse impact	There are incidental takes of the nontarget and prohibited species in question.
Beneficial impact	Natural at-sea mortality of the nontarget and prohibited species in question would be reduced – perhaps by the harvest of a predator or by the harvest of a species that competes for prey.
Significantly adverse impact	Fisheries are subject to operational constraints under PSC management measures. Groundfish fisheries without the PSC management measures would be a significantly adverse effect on prohibited species. Operation of the groundfish fisheries in a manner that substantially increases the take of nontarget species would be a significantly adverse effect on nontarget species.
Significantly beneficial impact	No benchmarks are available for significantly beneficial impact of the groundfish fishery on the nontarget and prohibited species, and significantly beneficial impacts are not defined for these species.
Unknown impact	Not applicable

The Amendment 91 EIS (NMFS 2009a) analyzes the impacts of pollock fishing on prohibited species. Potential direct and indirect effects include mortality of the PSC species, spatial and temporal effects on genetic structure and reproductive success, impacts on habitat, and impacts on prey composition for PSC species.

Salmon and herring are the primary PSC species of concern in the Bering Sea pollock fishery (NMFS 2007c). Salmon, halibut, and herring are potentially impacted by the proposed action. Other PSC species are not likely to be taken during the EFP activities because of the use of pelagic trawl gear. This action is not likely to affect PSC prey or habitat because any changes to the habitat or prey composition during the experiment is not expected based on the use of pelagic trawl gear to harvest a small amount of fish in relation to the commercial fishery, over a limited time period by one vessel in areas previously fished. Pelagic trawl gear is to be used in compliance with the trawl standard (50 CFR 679.7), which keeps the gear off the bottom; and the bycatch of this gear type is not likely to include prey that PSC species use. Because salmon and herring reproduce in habitats where groundfish fishing is not conducted, the EFP fishing is unlikely to have any effect on reproductive success (NMFS 2007c).

4.4.1 Alternative 1 – Status Quo Effects on Salmon

The effects of the pollock fishery on salmon are described in detail in the EIS for Amendment 91 (NMFS 2009a) and in the EA/RIR/FRFA for Amendment 84 (NMFS 2007a). Much of the discussion in these documents is incorporated here by reference.

The absolute numbers of salmon in the observed trawl bycatch that are presumed to originate from western Alaska stocks of Chinook salmon are small, relative to the size of the Chinook salmon biomass present in the eastern Bering Sea. The current Bering Sea pollock fishery is considered to have limited impact on these stocks although the actual impacts are difficult to determine (NMFS 2009a).

NMFS tracks the recovery of Coded-Wire Tagged (CWT) fish in the BSAI groundfish fisheries. Chinook salmon from two ESA-listed ESUs have been recovered in the BSAI groundfish fisheries (Balsiger 2013), although taking of these ESA-listed fish has been a rare event in the BSAI (NMFS 2007c). NMFS consulted on the potential effects of the BSAI groundfish fisheries on ESA-listed Pacific salmon from the Lower Columbia River and Upper Willamette River stocks based on the high amount of Chinook salmon bycatch in 2007 and for the implementation of Amendment 91 (NMFS 2007b, 2009a). No CWTs from ESA-listed ESUs were recovered from the salmon bycatch of the BSAI groundfish fisheries in either

2007 or 2008. However, one CWT from the Upper Willamette River Chinook salmon ESU was recovered from the bycatch of the BSAI groundfish fishery in both 2009 and 2010 (Balsiger 2011).

Some recent data are available regarding the spatial and temporal catch of Chinook salmon stocks in the BSAI groundfish fisheries. Two analyses of stock of origin were completed and distributed in the form of NOAA Technical reports in 2013. The first is for Chinook (Guthrie et al. 2013) and the second is for chum salmon (Kondzela et al. 2013). Both reports are available at: http://www.npfmc.org/salmon-bycatch-overview/bering-sea-chinook-salmon-bycatch/. Summarizing the results of these reports, in both analyses, 2011 genetic samples collected by fishery observers were used. Collections used stratified random sampling designs to characterize stock of origin for salmon taken as bycatch in the Bering Sea and Gulf of Alaska pollock trawl fisheries. The results for Chinook salmon taken as bycatch in the Bering Sea pollock fishery are as follows: 63%from coastal and western Alaska origin; 11% for Northern Alaska Peninsula,10% for Canada; 7% Pacific Northwest states. The results for chum salmon from 2011 observer data using a similar but less frequent sampling protocol were as follows: 18% for Eastern Gulf of Alaska/Pacific Northwest; 59% Asian (Eastern and North Asian combined); 14% for Western Alaska; 9% Yukon River drainage (upper and lower river); and 2% from Southwest Alaska.

The NMFS Auke Bay Laboratory (Auke Bay Lab) has conducted genetic analysis of Chinook and chum salmon taken in the BSAI groundfish. Myers et al. (2005) determined that bycatch of Chinook salmon from subregions of western Alaska stocks (Yukon, Kuskokwim, and Bristol Bay) vary with brood year, time, and area. Yukon River Chinook are the dominant stock for age 1.2 fish in the BSAI in winter, especially west of 170 degrees longitude west and for age 1.4 fish in the eastern BSAI. The Yukon River Chinook tend to range further west in the Bering Sea than other stocks. Bristol Bay and Cook Inlet Chinook stocks are dominate for age 1.2 salmon in the eastern BSAI in the fall. Age 1.1 Chinook salmon in the eastern BSAI in the fall are mostly Gulf of Alaska stocks. Myers et al. (2005) concluded that immature Chinook salmon are more abundant along the outer shelf break and maturing Chinook salmon are more abundant along the inner shelf break (east of 170 degrees west longitude). The adult equivalents of the Yukon River Chinook salmon bycatch in the BSAI groundfish fisheries from 1997 to 1999 was from 2,721 to 7,510 fish, having a greater impact on the Canadian escapement and catch than on the Alaska escapement and catch (Myers et al. 2005). Because no indication exists that the quantity and pattern of bycatch of Chinook salmon has affected the genetic structure of the population, the Alaska Groundfish Harvest Specifications EIS concluded that the BSAI groundfish fisheries have a small impact on salmon genetic structure (NMFS 2007c). The Amendment 91 EIS (NMFS 2009a) does not provide any conclusions regarding the impact of the Bering Sea pollock fishery on the genetic structure of salmon stocks.

4.4.2 Alternative 2 – Issue the EFP Effects on Salmon

The experimental design calls for 2,500 non-Chinook salmon and 250 Chinook salmon for the fall 2015 season and 250 non-Chinook salmon and 600 Chinook salmon for the two winter seasons of the EFP project. In total for fall 2015 through the end of the winter pollock season in 2016, up to 3,000 non-Chinook salmon and 1,450 Chinook salmon may be harvested. The most Chinook salmon harvested in a calendar year would be 850 fish in 2015. This amount would be equivalent to approximately 3% of the ten year average Chinook salmon bycatch amount (45,677 fish) in the Bering Sea pollock fishery from 2004 to 2013. The five year average (2009–2013) of Chinook salmon bycatch in the BSAI trawl fishery is 16,357 fish, and the 600 Chinook salmon taken in 2015 would be approximately 8 % of this five year average. The most chum harvest in a year under the EFP would be 2,500 fish, which is approximately 1.2% of the ten year average (2003 to 2013) for the amount of non-Chinook salmon bycatch in the BSAI groundfish fisheries or 3% of the five-year average (2006–2010). The five year average for the chum salmon bycatch in the Bering Sea pollock fishery is 81,155 fish. Even though the EFP would allow the incidental catch of salmon outside of the current PSC protection measures of Amendment 91, the increased harvest of salmon is not substantial in comparison to the commercial groundfish fishery. It is also unlikely that a CWT from an ESA-listed ESU would be recovered during the EFP fishery because of the small number of salmon harvested in relation to the pollock fishery salmon bycatch. An informal consultation with the NMFS Northwest Region on the effects of issuing the EFP 11-01 on ESA-listed Chinook salmon was completed in July 2011. The informal consultation concluded that issuing the EFP was not likely to adversely affect ESA-listed Chinook salmon (Stelle 2011). NMFS will consult on the potential impact of this proposed action on ESA-listed Chinook salmon as required under Section 7 of the ESA. This consultation will be concluded before NMFS issues the EFP.

The amount of chum and Chinook salmon taken during the EFP compared to the amount taken in the groundfish fisheries is very small and not likely to have a discernable effect on mortality on individual salmon stocks over the status quo. Because the levels of salmon bycatch under the EFP are such small amounts, and the harvest is dispersed over area and over different regional stocks, it is not likely there would be any discernable effects on the genetic structure of any Chinook or chum salmon stocks. The EFP would only require the take of Chinook salmon over the 60,000 cap in the event that full allocation was reached. However under the new requirements of Amendment 91, NMFS expects Chinook salmon bycatch numbers far below 60,000 and below 47,591.

If the salmon excluder device could be successfully implemented, the reduction in any potential effects on salmon stocks would create some expected benefits for commercial, recreational, and subsistence fishermen; salmon management; and conservation goals. In years where salmon returns are relatively low, the reduction in bycatch effects on salmon runs would be avoided to the timely benefit of those runs.

4.4.3 Alternative 1 and Alternative 2 – Effects on Halibut

The impacts of the PSC limits and the total halibut bycatch in the pollock fishery were analyzed in the Amendment 91 EIS (NMFS 2009a). The EIS examines the impacts of the fisheries on bycatch mortality, genetic structure, reproductive success, prey availability, and habitat. The EIS concludes that the impacts of the pollock fishery on prohibited species are reduced by existing management measures that mitigate adverse impacts to prohibited species. The IPHC takes account of the halibut bycatch in the Bering Sea pollock fishery when determining the fishery CEY. The Bering Sea pollock fishery is currently exempted from fishery closures due to reaching a halibut PSC limit. Regulations at 50 CFR 679.21(e)(7)(i) exempt vessels using pelagic trawl gear and targeting pollock from being closed due to reaching their bycatch allowance or seasonal apportionment. This exemption allows the pollock fishery to continue fishing even if their allowance of halibut PSC has been reached. As a result, NMFS balances the halibut PSC limit in the pollock trawl fishery against halibut PSC limits in the non-pollock trawl fishery categories. This process ensures the overall BSAI trawl PSC limit is not exceeded. (NMFS 2009a). As noted below, halibut PSC taken during EFP fishing is not expected to interfere with sustainable management of halibut stocks.

The process used by the IPHC to specify the annual catch limit for the IFQ fishery considers removals of halibut by the trawl fishery, including the Bering Sea pollock fishery. Because the annual amount of halibut PSC in the trawl fishery is limited by federal regulation, halibut mortality cannot be above biologically sustainable levels determined by the IPHC. Further, the IPHC adjusts catch in the IFQ program in accordance with other sources of halibut mortality such as trawl fishing.

In EFP 11-01, the most recent salmon excluder trial in the Bering Sea, approximately 0.33 mt (2011) and 8.5 mt (2012) of halibut was taken in the two testing years of the permit (see Table 2). In 2011, as in most recent years, the halibut trawl PSC in the BSAI of 2,171 mt[8] was well below the halibut PSC apportionment specified by NMFS in the BSAI of 3,250 mt. In comparison with the buffer between the 2011 PSC apportionment and trawl PSC of approximately 1,079 mt, the amount of PSC removed by the EFP in 2011 represented 0.03% of the available buffer. In 2012 the EFP catch of 8.5 mt of halibut PSC represented approximately 2% of the available buffer between the PSC and PSC apportionment. In 2013, the BSAI trawl fishery took 90 percent of the halibut PSC apportioned by the harvest specifications. A substantial difference exists between the 3,665 mt not harvested in 2013 and actual trawl total mortality in 2013 and previous years. Even an upper end predicted amount of EFP halibut mortality of 12 mt of halibut (based on a scenario of an increase of approximately 50% from the annual high of 8.5 mt in 2012) would be expected to remain below the annual PSC apportionment for halibut in the BSAI trawl fisheries. Thus, the alternatives considered in this analysis are not expected to change the catch of Pacific halibut in a manner that would impact the abundance of this species or exceed the PSC limits. Therefore the effects of these alternatives are expected to be the same as those previously analyzed (NMFS 2007c, 2006, and 2009a) and not significant.

4.4.4 Alternative 1 and Alternative 2 – Effects on Herring

As shown in section 4.3.2, the amount of herring harvested overall in the pollock fishery is well below the 1 percent of biomass limit. Herring may be present in a very small portion of the other species taken in the EFP fishing. Any potential additional harvest of herring under the proposed action is likely to be well below the one percent biomass limit for herring because of the small amount of herring that is normally taken in the pollock fishery and therefore any effects of Alternative 2 are likely not discernable from any effects of Alternative 1.

The EFP has no exemptions from the herring PSC limit or the Herring Savings Area closures (§ 679.21(e)(7)(vi)). No impact on herring resources is expected under the EFP beyond those already analyzed (NMFS 2009a). The Amendment 91 EIS found that the status quo fishery has very low mortality for herring in relation to the biomass and that it is unlikely there would be any impact on genetic structure of herring stocks section 7.3 of NMFS 2009a.

4.4.5 Cumulative Effects

A discussion of the cumulative effects of the pollock fishery is in the EIS for Amendment 91 (NMFS 2009a) and is incorporated by reference incorporated by reference. For prohibited species, several future actions were identified as reasonably foreseeable future actions. The reasonably foreseeable future actions that may impact prohibited species are—

- ecosystem-sensitive management;
- fisheries rationalization;
- traditional management tools;
- actions by other state, federal, and international agencies; and
- private actions.

The following reasonably foreseeable future actions may have a continuing, additive, and meaningful relationship to the direct and indirect effects of the alternatives on prohibited species. This analysis builds

[8] http://alaskafisheries.noaa.gov/sustainablefisheries/inseason/2011_bsai_council_report.pdf

on the analysis of the impacts of each of these actions on prohibited species in section 7.3 of the Amendment 91 EIS (NMFS 2009a).

Ecosystem approaches to management

As noted in section 3.4.1 of NMFS 2009a, an increased understanding of interactions between ecosystem components is reasonably foreseeable. This coupled with another reasonably foreseeable action, increased integration of ecosystem considerations into fisheries decision-making, is likely to result in fishery management that reduces potential adverse impacts of the proposed action on target and nontarget stocks.

Ecosystem research, and increasing attention to ecosystem issues, should lead to increased attention to the impact of fishing activity on non-target resource components, including prohibited species. This is likely to result in reduced adverse impacts. The North Pacific Groundfish Observer Program and Alaska Fisheries Science Center's Auke Bay Lab collection and analysis of salmon tissue samples will help identify the regions and natal streams of origin of bycaught salmon, and help clarify the dimensions of the environmental impact.

Many efforts are underway to assess the relationship between oceanographic conditions, ocean mortality of salmon, and their maturation timing to their respective rivers of origin for spawning. It is unclear whether the observed changes in salmon bycatch in recent years is due to fluctuations in salmon abundance, or whether there is a greater degree of co-occurrence between salmon and pollock stocks as a result of changing oceanographic conditions. Pollock distribution has been shown to be affected by bottom temperatures, with densities occurring in areas where the bottom temperatures are greater than zero (Ianelli et al. 2008). Specific ocean temperature preferences for salmon species are poorly understood. Regime shifts and consequent changes in climate patterns in the North Pacific ocean has been shown to correspond with changes in salmon production (Mantua et al. 1997). Archival tags affixed to Asian chum salmon indicate that behavior and migration in juvenile, immature, and maturing fish are linked to temperature gradients (Friedland et al. 2001) and that immature chum salmon exhibit a tendency to remain above the thermocline along the continental shelf (Azumaya et al. 2006). Anecdotal information suggests that Chinook and chum salmon prefer different (warmer) ocean water temperatures than adult pollock. A study linking temperature and salmon bycatch rates was conducted and preliminary evidence indicates a relationship, even when factoring for month and area; Chinook bycatch appeared to be also related to conditions for a given year, season, and location (Ianelli et al. 2010).

Compelling evidence from studies of changes in Bering Sea and Arctic climate, ocean conditions, sea ice cover, permafrost, and vegetation indicate that the area is experiencing warming trends in ocean temperatures and major declines in seasonal sea ice (IPCC, 2007; ACIA, 2005). Some evidence exists for a contraction of ocean habitats for salmon species under global warming scenarios (Welch et al. 1998). Studies in the Pacific northwest have found that juvenile survival is reduced when in-stream temperatures increase (Marine and Cech 2004, Crozier and Zabel 2006). A correlation between sea surface temperature and juvenile salmon survival rates in their early marine life has also been proposed (Mueter et al. 2002). The variability of salmon responses to climate changes is highly variable at small spatial scales, and among individual populations (Schindler et al. 2008). This diversity among salmon populations means that the uncertainty in predicting biological responses of salmon to climate change remains large, and the specific impacts of changing climate on salmon cannot be assessed.

Traditional management tools

Annual harvest specifications will authorize annual groundfish fishing activity and associated annual incidental catch of PSC species. The improvement of the Catch Accounting System has made it possible for NMFS to maintain more timely and accurate information regarding the incidental catch of prohibited species. This information can be used by NMFS and the industry to reduce incidental catch of prohibited species by tracking when and where it is occurring and react quickly to reduce the potential for additional incidental catch. The number of TAC categories with low values of ABC/OFL are increasing, which tends to increase the likelihood that closures of directed fisheries to prevent overfishing will occur. In recent years management of species groups has tended to separate the constituent species into individual ABCs and OFLs. For example, in 1991 the category "other red rockfish" consisted of four species of rockfish. By 2007, one of those species (sharpchin rockfish) had been moved to the "other rockfish" category and northern, shortraker, and rougheye are now managed as separate species. While managing the species with separate ABCs and OFLs reduces the potential for overfishing the individual species, the effect of creating more species categories can increase the potential for incurring management measures to prevent overfishing, such as fishery closures. Managers closely watch species with fairly close amounts between the OFL and ABCs during the fishing year and the fleet will adjust behavior to prevent incurring management actions.

The Council's Non-target Species Committee will continue to identify species harvested in the groundfish fisheries that may need to be placed in the target or ecosystem component species groups in the FMPs to ensure the capability of managing the harvest of these species in the groundfish fisheries. The continued improvement of target species management may be beneficial to nontarget species as it may mitigate potential adverse impacts of the fisheries on these nontarget stocks, as seen with Amendment 91 (NMFS 2009a).

The reasonable foreseeable future actions that will most impact the western Alaska Chinook salmon stocks are the continuation of the management of the directed commercial, subsistence, and sport fisheries for Chinook salmon and changes to the management of the Bering Sea pollock fishery. The Council is considering action on management measure to minimize chum salmon bycatch in the Bering Sea pollock fishery. Because any revised chum salmon bycatch measures will also regulate the pollock fishery, there will be a synergistic interaction between the management measures under Amendment 91 and those considered under the chum salmon action. Analysis on the chum salmon action is currently underway, and a further discussion of the impact interactions will be included. As with new chum salmon measures, analysis of any new management measures for the pollock fleet would consider the impacts of adding those new measures to the existing suite of management measure for the pollock fleet and analyzing those impacts on prohibited species.

Actions by Other Federal, State, and International Agencies

ADF&G is responsible for managing commercial, subsistence, sport, and personal use salmon fisheries. The first priority for management is to meet spawning escapement goals to sustain salmon resources for future generations. Highest priority use is for subsistence under both State and Federal law. Surplus fish beyond escapement needs and subsistence use are made available for other uses. The BOF adopts regulations through a public process to conserve fisheries resources and to allocate fisheries resources to the various users. Subsistence fisheries management includes coordination with U.S. Federal government agencies where federal rules apply under Alaska National Interest Lands Conservation Act (ANILCA). Subsistence salmon fisheries are an important culturally and greatly contribute to local economies. Commercial fisheries are also an important contributor to many local communities as well as supporting the subsistence lifestyle. While specific aspects of salmon fishery management continue to be modified, it is reasonably foreseeable that the current State management of the salmon fisheries will continue into the future.

BOEMRE expects that reasonably foreseeable future activities include development of oil and gas deposits over the next 15–20 years in federal waters off Alaska. Potential environmental risks from the development of offshore drilling include the impacts of increased vessel offshore oil spills, drilling discharges, offshore construction activities, and seismic surveys. Adverse environmental impacts resulting from exploration and development in the future could impact salmon, halibut, and herring stocks. The extent to which these impacts may occur is unknown.

The continued release of salmon fry into the ocean by domestic and foreign hatcheries is also expected to continue at similar levels. Hatchery production increases the numbers of salmon in the ocean beyond what is produced by the natural system, however some studies have suggested that efforts to increase salmon populations with hatcheries may have an impact on the body size of Pacific salmon (Holt et al 2008).

The IPHC will continue to manage halibut and conduct annual projects for stock assessments and basic halibut biology. These continued activities will improve the information available for halibut management. In 2014 NMFS implemented a new halibut catch sharing plan for the commercial and charter halibut fisheries in Southeast Alaska (Area 2C) and the Central Gulf of Alaska (Area 3A) (78 FR 75844, December 12, 2013). Prior to the catch sharing plan, the charter sector was managed under a guideline harvest level—a management program that was not optimal in preventing fishing overages when harvest of halibut by recreational anglers on charter vessels increased in areas 2C and 3A beginning in the late 1990s. The catch sharing plan prevents the guided charter harvest from exceeding the Guideline Harvest Level and decreases the risk of the total harvest exceeding the total Constant Exploitation Yield.

Private sector actions

The reasonable foreseeable future actions that will most impact salmon stocks are the continuation of the management of the directed commercial, subsistence, and sport fisheries for salmon and changes to the management of the Bering Sea pollock fishery. Ongoing pollock fishing activity will continue to take other groundfish, prohibited species, and forage fish species as bycatch. Likewise, most of these species support directed fisheries that will continue. Ongoing economic development of coastal Alaska, and increasing levels of marine transportation activity may interact adversely with non-target species. Development that may impact coastal and riverine spawning habitat may have the greatest potential for affecting salmon and herring. However, development in Alaska remains small compared to development in other coastal states.

Fishing activity will continue in future years as constrained by fishing regulations and the ABCs and TACs set by the Council in each year. This fishing activity is expected to result in annual incidental catch of the prohibited species and forage fish, subject to the FMPs and regulatory measures that constrain groundfish fishery PSC. The Marine Stewardship Council's certification of the pollock fishery may add to pollock industry incentives to minimize Chinook and chum salmon bycatch. Additionally, the current development and future use of salmon excluder devices for trawl vessels may result in decreases of Chinook and chum salmon incidental catch.

Increasing economic activity in and off Alaska may affect future fisheries. The high levels of traffic between the West coast of the United States and East Asia raise concerns about pollution incidents or the introduction of invasive species from ballast water. Pollution issues were highlighted in December 2004 when the M/V *Selendang Ayu* wrecked on Unalaska Island and again in July 2006 with the M/V *Cougar Ace* accident. Salmon and herring stocks may also be affected by onshore mining activities, to the extent that pollutants or contaminants from those operations may affect salmon spawning streams and herring spawning locations.

Alaskan economic development can affect the coastal zone and the species that depend on the zone. However, Alaska remains relatively lightly developed compared to other states in the nation. Marine transportation associated with that development may be more of a concern than in other states, due to the relatively greater importance of marine transportation to Alaska's economy.

4.4.6 Summary of Effects

There are incidental catch of salmon, halibut, and herring in the Bering Sea subareas. Under both of the alternatives salmon, halibut, and herring PSC will continue to occur in the Bering Sea. Any mortality to prohibited species is an adverse impact; however, reducing mortality to salmon with the use of a salmon excluder device could be beneficial compared to the status quo. The amounts of salmon, halibut, and herring expected to be taken under Alternative 2 is not a substantial increase over PSC amounts experienced in the pollock fishery. Alternative 1 PSC management for herring would remain unchanged under Alternative 2. The harvest of halibut under both alternatives is expected to remain below the halibut PSC limit in the BSAI trawl fisheries. The additional harvest of salmon under Alternative 2 in combination with the harvests in the pollock fishery is expected to be within the PSC limits for Chinook and chum salmon. **For these reasons, impacts to salmon, halibut, and herring are predicted to be insignificant for these species evaluated under Alternatives 1 and 2.**

4.5 Status of Marine Mammal Populations

A number of concerns may be related to marine mammals and potential impacts of fishing. For individual species, these concerns include—

- listing as endangered or threatened under the ESA;
- protection under the Marine Mammal Protection Act (MMPA);
- announcement as candidate or being considered as candidates for ESA listings;
- declining populations in a manner of concern to state or federal agencies;
- experiencing large bycatch or other mortality related to fishing activities; or
- being vulnerable to direct or indirect adverse effects from some fishing activities.

Marine mammals have been given various levels of protection under the current FMPs of the Council, and are the subjects of continuing research and monitoring to further define the nature and extent of fishery impacts on these species. The Alaska Marine Mammal Stock Assessments, 2013 (Allen and Angliss 2013) provide the most recent status information on marine mammals and the Environmental Assessment for issuing an Exempted Fishing Permit for the Purpose of Testing a Salmon Excluder Device in the Eastern Bering Sea Fishery (Salmon Excluder Device EA) (NMFS 2011) provides the most recent assessment of the potential effects that this action may have on marine mammals. The status descriptions in the marine mammal stock assessments and Salmon Excluder Device EA are incorporated here by reference.

The BSAI supports one of the richest assemblages of marine mammals in the world. Twenty-five species are present from the orders Pinnipedia (seals, sea lion, and walrus), Carnivora (sea otter and polar bear), and Cetacea (whales, dolphins, and porpoises). Marine mammals occur in diverse habitats, including deep oceanic waters, the continental slope, and the continental shelf (Lowry et al. 1982). Marine mammals that are likely to occur in the action area and their status under the ESA are listed in Table 10.

Table 10 Marine mammals likely to occur in the action area.

Common Name	Scientific Name	ESA Status
Northern Right Whale[2]	*Balaena glacialis*	Endangered
Bowhead Whale	*Balaena mysticetus*	Endangered
Sei Whale	*Balaenoptera borealis*	Endangered
Blue Whale	*Balaenoptera musculus*	Endangered
Fin Whale	*Balaenoptera physalus*	Endangered
Humpback Whale	*Megaptera novaeangliae*	Endangered
Sperm Whale	*Physeter macrocephalus*	Endangered
Steller Sea Lion[1]	*Eumetopias jubatus*	Endangered
Beluga Whale	*Delphinapterus leucas*	None
Minke Whale	*Balaenoptera acutorostrata*	None
Killer Whale	*Orcinus orca*	None
Dall's Porpoise	*Phocoenoides dalli*	None
Harbor Porpoise	*Phocoena phocoena*	None
Pacific White-sided Dolphin	*Lagenorhynchus obliquidens*	None
Beaked Whales	*Berardius bairdii* and *Mesoplodon* spp.	None
Northern Fur Seal	*Callorhinus ursinus*	None
Pacific Harbor Seal	*Phoca vitulina*	None
Pacific Walrus[3]	*Odobenus rosmarus divergens*	Precluded
Northern Sea Otter[3]	*Enhydra lutis*	Threatened
Bearded Seal, Beringia DPS	*Erignathus barbatus*	Threatened
Spotted Seal	*Phoca largha*	Threatened
Ringed Seal, Arctic subspecies	*Phoca hispida*	Threatened
Ribbon Seal	*Phoca fasciata*	None
Polar Bear[3]	*Ursus maritimus*	Threatened

[1]Steller sea lion are listed as endangered west of Cape Suckling.
[2]NMFS designated critical habitat for the northern right whale on July 6, 2006 (71 FR 38277).
[3]Pacific walrus, sea otter, and polar bear are species under the jurisdiction of the USFWS. Walrus ESA listing is warranted but precluded (76 FR 7634, February 10, 2011).

Direct and indirect interactions between marine mammals and groundfish harvest activity may occur due to overlap of groundfish fishery activities and marine mammal habitat. Fishing activities may either directly take marine mammals through injury, death, or disturbance, or indirectly affect these animals by removing prey important for growth and nutrition or cause sufficient disturbance that marine mammals avoid or abandon important habitat. Fishing also may result in loss or discard of equipment such as fishing nets and line that may ultimately entangle marine mammals causing injury or death.

The PSEIS (NMFS 2004) describes the range, habitat, diet, abundance, and population status for marine mammals. The most recent marine mammal Stock Assessment Reports (SARs) for nearly all marine mammals occurring in the BSAI were completed in 2013 based on 2008 through 2009 data (Allen and Angliss 2013). The USFWS has management authority for polar bears, sea otters, and walrus. The stock assessments for polar bear and walrus were last revised on January 1, 2010 and stock assessments for sea otters were last revised in 2002 for the southwest Alaska stock and 2008 for the south central and southeastern stocks (USFWS 2011). This information is incorporated by reference. The Amendment 91 EIS (NMFS 2009a) also provides recent information on the effects of the pollock fisheries on marine mammals including a detailed description of the status of ESA Section 7 consultations (Section 1.7.2 and 8.1.2 of NMFS 2009a). For Bering Sea marine mammals, ESA Section 7 consultation has been completed for all ESA-listed marine mammals, except for the Arctic subspecies of ringed seals and the Beringia DPS of bearded seals.

NMFS issued a final determination to list the Arctic, Okhotsk, and Baltic subspecies of the ringed seal as threatened and the Ladoga subspecies of the ringed seal as endangered under the ESA, effective February 26, 2013 (77 FR 76740). NMFS also issued a final determination to list the Beringia and Okhotsk DPSs of the subspecies of the bearded seal as threatened under the ESA, also effective February 26, 2013 (77 FR 76740). The Arctic subspecies of ringed seals and the Beringia DPS of bearded seals occur where the Bering Sea/Aleutian Island federal fisheries are conducted. Critical habitat for the Arctic ringed seal and Beringia DPS of bearded seals will be designated in a future rulemaking. On March 29, 2013, NMFS initiated consultation of the potential effects of federal groundfish and crab fisheries on the Arctic subspecies of ringed seals and the Beringia DPS of bearded seals under Section 7 of the ESA (Merrill 2013).

Direct and indirect interactions between marine mammals and groundfish harvest occur due to overlap in the size and species of groundfish harvested in the fisheries that are also important marine mammal prey, and due to temporal and spatial overlap in marine mammal foraging and commercial fishing activities. This discussion focuses on those marine mammals that may interact or be affected by the pollock pelagic trawl fishery in the BSAI. These species are listed in Table 11 and Table 12. Steller sea lions, resident killer whales, beluga whales, northern fur seals, bearded seals, and ringed seals are the only marine mammals that may compete with the pollock fishery for prey. Marine mammals species listed in Table 12 are taken incidentally in the BSAI pollock trawl fishery.

Table 11 Status of Pinniped Stocks Potentially Affected by the BSAI Pollock Fishery.

Pinnipedia species and stock	*Status under the ESA*	*Status under the MMPA*	*Population Trends*	*Distribution in action area*
Steller sea lion – Western and Eastern Distinct Population Segment (DPS)	Endangered (W)	Depleted & a strategic stock	Between 1991 and 2000, overall Steller sea lions at trend sites decreased 40%, an annual overall decline of 5.4% (Louglin and York 2000). The current estimate of the total population size of western Steller sea lions in Alaska is 52,200, On November 4, 2013, NMFS determined that the eastern DPS no longer meets the definition of an endangered or threatened species under ESA and that delisting the DPS is warranted. The final rule to delist the eastern DPS was effective on December 4, 2013 (78 FR 66140).	Western DPS inhabits Alaska waters from Prince William Sound westward to the end of the Aleutian Island chain and into Russian waters. Eastern DPS inhabit waters east of Prince William Sound to Dixon Entrance. Occur throughout AK waters, terrestrial haulouts and rookeries on Pribilof Islands, Aleutian Islands, St. Lawrence Island, and off the mainland. Use marine areas for foraging. Critical habitat designated around major rookeries, haulouts, and foraging areas.
Northern fur seal – Eastern Pacific	None	Depleted & a strategic stock	Recent pup counts show a continuing decline in productivity in the Pribilof Islands. During 1998–2010, pup production declined 5.42% annually on St. Paul Island and 2.09% annually on St. George Island. Despite near exponential growth on Bogoslof Island since the 1990s, the recent estimates of pup production indicate the rate of increase may be slowing. The overall abundance estimate continues to decline in the Bering Sea.	Fur seals occur throughout Alaska waters, but their main rookeries are located in the Bering Sea on Bogoslof Island and the Pribilof Islands. Approximately 55% of the worldwide abundance of fur seals is found on the Pribilof Islands (NMFS 2007c). Forages in the pelagic area of the Bering Sea during summer breeding season, but most leave the Bering Sea in the fall to spend winter and spring in the N. Pacific.
Harbor seal –Aleutian Islands Pribilof Islands Bristol Bay	None	None	Aleutian Islands: Overall estimates show a 67% decline during the late 1970s to late 1990s (Small et al. 2008). The current population trend is unknown. Pribilof Islands: In July 2010, a total of 232 harbor seals were observed on all islands. The current population trend is unknown. Bristol Bay: At Nanvak Bay (the largest haul-out in northern Bristol Bay), harbor seals declined in abundance between 1975-1990 and increased from 1990-2000 (Jemison et al. 2006).	In 2010, 12 separate stocks of harbor seals were determined. The Aleutian Islands stock is located from Ugamak Island to Cape Wrangell. Pribilof Islands stock is distributed around St. George and St. Paul Islands and the Bristol Bay stocks are located east of Unimak Island, north to Nunivack Island.
Ringed seal – Alaska	Threatened	None	Reliable data on population trends are unavailable.	Found in the northern Bering Sea from Bristol Bay to north of St. George Island and occupy ice.

Pinnipedia species and stock	***Status under the ESA***	***Status under the MMPA***	***Population Trends***	***Distribution in action area***
Bearded seal – Alaska	Threatened	None	Reliable data on population trends are unavailable.	Found in the northern Bering Sea from Bristol Bay to north of St. George Island and inhabit areas of water less than 200 m that are seasonally ice covered.
Ribbon seal – Alaska	None	None	Reliable data on population trends are unavailable.	Found throughout the offshore Bering Sea waters.
Spotted seal – Alaska	Threatened (Southern DPS)	None	Reliable data on population trends are unavailable.	Found throughout the Bering Sea waters.
Pacific Walrus	Warranted but precluded	Strategic	Population trends are unknown. The stock assessment for Pacific walrus was revised on January 1, 2010 with a minimum population size estimate of 129,000 walruses within the surveyed area.	Occur primarily in shelf waters of the Bering Sea. Primarily males stay in the Bering Sea in the summer. Major haulout sites are on Round Island in Bristol Bay and on Cape Seniavan on the north side of the Alaska Peninsula.

Source: Allen and Angliss 2013; List of Fisheries for 2014 (79 FR 14418, March 14, 2014).
Ringed and bearded seal information available from http://alaskafisheries.noaa.gov/newsreleases/2012/icesealsesa1212.pdf
Pacific Walrus information available from http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A0J8

Table 12 Status of Cetacea Stocks Potentially Affected by the BSAI Pollock Fishery.

Cetacea species and stock	*Status under the ESA*	*Status under the MMPA*	*Population Trends*	*Distribution in action area*
Killer whale – AT1 Transient; Eastern North Pacific transient, GOA, AI, and BS transient; West Coast transient; Eastern North Pacific Alaska Resident, and Southern Resident	Southern Resident: Endangered. Remaining Stocks: none	AT1 Transient ,– Depleted & a strategic stock Southern Resident: Depleted	Unknown abundance for the Alaska resident; and Eastern North Pacific GOA, Aleutian Islands, and Bering Sea transient stocks. The minimum abundance estimate for the Eastern North Pacific Alaska Resident stock is likely underestimated because researchers continue to encounter new whales in the Alaskan waters. Southern residents have declined by more than half since 1960s and 1970s.	Transient-type killer whales from the Aleutian Islands and Bering Sea are considered to be part of a single population that includes Gulf of Alaska transients. Killer whales are seen in the northern Bering Sea and Beaufort Sea, but little is known about these whales. Southern Resident killer whales do not occur in BSAI.
Dall's porpoise – Alaska	None	None	Reliable data on population trends are unavailable.	Found in the offshore waters from coastal western Alaska to Bering Sea.
Harbor porpoise – Bering Sea	None	Strategic	Reliable data on population trends are unavailable	Primarily in coastal waters, usually less than 100 m.
Humpback whale – Western North Pacific Central North Pacific	Endangered. NMFS is conducting a status review to identify the North Pacific population to the humpback whale as a DPS and delist the DPS under the ESA (August 29, 2013, 78 FR 53391).	Depleted & a strategic stock	Increasing. The Structure of Populations, Levels of Abundance, and Status of Humpbacks (SPLASH) abundance estimate for the total North Pacific represents an annual increase of 4.9% over the most complete estimate for the North Pacific from 1991–93. Comparisons of SPLASH abundance estimates for Hawaii to estimates from 1991–93 gave estimates of annual increase that ranged from 5.5 % to 6.0% (Calambokidis et al. 2008).	W. Pacific and C. North Pacific stocks occur in Alaskan waters and may mingle in the North Pacific feeding area. Humpback whales in the Bering Sea (Moore et al. 2002) cannot be conclusively identified as belonging to the western or Central North Pacific stocks, or to a separate, unnamed stock.
North Pacific right whale Eastern North Pacific	Endangered	Depleted & a strategic stock	Photographic and genotype data through 2008 were used to calculate the first mark-recapture estimates of abundance for right whales in the Bering Sea and Aleutian Islands, resulting in estimates of 31 (95% CL 23-54, CV=0.22) and 28 (95% CL 24-42), respectively (Wade et al. 2011) No estimate of trend in abundance is available.	Before commercial whaling on right whales, concentrations were found in the Gulf of Alaska, eastern Aleutian Islands, south-central Bering Sea, Sea of Okhotsk, and Sea of Japan (Braham and Rice 1984). During 1965–99, following large illegal catches by the U.S.S.R., there were only 82 sightings of right whales in the entire eastern North Pacific, with the majority of these occurring in the Bering Sea and adjacent areas of the Aleutian Islands (Brownell et al. 2001).

Cetacea species and stock	Status under the ESA	Status under the MMPA	Population Trends	Distribution in action area
Fin whale – Northeast Pacific	Endangered	Depleted & a strategic stock	The provisional estimate of the fin whale population west of the Kenai Peninsula is 1,214, the average of the estimates in 2008 and 2010 (Friday et al. 2013).Friday et al. (2013) estimated a 14% (95% CI = 1.0 - 26.5%) annual rate of change in abundance of fin whales between 2002 and 2010.	Found in the Bering Sea and coastal waters of the Aleutian Islands and Alaska Peninsula. Most sightings in the central-eastern Bering Sea occur in a high productivity zone on the shelf break.
Minke whale – Alaska	None	None	There are no data on trends in Minke whale abundance in Alaska waters.	Common in the Bering and Chukchi Seas and in the inshore waters of the GOA.
Sperm Whale – North Pacific	Endangered	Depleted & a strategic stock	Abundance and population trends in Alaska waters are unknown.	Inhabit waters 600 m or more depth, south of 62°N lat. Males inhabit Bering Sea in summer.
Gray Whale – Eastern North Pacific	None	None	Minimum population estimate is 18,017 animals. The population size of the Eastern North Pacific gray whale stock has been increasing over the past several decades despite an unusual mortality event in 1999 and 2000. The estimated annual rate of increase, based on shore counts of southward migrating gray whales the unrevised abundance estimates between 1967 and 1988, is 3.3% with a standard error of 0.44% (Buckland et al. 1993); using the revised abundance time series from Laake et al. (2009) leads to an annual rate of increase for that same period of 3.2% with a standard error of 0.5% (Punt and Wade 2010).	Most spend summers in the shallow waters of the northern Bering Sea and Arctic Ocean. Winters spent along the Pacific coast near Baja California.
Beluga Whale – Bristol Bay, Eastern Bering Sea, eastern Chukchi Sea, and Cook Inlet	Cook Inlet: Endangered. Remaining Stocks: None	Cook Inlet: Depleted & a strategic stock	Abundance estimate is 3,710 animals and population trend is not declining for the eastern Chukchi Sea stock. Minimum population estimate for the eastern Bering Sea stock is 20,231 animals and population trend is unknown. The minimum population estimate for the Bristol Bay stock is 2,467 animals and the population trend is stable and may be increasing. Cook Inlet 2012 abundance estimate of 312 whales is unchanged from 2007.	Summer in the Arctic Ocean and Bering Sea coastal waters, and winter in the Bering Sea in offshore waters associated with pack ice. Cook Inlet belugas do not occur in BSAI.

Source: Allen and Angliss 2010 and 2013; List of Fisheries for 2014 (79 FR 14418, December 6, 2013).

The Steller sea lion inhabits many of the shoreline areas of the BSAI, using these habitats as seasonal rookeries and year-round haulouts. The Steller sea lion has been listed as threatened under the ESA since

1990. In 1997 the population was split into two stocks or distinct population segments (DPS) based on genetic and demographic dissimilarities, the western and eastern stocks. Because of a pattern of continued decline in the western DPS, it was listed as endangered on May 5, 1997 (62 FR 30772), while the eastern DPS remained under threatened status. The western DPS inhabits an area of Alaska approximately from Prince William Sound westward to the end of the Aleutian Island chain and into Russian waters. Steller sea lions present in the action area would be primarily from the western DPS.

Throughout the 1990s, particularly after critical habitat was designated, various closures of areas around rookeries and haulouts and some offshore foraging areas affected commercial harvest of pollock, an important component of the western DPS of Steller sea lion diet. In 2001, a biological opinion was released that provided protection measures to ensure that the groundfish fisheries would not jeopardize the continued existence of the Steller sea lion nor adversely modify its critical habitat; that opinion was supplemented in 2003. After court challenge, these protection measures remain in effect today (NMFS 2001). A detailed analysis of the effects of these protection measures is provided in the *Steller Sea Lion Protection Measures Supplemental EIS* (NMFS 2001).

A biological opinion documenting the program level Section 7 formal consultation on the effects of the Alaska groundfish fisheries on Steller sea lions, humpback whales, sperm whales, and fin whales was completed November 24, 2010 (NMFS 2010b). The biological opinion concluded that the fisheries were not likely to jeopardize the continued existence of the eastern distinct population segment (DPS) of Steller sea lions, the Western North Pacific and Central North Pacific populations of humpback whales, North Pacific sperm whales, or the Northeast Pacific population of fin whales. The biological opinion concluded that the fisheries were not likely to adversely modify designated critical habitat for the eastern DPS of Steller sea lions. The biological opinion concluded that the fisheries were likely to jeopardize the continued existence of the western DPS of Steller sea lions and were likely to adversely modify their designated critical habitat. The biological opinion contained a reasonable prudent alternative (RPA) designed to remove the likelihood the fisheries would jeopardize the western DPS of Steller sea lions or adversely modify their designated critical habitat.

This RPA was implemented for the 2011 fishing year (75 FR 77535; December 13, 2010). NMFS issued an interim final rule to implement Steller sea lion protection measures to insure that the BSAI management area groundfish fisheries are not likely to jeopardize the continued existence of the western DPS of Steller sea lions or adversely modify its designated critical habitat (75 FR 77535; December 13, 2010). These management measures primarily disperse fishing effort over time and area to provide protection from potential competition for important Steller sea lion prey species in waters adjacent to rookeries and important haulouts. The intended effect of this interim final rule is to protect the endangered western DPS of Steller sea lions, as required under the ESA, and to conserve and manage the groundfish resources in accordance with the Magnuson-Stevens Act. The protection measures focused on the Atka mackerel and Pacific cod fisheries in the Aleutian Islands. No changes were made to the Bering Sea pollock fishery. Subsequent Steller Sea Lion analyses, Steller Sea Lion Protection Measures EIS/RIR/IRFA (NMFS 2014a) and 2014 biological opinion (NMFS 2014b), are project-level actions focused on the Aleutian Islands and do not address the Bering Sea pollock fishery.

On December 13, 2010, NMFS announced a 90-day finding on two petitions to delist the eastern DPS of Steller sea lions under the ESA. NMFS concluded that the petitions presented substantial scientific or commercial information indicating that the petitioned action may be warranted (75 FR 77602).The status review of the eastern DPS concluded that the DPS has recovered and no longer meets the definition of an endangered or threated species under the ESA. The final rule implementing this change also made technical changes to recodify existing regulatory provisions to remove special protections for the eastern

DPS and clarify that existing regulatory protections for the western DPS continue to apply. The final rule was effective December 4, 2013 (November 4, 2013, 78 FR 66140).

The Bering Sea subarea has several closures in place for Steller sea lions including no transit zones, rookeries, haulouts, and the Steller Sea Lion Conservation Area. The proposed action would not change the pollock fishery, and groundfish closures associated with the five Steller sea lion sites located at Sea lion Rock, Bogoslof Island/Fire Island, Adugak Island, Pribilof Islands, and Walrus Islands. The harvest of pollock in the Bering Sea subarea is temporally dispersed (§ 679.20) and spatially dispersed through area closures (§ 679.22). These harvest restrictions on the pollock fishery decrease the likelihood of disturbance, incidental take, and competition for prey to ensure the groundfish fisheries do not jeopardize the continued existence or adversely modify the designated critical habitat of Steller sea lions (NMFS 2000 and NMFS 2001).

Northern fur seals forage in the pelagic area of the Bering Sea and reproduce on the Pribilof and Bogoslof Islands. On June 17, 1988, NMFS declared the northern fur seal stock of the Pribilof Islands, Alaska (St. Paul and St. George Islands), to be depleted under the MMPA. The Pribilof Islands population was designated depleted because it declined to less than 50 percent of levels observed in the late 1950s, and no compelling evidence suggested that carrying capacity has changed substantially since the late 1950s (NMFS 2007d). Recent pup counts from the Pribilofs in 2010 suggest a continuing decline in survival rates and show the overall abundance estimate is strongly influenced by the continued rapid decline in pups at St. Paul Island (Allen and Angliss 2013).

4.6 Effects on Marine Mammals

Table 13 contains the significance criteria for analyzing the effects of the proposed action on marine mammals. These criteria are from the Amendment 94 environmental assessment/regulatory impact review/final regulatory flexibility analysis (EA/RIR/FRFA) (NMFS 2010c) and applied in the Salmon Excluder Device EA (NMFS 2011). Significantly beneficial impacts are not possible with the management of groundfish fisheries as no beneficial impacts to marine mammals are likely with groundfish harvest. Generally, changes to the fisheries do not benefit marine mammals in relation to incidental take, prey availability, and disturbances; changes increase or decrease potential adverse impacts.

Table 13 Criteria for Determining Significance of Impacts to Marine Mammals.

	Incidental take and entanglement in marine debris	Harvest of prey species	Disturbance
Adverse impact	Mammals are taken incidentally to fishing operations or become entangled in marine debris.	Fisheries reduce the availability of marine mammal prey.	Fishing operations disturb marine mammals.
Beneficial impact	There is no beneficial impact.	There are no beneficial impacts.	There is no beneficial impact.
Insignificant impact	No substantial change in incidental take by fishing operations or in entanglement in marine debris.	No substantial change in competition for key marine mammal prey species by the fishery.	No substantial change in disturbance of mammals.
Significantly adverse impact	Incidental take is more than PBR or is considered major in relation to estimated population when PBR is undefined.	Competition for key prey species likely to constrain foraging success of marine mammal species causing population decline.	Disturbance of mammal or such that population is likely to decrease.
Significantly beneficial impact	Not applicable	Not applicable	Not applicable
Unknown impact	Insufficient information available on take rates.	Insufficient information as to what constitutes a key area or important time of year.	Insufficient information as to what constitutes disturbance.

4.6.1 Incidental Takes

The Amendment 91 EIS contains a detailed description of the effects of the pollock fishery on marine mammals (NMFS 2009a) and is incorporated by reference. Potential take in the groundfish fisheries is well below the potential biological removal (PBR) for all marine mammals, except killer whales and humpback whales. This means that predicted take would be below the maximum number of animals that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population.

Table 14 provides the marine mammals taken in the BSAI pollock fishery as published in the List of Fisheries for 2014. Table 15 provides more detail on the levels of take based on the most recent Draft SAR (Allen and Angliss 2013). The BSAI pollock fishery is a Category II fishery because it has annual mortality and serious injury of a marine mammal stock greater than 1 percent and less than 50 percent of the PBR level (78 FR 73477, December 6, 2013).

Table 14 Category II BSAI Pollock Fishery with documented marine mammal takes from the List of Fisheries for 2014 (79 FR 14418, March 14, 2014).

Fishery Category II	Marine Mammal Stocks Taken
BSAI pollock trawl	Bearded seal, AK Dall's porpoise, AK Harbor seal, AK Humpback whale, Central and Western N. Pacific Northern fur seal, Eastern Pacific Ribbon seal, AK Ringed seal, AK Spotted seal, AK Steller sea lion, Western U. S

Table 15 Estimated mean annual mortality of marine mammals from observed BSAI pollock fishery compared to the total mean annual human-caused mortality and potential biological removal.

Marine Mammal	Mean annual mortality, from BSAI pollock fishery	Total mean annual human-caused mortality and serious injury*	PBR
**Steller sea lions (western)	7.36	229.8	274
Northern fur seal	3.52	471	11,638
Harbor seal (Aleutian Islands)	0.30	93	99
Harbor seal (Pribilof Islands)	0.30	3	7
Harbor seal (Bristol Bay)	0.30	144.1	1061
Spotted seal	0	5,265	N/A
**Bearded seal	1.4	6,790	N/A
Ribbon seal	0.62	194	N/A
**Ringed seal	1.0	9,571	9,000
Dall's porpoise	0.31	28	Undetermined
**Humpback whale Western North Pacific	0.20	2.0	2.6/2.0
**Humpback whale Central North Pacific – BSAI feeding	0.20	8.76	7.9

Mean annual mortality, expressed in number of animals, includes both incidental takes and entanglements, as data are available, and averaged over several years of data. Years chosen vary by species (Allen and Angliss 2013).
* Does not include research mortality. Other human-caused mortality is predominantly subsistence harvests for seals and sea lions.
** ESA-listed stock

The incidental takes in Table 15 are very small numbers in comparison to the total mean annual human caused mortality and/or in comparison to the PBR. Under this proposed action the quantity of pollock is very small, in relation to the commercial pollock fishery and the harvest is by one vessel in the same locations where pollock fishing already occurs. In addition, the EFP vessel will be required to comply with most Steller sea lion protection measures, reducing the potential for interaction with this species.

For these reasons, while it is not likely, it is possible that the additional pollock fishing under the EFP could result in additional interaction with marine mammals. In 2011, under the proposed action described in the Salmon Excluder Device EA (2011), a bearded seal was taken on September 26, 2011 (John Gauvin, personal communication, September 27, 2011). At the time of this take, bearded seals and ringed seals were proposed for ESA-listing. On December 28, 2012, NMFS announced that it was listing the Beringia DPS of the bearded seal and the Arctic subspecies of ringed seals as threatened under the ESA

(77 FR 76740 and 77 FR 7606, December 28, 2012). NMFS completed formal ESA section 7 consultation on the potential effects of federal groundfish fisheries, including fishing under the EFP to test salmon excluder devices in the Bering Sea pollock fishery, on the Beringia DPS of bearded seals and the Arctic ringed seal (NMFS 2014c). NMFS (2014c) found that the groundfish fisheries in the Bering Sea Aleutian Islands, including fishing under the salmon excluder device EFPs, were not likely to jeopardize the continued existence of the Beringia DPS of bearded seals or the Arctic Ringed seal.

4.6.2 Harvest of Prey Species

The Amendment 91 EIS determined that competition for key prey species under the status quo fishery is not likely to constrain foraging success of marine mammal species or cause population declines (NMFS 2009a). The exceptions to this are the Steller sea lions and northern fur seals for which potential prey competition with the groundfish fisheries may be a concern. Both of these species depend on pollock as a principal prey species (NMFS 2009a).

The Bering Sea pollock fishery may impact availability of key prey species of Steller sea lions, harbor seals, northern fur seals, ribbon seals; and fin, minke, humpback, beluga, and resident killer whales. Animals with more varied diets (baleen whales) are less likely to be impacted than those that eat primarily pollock and salmon, such as northern fur seals. Ringed seals were not believed to be significantly competing with or affected by commercial fisheries in the waters of Alaska (Frost 1985, Kelly 1988). Bearded seals also have a wide range of potential prey species and thus are less likely to be impacted by the pollock fishery. However, the potential impact of federal fisheries on the prey of the Arctic subspecies of ringed seals and the Beringia DPS of bearded seals will be analyzed as part of Section 7 consultation. Resident killer whales and beluga whales have shown a preference for Chinook salmon (Salveson 2009, NMFS 2008c). Table 16 shows the Bering Sea marine mammal species and their prey species that may be impacted by the Bering Sea pollock fishery. Pollock and salmon prey are in bold.

Table 16 Prey species used by Bering Sea marine mammals that may be impacted by the Bering Sea pollock fishery

Species	Prey
Fin whale	Zooplankton, squid, fish (herring, cod, capelin, and **pollock**), and cephalopods
Humpback whale	Zooplankton, schooling fish (**pollock**, herring, capelin, saffron, cod, sand lance, Arctic cod, and **salmon**)
Minke whale	Pelagic schooling fish (including herring and **pollock**)
Beluga whale	Wide variety of invertebrates and fish including **salmon and pollock**
Killer whale	Marine mammals (transients) and fish (residents) including herring, halibut, **salmon**, and cod.
Ribbon seal	Cod, **pollock**, capelin, eelpout, sculpin, flatfish, crustaceans, and cephalopods.
Northern fur seal	**Pollock**, squid, herring, **salmon**, capelin
Harbor seal	Crustaceans, squid, fish (including **salmon**), and mollusks
Steller sea lion	**Pollock**, Atka mackerel, Pacific herring, Capelin, Pacific sand lance, Pacific cod, and **salmon**

Sources: NOAA 1988; NMFS 2004; NMFS 2007c; Nemoto 1959; Tomilin 1957; Lowry et al. 1980; Kawamura 1980; and http://www.adfg.state.ak.us/pubs/notebook/marine/orca.php

Under Alternative 2, the EFP would allow harvests of pollock that exceed the TAC by 0.002% in 2011. These amounts of pollock are so small, that harvest under Alternative 2 is not likely to have an effect on the overall availability of pollock to marine mammals. Because the harvest would be conducted with one to two vessels, over several seasons, outside of most protection areas for Steller sea lions and for fur seals in the Pribilof Island Area Habitat Conservation Zone and dispersed over a large area (Figure 2 and Figure 3); it is unlikely the pollock harvest under Alternative 2 would have any discernable effect on prey availability for marine mammals dependent on pollock.

The exemption from the sector closures of the Steller Sea Lion Conservation Area (SCA) is not expected to have an impact on Steller sea lions. From 2009 through 2014, an average of 108,000 mt of sector combined pollock quota was left unharvested in the SCA before April 1 (Mary Furuness, NMFS Inseason Management, personal communication, May, 2014). Since 2010, the amount of unharvested pollock in the SCA has continued to remain below the allocation. The amount of groundfish expected to be taken during EFP fishing before April 1 is no more than 2,652 mt. The goal of the Steller sea lion protection measures for harvest in the SCA is to prevent the temporal concentration of harvest before April 1. This is accomplished by limiting harvest to 28% of the annual TAC. The SCA has not been closed since 1999 because the American Fisheries Act allowed for the establishment of pollock cooperatives which monitor their own fishing, generally leaving the SCA before quotas are exceeded. The SCA exemption under the EFP would only apply as long as the combined amount of pollock taken from the SCA does not exceed the 28 percent annual TAC before April 1, as specified in the Steller sea lion protection measures (§ 679.20(a)(5)(i)(B)). Because this exemption ensures the temporal harvest of pollock remains dispersed as specified in the Steller sea lion protection measures, this exemption is not expected to have an impact beyond those already identified in previous analysis (NMFS 2001).

Salmon is also a prey species of Steller sea lions (NMFS 2001), northern fur seals (NMFS 2007d), killer whales and beluga whales (NMFS 2011). Sea lions eat salmon primarily in May and where salmon congregate for migration based on geography. Alternative 2 will be taking a limited amount of salmon that will not likely affect salmon prey availability for Steller sea lions. EFP fishing would be conducted outside of protection areas (except the SCA), and the salmon harvest would be limited to one to two vessels over a large area, and dispersed over two seasons in 2012. It is not likely that the harvest of salmon under the EFP will have a measurable effect on salmon used by killer whales or beluga whales. As described in Section 4.3.1, salmon stocks taken as bycatch in the Bering Sea pollock fishery are mixed origin, with the majority of the Chinook salmon bycatch analyzed coming from Western Alaska. The Cook Inlet beluga and Southern Resident killer whale stocks depend on Chinook salmon returning to Cook Inlet and the area of occurrence of the Southern Resident killer whale in the Vancouver, Puget Sound Region. The amount of Chinook salmon harvested under the EFP is so small that is not possible to measure a potential effect on the prey availability for these ESA-listed marine mammal stocks.

For EFP11-01, informal ESA section 7 consultations on the effects of issuing the EFP on Southern Resident killer whales and Cook Inlet Beluga whales and their critical habitat were completed in July and August 2011. The informal consultations concluded that issuing the EFP was not likely to adversely affect these species or their critical habitat (Stelle 2011, Brix 2011). NMFS consulted on the potential impact of this proposed action on the Cook Inlet beluga and Southern Resident killer whale as required under section 7 of the ESA. These consultations also concluded that fishing under the proposed EFP was not likely to adversely affect Cook Inlet beluga or Southern Resident killer whales or designated critical habitat for these whales (Kurland 2014, Stelle 2014).

Under the status quo, the Northern Fur Seal Conservation Plan recommends gathering information on the effects of the fisheries on fur seal prey, including measuring and modeling effects of fishing on prey (both commercial and noncommercial) composition, distribution, abundance, and schooling behavior, and evaluate existing fisheries closures and protected areas (NMFS 2007d). The Amendment 91 EIS analyzed the effects of the pollock fishery on fur seal prey (section 8.1 of NMFS 2009a). The EIS for the annual subsistence harvest of fur seals determined that the groundfish fisheries in combination with the subsistence harvest may have a conditional cumulative effect on prey availability if the fisheries were to become further concentrated spatially or temporally in fur seal habitat, especially during June through August (NMFS 2005b).

The harvest of pollock under the EFP would occur in the northern area of the Bering Sea in September or October (Figure 3). Fur seals are likely to be in the same area at the same time as the EFP fishery would be occurring (NMFS 2007d). No more than 2,500 mt of pollock are likely to be harvested in this northern area due to the seasonal distribution of fishing under the EFP. No more than 125 Chinook and 2,500 non-Chinook salmon would be taken in the B season and in the area that may overlap with fur seals. The frequency of occurrence of salmon occurring in fur seal scat collected from Bering Sea rookeries range from 3 to 16 percent (NMFS 2007d). Salmon does not appear to be as important in the fur seal diet as pollock and squid which occur much more frequently in scat samples analyzed. Because the harvest of pollock and salmon is such a small proportion of the total annual pollock and salmon harvest, occurs over a short time period, and is limited to one to two vessels, it is not likely to have a discernable effect on fur seal prey.

4.6.3 Disturbance

The Amendment 91 EIS analyzed the potential disturbance of marine mammals by the groundfish fisheries (NMFS 2009a). The EIS concluded that the status quo fishery does not cause disturbance to marine mammals that may cause population level effects and fishery closures limit the potential interaction between the fishing vessels and marine mammals. Because the EFP fishing would be conducted by one vessel outside of areas closed to protect Steller sea lions and northern fur seals and the time period of fishing is limited, it is not likely that any discernable disturbance of marine mammals would occur. Therefore, Alternative 2 is not likely to result in marine mammal disturbance beyond that which may occur under the status quo.

4.6.4 Cumulative Effects

The following reasonably foreseeable future actions may have a continuing, additive, and meaningful relationship to the effects of the alternatives on marine mammals. Some of these actions are broadly based on the potential changes to the groundfish fisheries that may result in impacts on marine mammals.

Ecosystem-sensitive management

Increased attention to ecosystem-sensitive management is likely to lead to more consideration for the impact of the pollock fishery on marine mammals and more efforts to ensure the ecosystem structure that marine mammals depend on is maintained, including prey availability. Increasing the potential for observers collecting information on marine mammals and groundfish fisheries interaction, and any take reduction plans, may lead to less incidental take and interaction with the groundfish fisheries, thus reducing the adverse effects of the groundfish fisheries on marine mammals.

Changes in the status of species listed under the ESA, the addition of new listed species or critical habitat, and results of future Section 7 consultations may require modifications to groundfish fishing practices to reduce the impacts of these fisheries on listed species and critical habitat. Listing any of the ice seals and designating critical habitat would require Section 7 consultation for the groundfish fisheries to determine if they are likely to adversely affect the listed species or designated critical habitat. Change to the fisheries may be required if it is determined that the fishery may pose jeopardy or adverse modification or destruction of critical habitat. Fishery measures would be needed to reduce that potential harm.

Modifications to Steller sea lion protection measures will result in Section 7 consultations. These changes may be a result of recommendations by the Council based on a review of the current protection measures, potential state actions, or recommendations from future biological opinions. Any change in protection measures likely would have insignificant effects because any changes would be unlikely to result in the PBR being exceeded and would not be likely to result in jeopardy of continued existence or adverse modification or destruction of designated critical habitat.

Improved management of fur seals may result from the Council's formation of the Fur Seal Committee, and the continued development of information regarding groundfish fishery interactions and fur seals. The timing and nature of potential future protection measures for fur seals are unknown, but any action is likely to reduce the adverse effects of the groundfish fisheries on fur seals.

Ongoing research efforts are likely to improve our understanding of the interactions between the harvest of pollock and salmon and the impacts on marine mammals in the Bering Sea. NMFS is conducting or participating in several research projects, which include understanding the ecosystems and fisheries interactions. These projects will allow NMFS to better understand the potential impacts of commercial fisheries, the potential for reducing salmon bycatch, and the Bering Sea ecosystem. The results of the research will be useful in managing the fisheries with ecosystem considerations and is likely to result in reducing potential effects on marine mammals. For more information see http://www.afsc.noaa.gov/.

The implementation of the Arctic fishery management plan will provide protection to those marine mammals that use Arctic and Bering Sea waters, such as ice seals. The plan initially prohibits commercial fishing in the Arctic Management Area until information is available to sustainably manage the fishery (74 FR 56734, November 3, 2009). No commercial fishing in either the Chukchi or Beaufort Seas would prevent the potential for incidental takes, disturbance or competition for prey species between fishing vessels and marine mammals.

Traditional management tools

The cumulative impact of the Bering Sea pollock fishery in combination with future changes to the pollock fishery or harvest specifications may have lasting effects on marine mammals. However, as long as future incidental takes remain at or below the PBR, the stocks will still be able to reach or maintain their optimal sustainable population. The potential exception to this is the harvest of ringed seals, which is over the PBR (Table 16). The amount of incidental takes in the fisheries is a very small additional contribution, which does not result in exceeding the PBR based on total human caused mortality. Additionally, since future TACs will be set with existing or enhanced protection measures, it is reasonable to assume that the effects of the fishery on the harvest of prey species and disturbance will likely decrease in future years. Improved monitoring and enforcement through the use of technology would improve the effectiveness of existing and future marine mammal protection measures by ensuring the fleet complies with the protection measures, and thus, reducing the adverse impacts of the alternatives.

Actions by other Federal, State, and International Agencies

Expansion of state pollock or Pacific cod fisheries may increase the potential for effects on marine mammals. However, due to ESA requirements, any expansion of state groundfish fisheries may result in reductions in federal groundfish fisheries to ensure that the total removals of these species do not jeopardize any ESA-listed species or adversely modify designated critical habitat, including Steller sea lion critical habitat.

The state manages the salmon fisheries of Alaska and the state's first priority for management is to meet spawning escapement goals to sustain salmon resources for future generations. Subsistence use is the highest priority use under both state and federal law. Surplus fish beyond escapement needs and subsistence use are made available for other uses, such as commercial and sport harvests. The state carefully monitors the status of salmon stocks returning to Alaska streams and controls fishing pressure on these stocks. Even though prey availability is not accounted for in the setting of salmon harvest levels, the management of salmon stocks effectively maintains healthy populations of salmon where possible and may provide sufficient prey availability to marine mammals.

Incidental takes of Steller sea lions and other marine mammals occur in the state managed set and drift gillnet, troll, and purse seine salmon fisheries (79 FR 14418, March 14, 2014). Marine mammal species taken in the state-managed fisheries and also the pollock fishery are in Table 17.

Table 17 Marine Mammals Taken in State-Managed and Federal Pollock Fisheries

Marine Mammal Stocks Taken in State Managed and Federal Pollock Fishery	State Fisheries mean annual mortality*
Dall's porpoise	28
Harbor seal, Bering Sea	0
Steller sea lions, western	14.5
Humpback whale western and central stocks	0
Spotted seal	0
Harbor Porpoise, Gulf of Alaska	21.8

Allen and Angliss 2013
List of Fisheries for 2014 (79 FR 14418, March 14, 2014)

The mortalities listed in Table 17 are included in the total mean annual human caused mortalities in Allen and Angliss 2013. The combination of the incidental takes in the pollock fishery with takes in the State-managed fisheries for these species is either well below the PBR or a small portion of the total mean annual human caused mortality for species which PBR is not determined. It is not likely that EFP fishing would change the pollock fishery in a manner that would greatly increase the overall incidental takes of these marine mammals to where either the PBR would be exceeded or the proportion of fishery mortality in the total mean annual human caused mortality would greatly change.

Private actions

Subsistence harvest is the primary source of direct mortality for many species of marine mammals. Current levels of subsistence harvests are controlled only for fur seals. Subsistence harvest information is collected for other marine mammals and considered in the stock assessment reports. It is unknown how rates of subsistence harvests of marine mammals may change in the future, but subsistence harvests are not expected to greatly increase as the number of subsistence users is not expected to greatly increase.

Other factors that may impact marine mammals include continued commercial fishing; non-fishing commercial, recreational, and military vessel traffic in Alaskan waters; oil and gas exploration; seismic surveying; and tourism and population growth that may impact the coastal zone. Little is known about the impacts of these activities on marine mammals in the BSAI. However, Alaska's coasts are currently relatively lightly developed, compared to coastal regions elsewhere. Despite the likelihood of localized impacts, the overall impact of these activities on marine mammal populations is expected to be modest.

4.6.5 Summary of Effects

The continuing fishing activity and continued subsistence harvest are potentially the most important sources of additional annual adverse impacts on marine mammals. Both of these activities are monitored and are not expected to increase beyond the PBRs for marine mammals. The extent of the fishery impacts would depend on the size of the fisheries, the protection measures in place, and the level of interactions between the fisheries and marine mammals. However, a number of factors will tend to reduce the impacts of fishing activity on marine mammals in the future, most importantly ecosystem management. Ecosystem-sensitive management and institutionalization of ecosystem considerations into fisheries governance are likely to increase our understanding of marine mammal populations and interactions with fisheries. The effects of actions of other federal, state, and international agencies are likely to be less important when compared to the direct interaction of the commercial fisheries, subsistence harvests, and marine mammals.

Because of the amount of harvest and method under Alternative 2, compared to Alternative 1, no substantial change in effects on marine mammals is expected. There will be no substantial change in incidental take by fishing operations or entanglement in marine debris under Alternative 2. There will be no substantial change in competition for key marine mammal prey species by the fishery. There will be no substantial change in disturbance of marine mammals. **For these reasons, impacts to marine mammals are likely insignificant under Alternatives 1 and 2.**

4.7 Economic Effects

4.7.1 Background

The operation of the pollock fishery in the BSAI is described by gear type in the Amendment 91 EIS (NMFS 2009a). General background on the fisheries with regard to each fish species is given in the BSAI and GOA groundfish Fishery Management Plans (FMPs) (NPFMC 2014a and 2014b). The pollock trawl and State salmon fishery sectors are the only sectors that may be affected by this proposed action. Additional information regarding fishery participants can be found in the 2014 Economic SAFE report (NPFMC 2014c).

The most recent description of the economic aspects of the groundfish fishery is contained in the 2014 Economic SAFE report (NPFMC 2014c). This report, incorporated herein by reference, presents the economic status of groundfish fisheries off Alaska in terms of economic activity and outputs using estimates of catch, bycatch, ex-vessel prices and value, the size and level of activity of the groundfish fleet, the weight and value of processed products, wholesale prices, exports, and cold storage holdings. The catch, fleet size, and activity data are for the fishing industry activities that are reflected in Weekly Production Reports, Observer Reports, fish tickets from processors who file Weekly Production Reports, and the annual survey of groundfish processors. External factors that, in part, determine the economic status of the fisheries are foreign exchange rates, the prices and price indices of products that compete with products from these fisheries, and fishery imports.

4.7.2 Socioeconomic Effects

The potential socioeconomic effects of this proposed action primarily are future benefits that may result from the use of a salmon excluder device in the pollock trawl fisheries. Pollock taken during the testing will be sold to help offset the costs to the vessel operations during the experimental work. Salmon harvested during the testing will be donated for distribution under the Prohibited Species Donation Program (§ 679.26) or disposed of in accordance with § 679.21(b).

4.7.3 Alternative 1 – Status Quo Effects

If the EFP is not issued, the development of an effective salmon excluder device may be more difficult, if not impossible. The pollock fishery may experience high salmon bycatch rates that exceed salmon bycatch limits, especially for Chinook salmon. The economic impact to the pollock fishery is the potential closure of hot spots under the voluntary rolling hot spot program, and closure areas under the IPA, limiting the choices for pollock harvest. Limited fishing grounds can result in additional expense in finding areas with sufficient catch rates and quality of fish. In addition, the pollock industry incurs costs in sorting and disposing bycatch. Alternative 1 would not facilitate the development of a salmon excluder device, eliminating the potential for future socioeconomic benefits identified under Alternative 2.

4.7.4 Alternative 2 – Issue the EFP Effects

The knowledge gained from this experiment may make it possible to reduce the costs of salmon bycatch in the pollock trawl fisheries. However, there are several caveats. The experiment may not be successful; the vessel may not encounter sufficient salmon to support the experimental design. The excluder device may exclude enough pollock to reduce net CPUE. Moreover, the excluder may turn out to be expensive to purchase or operate (perhaps by excluding large numbers of pollock or by increasing the net's drag) and not be widely adopted by the fleet.

Under Alternative 2, the proposed action may allow for the development of an effective salmon excluder device for trawl gear. If such a device were available, trawl vessels could use this device to lower the salmon bycatch which would result in less potential for exceeding the PSC limits or requiring the vessel to move to areas with lower salmon bycatch rates. By not exceeding the PSC limits or by not being closed out of salmon hot spot areas, pollock fisheries would have more locations available for selecting fishing grounds, potentially leading to less harvesting expense and higher quality product. Benefits to consumers and the country overall from the pollock fishery could also increase under the expectation that the benefits of efficiency gains and increased product quality would accrue to consumers and the nation.

These benefits are based on the assumption of minimal injury to salmon utilizing the escapement device. Any evaluation of the performance of salmon bycatch reduction device and its costs and benefits would clearly need to explicitly evaluate the question of long term survival in order to assess actual benefit/cost tradeoffs. The expectation of benefits from a bycatch reduction device also assumes that changes in fishing behavior as a result of widespread use of the device would not increase some other potential environmental costs associated with the fishery. It is also not possible to predict the level of acceptance of using such a device in the pollock trawl fishery though there is great interest in reducing salmon bycatch within and outside the pollock industry.

Issuing the EFP also would provide the pollock industry a way to show those concerned about salmon bycatch that there is a good faith effort by the industry to address the problem. The success of such a device would likely result in benefits to salmon stocks used by subsistence, commercial and recreational fishermen and those communities that depend on salmon resources.

Selection of Vessels, Costs and Revenue

This is a joint project of the NMFS AFSC and the North Pacific Fishery Research Foundation (NPFRF). The NPFRF is a private non-profit foundation whose main purpose in recent years has been to promote the development of trawls that take fewer salmon PSC during pollock fishing operations (Paine)[9]. The principal investigators will be scientists from the AFSC and a contractor chosen by the NPFRF. This contractor is the applicant for the EFP. Based on previous practice, Requests for Proposals (RFPs) will be issued separately for each of the three seasonal experiments. Vessels will be selected by an AFSC review panel based on criteria described in the RFP (Gauvin 2013a).

The vessel operations selected under the RFP will be able to sell the groundfish harvested under the EFP and retain the proceeds (although, as noted below, the EFP may impose some requirements on delivery). The value of the revenues in the 2015 "A" and "B" seasons, and the 2016 "A" season, cannot be determined with any precision at the current time (March 2011). For the purposes of this analysis, 2012 wholesale values have been used to provide a rough estimate of possible revenues. Catcher/processor "A" and "B" season values have been used to value the harvest in the relevant seasons ($1,501 per metric ton round weight for the "A" season, and $1,135 for the "B" seasons) (Haitt, pers. comm.[10])[11]. This produces a revenue estimate of about $9.4 million. There is a great deal of uncertainty associated with this revenue estimate; however, it is not possible to quantify this with a confidence interval.[12] If catcher vessels are used, the value received by fishing operations would be quite a bit less. The catcher vessel trawl revenue per metric ton of round weight of pollock in 2012 is $ 282 for paid by shoreside processors at the exvessel level (NPFMC 2014c). In this case the pollock would be processed on-shore (with associated processing costs) by a firm associated with the catcher vessel either through ownership or joint membership in a coop, and there would be a wholesale value received by the processor. Using the average pollock price from 2012, the gross earnings for the pollock caught from this EFP, could be as much $2.1 million. The cost of harvesting this pollock could be substantially different than the normal fishing costs of vessels in the commercial fishery. In the Bering Sea Pollock fishery, these vessels are not attempting to optimize the testing of a salmon excluder device. While they may fish in similar areas and with the modified gear, the focus on EFP testing is likely to accumulate different and most likely higher costs for trawl operations. Thus, the returns from EFP testing are likely to be less than the returns from commercial fishing.

This is an estimate of gross revenue accruing to the program participants. Actual profits will be less than this, depending on the costs of participating in the program. These costs include the normal costs of fishing for and processing pollock, the additional costs imposed on fishing operations by the need to comply with the requirements of the EFP, the profits foregone by fishing for EFP pollock instead of pursuing other fishing opportunities (such as American Fisheries Act (AFA) pollock, Community Development Quota (CDQ) pollock, or other groundfish), and the possibility that operations may donate part of the proceeds to the NPFRF for its research efforts.

The EFP fishing protocol sets out how many hauls and how many tons per day can be harvested, the criteria used to select fishing areas for the EFP test, the gear the EFP applicant will need to provide for the EFP testing (e.g., nets and catch indicating devices), and the duties of crew members in support of the EFP experiment. These requirements and others are described in the RFP used to solicit applications from interested Bering Sea pollock vessel-owning companies (Gauvin 2011).

[9] Paine, Brent. Executive Director of the United Catcher Boats, Fisherman's Terminal, Seattle, WA. President of the North Pacific Fishery Research Foundation. Phone call on March 21, 2011.

[10] Ben Muse, NMFS, Juneau Alaska. from Steller Sea Lion EIS May 1, 2014.

[11] These are not wholesale prices, but values, estimated by dividing the wholesale value of the wholesale production of all pollock products, by the round weight volume of pollock harvested.

[12] Among the factors contributing to the uncertainty are the use of 2012 prices as a proxy for unknown 2015 and 2016 prices, the potential impact of EFP project requirements on product quality and price, and whether or not the pollock will be taken by catcher/processors or by catcher vessels delivering to shoreside plants for processing.

The costs of fishing under the EFP are likely to be higher than the costs of fishing for AFA or CDQ pollock. In every stage of salmon excluder EFP fieldwork for past EFPs, and as will be the case for the current application, the EFP protocol constrains harvest amounts per day due to the necessity of collecting more data on the catches than would occur in the normal fishery and due to the need to essentially collect data from two separate nets on each haul (the regular codend and the fish in the recapture net). The EFP also constrains the selection of fishing areas to those that provide sufficient levels of pollock and salmon for the EFP experimental design. In the past this has often forced a vessel to conduct fishing where target catch rates are not optimal and where product quality factors are not the best. As such, EFP applicants need to consider whether they are able to operate under the EFP protocol and recover their operating costs. Profitability is not guaranteed given the constraints of the EFP fishing protocol. The major factor affecting production under the EFP may be frequent slowdowns from the need to handle and account for EFP catches from two nets separately. This is very problematic when a large quantity of catch occurs in the recapture net as this can damage that secondary net, and it must be repaired before EFP testing can resume. Malfunctions in camera and sonar equipment that are needed during the EFP are also common, and these must be resolved before EFP fishing can resume. The EFP vessel cannot switch to its non-EFP fishing opportunities during the EFP because once the EFP commences, only EFP fishing is allowed. (Gauvin 2013a)

Past EFPs have not been evaluated to determine whether or not they were profitable for the successful applicants. In the past, EFPs may have resulted in losses (failures to recover operating costs) when participating vessels relocated to areas where salmon bycatch rates were sufficient for the objectives of the EFP or fishing operations were suspended because of equipment breakdowns. Past RFPs specifically informed applicants of this possibility. NMFS' application review panel considers the applicants' responses to questions in the RFP about their ability to accommodate slowdowns and unanticipated occurrences during the EFP. Possible scenarios include equipment failure requiring the vessel to return to port for parts, or difficulty finding fishing locations that meet EFP objectives, leading to days of searching with few or no hauls (Gauvin 2011).

In addition to the potentially higher operating costs involved in fishing under the EFP protocols, applicants may be under an obligation to transfer part of their revenues to the NPFRF. In the past, the RFPs have assigned points for willingness of the applicant to commit to donate part of the revenues from the sale of groundfish to the NPFRF. A recent RFP provided that the applicant could receive up to 5 points (out of a total of 100) for donations to the NPFRF at the rate of 1 point for every $20 increase in the donation. The donation was meant to contribute to defraying the costs the NPFRF incurs for this project (including field project manager, sea samplers, gear, travel) as well as other North Pacific fisheries research activities of the Foundation.[13] In this recent RFP, all of the successful applicant's sea sampler costs during the EFP were paid by the NPFRF out of the donations made in connection with the EFP. The

[13] Specific to the salmon excluder EFP, the NPFRF pays for many of the cost components of EFP fieldwork that are not covered by EFP participants. These include the cost of the two sea samplers needed on each EFP vessel during testing, the field project manager and travel costs for getting people and equipment to Dutch Harbor. The field project manager goes out on all EFP fieldwork to manage the experiment to ensure the fieldwork meets the requirements of the experimental design. Additionally, the NPFRF typically covers most of the costs of gear expenditures for excluders and recapture nets as well as provides some of the equipment (e.g. supplemental underwater camera system). In addition to covering costs of field research on the EFP, the NPFRF has also funded facility and travel costs for multiple trips to the flume tank facility in Newfoundland. It has also funded several outreach projects related to the salmon excluder implementation into the regular pollock fishery such as hiring a video technician during the summer and fall of 2010 working out of Dutch Harbor to go out on boats interested in video work to help them tune their salmon excluders. A more recent project by the NPFRF was to send a technician out to sea during the 2010 A season during the regular pollock fishery to evaluate whether salmon catches in future EFPs can be accounted for via video cameras placed in recapture nets with open codends. This A season work included having the same technician go to Kodiak last month to get preliminary information on how to adapt the current salmon excluder to the smaller scale Gulf of Alaska vessels and pollock nets (Gauvin 2011).

EFP exempted the EFP vessel from its normal observer coverage requirements, and the EFP provided for the EFP holder to place up to two sea samplers on EFP vessels to collect the necessary data for the EFP test (Gauvin 2013a).

In the current instance, a $100 per ton donation commitment for 7,500 metric tons of groundfish implies revenues of $750,000. Any donation commitment by an applicant would be premised on applicant's estimate of the profitability of the EFP. $100/ton is an upper bound potential commitment in the above-cited RFP. In the past, successful bidders have committed to donate $50/ton to $100/ton. (Paine)[14] As noted earlier, the evaluation of applicants is carried out by AFSC staff, and not by the NPFRF or its contractor, so that the NPFRF does not have control over the size of the donation.

[14] Email on March 21, 2011.

5 Summary and Conclusions

Context: The action would issue an EFP to allow for the continued development and testing of a salmon excluder device for pollock trawl gear in the Bering Sea. Any effects of the action are limited to areas commonly used by the pollock trawl fishery. The effects on society within these areas are on individuals directly and indirectly participating in the pollock fisheries, those participating in the experiment, those who depend on salmon resources, and those who may receive the small amount of salmon through the Prohibited Species Donation Program. Because this action may affect the efficiency of pollock fishing and the bycatch of salmon in the future, this action may have impacts on society as a whole or regionally.

Intensity: National Oceanic and Atmospheric Administration Administrative Order (NAO) 216-6 (May 20, 1999) contains criteria for determining the significance of the impacts of a proposed action. In addition, the Council on Environmental Quality (CEQ) regulations at 40 CFR1508.27 state that the significance of an action should be analyzed both in terms of "context" and "intensity." Each criterion listed below is relevant to making a finding of no significant impact and has been considered individually, as well as in combination with the others. The significance of this action is analyzed based on the NAO 216-6 criteria and CEQ's context and intensity criteria. These include:

1) Can the proposed action reasonably be expected to jeopardize the sustainability of any target species that may be affected by the action?

Response: No. The proposed action would harvest a very small quantity of pollock in relation to the overall annual harvest of pollock. No discernable effect on any target species is expected; therefore, the proposed action is not likely to jeopardize the sustainability of any target species (EA section 4.2).

2) Can the proposed action reasonably be expected to jeopardize the sustainability of any non-target species?

Response: No. A very small quantity of fish species other than pollock and salmon is expected to be taken by the proposed action. The amount of salmon taken is a small portion of the annual bycatch of salmon. Any effect from the EFP is not likely discernable over the status quo fishery effects; therefore, the proposed action is not likely to jeopardize the sustainability of any non-target species (EA section 4).

3) Can the proposed action reasonably be expected to cause substantial damage to the ocean and coastal habitats and/or essential fish habitat as defined under the Magnuson-Stevens Act and identified in FMPs?

Response: No. This action is limited to the use of pelagic trawl gear in a manner which has been found to not cause substantial damage to oceans and coastal habitats or essential fish habitat (EA section 4 Introduction).

4) Can the proposed action reasonably be expected to have a substantial adverse impact on public health or safety?

Response: No. The proposed action involves one vessel conducting controlled scientific testing of a bycatch reduction device in a location away from the public. No changes to fishing practices are expected that would impact public health and safety. Therefore, no impacts to public health or safety are expected (EA section 2).

5) Can the proposed action reasonably be expected to adversely affect endangered or threatened species, marine mammals, or critical habitat of these species?

Response: No. The proposed action is limited to the use of pelagic trawl gear by one vessel, harvesting a relatively small amount of fish over several seasons in two large areas of the Bering Sea. Because of the amount of pollock and salmon harvested, the method of harvest, and compliance with existing closures for Steller sea lions and northern fur seals, no discernable effects are expected on ESA-listed species, critical habitat, marine mammals or other non-target species (EA sections 4.4 and 4.6).

6) *Can the proposed action be expected to have a substantial impact on biodiversity and/or ecosystem function within the affected area (e.g., benthic productivity, predator-prey relationships, etc.)?*

Response: No. This action is limited to the use of pelagic trawl gear by one vessel, harvesting a relatively small amount of fish over several seasons in two large areas of the Bering Sea. The quantity of fish and method of harvest are not likely to have any discernable effects on biodiversity or ecosystem function (EA section 4).

7) Are significant social or economic impacts interrelated with natural or physical environmental effects?

Response: No. The issuance of the EFP would allow for the vessel used in the EFP work to be compensated for expenses through the sale of pollock harvested during the salmon excluder device testing. No significant social or economic impacts are expected from the issuance of the EFP. Successful development and use of the salmon excluder device may result in beneficial economic effects for the pollock industry and for those dependent on salmon resources (EA section 4.7).

8) Are the effects on the quality of the human environment likely to be highly controversial?

Response: No. The potential effects of the action are well understood and not controversial. Any effects on the human environment are not likely discernable due to the limited amount of fish and vessel participation and short time period of the EFP project. The industry, NMFS, Western Alaska salmon users, and environmental organizations are in favor of efforts to reduce salmon bycatch (EA section 1).

9) *Can the proposed action reasonably be expected to result in substantial impacts to unique areas, such as historic or cultural resources, park land, prime farmlands, wetlands, wild and scenic rivers, essential fish habitat, or ecologically critical areas?*

Response: No. This action is limited to the use of pelagic trawl gear in a manner which has been found to not cause substantial damage to oceans and coastal habitats or essential fish habitat (EA Section 3 Introduction). This action is limited to the marine environment so other unique areas listed would not be impacted (EA section 1).

10) Are the effects on the human environment likely to be highly uncertain or involve unique or unknown risks?

Response: No. The potential effects of fishing on pollock and marine mammals are well understood and the returns of salmon in Alaska are well monitored. Any effects on the human environment are not likely discernable due to the limited amount of fish and vessel participation and short time period of the EFP project (EA sections 4.1, 4.3 and 4.5).

11) Is the proposed action related to other actions with individually insignificant, but cumulatively significant impacts?

<u>Response</u>: No. Each environmental component that may be affected by this action was analyzed for potential direct and indirect impacts. For each of these components, no discernable direct or indirect effects were identified resulting from this action when comparing the potential impacts under Alternative 2 compared to Alternative 1. An analysis of cumulative effects was included to determine the incremental effects of this and other actions on each environmental component affected. The combined direct, indirect, and cumulative impacts were not likely significant for this action (EA section 4).

12) Is the proposed action likely to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural or historical resources?

<u>Response</u>: No. This action is limited to the marine waters of the Bering Sea, and these types of land-based sites do not occur in the Bering Sea. The fishing activities under this action are not likely to result in destruction or loss of significant scientific, cultural, or historical resources because the pelagic trawling occurs in the water column where these resources do not occur. Therefore, this question is not applicable (EA section 1).

13) Can the proposed action reasonably be expected to result in the introduction or spread of a nonindigenous species?

<u>Response</u>: No. This action does not change fishing activities in a manner that would result in the spread or introduction of non-indigenous species (EA section 1).

14) Is the proposed action likely to establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration?

<u>Response</u>: No. This action allows for the development of a single device that may be considered for manufactured and widespread use by the fishing industry at a later time. No decisions would be made at this time regarding the future use of the device, and any future actions would be analyzed for potential significant effects (EA section 1).

15) Can the proposed action reasonably be expected to threaten a violation of Federal, State, or local law or requirements imposed for the protection of the environment?

<u>Response</u>: No. The proposed action would be conducted in accordance with all federal, state, and local laws (EA section 1).

16) Can the proposed action reasonably be expected to result in cumulative adverse effects that could have a substantial effect on the target species or non-target species?

<u>Response</u>: No. Reasonably foreseeable future actions from this EFP study is the industry's use of a salmon excluder device which would be a beneficial cumulative effect for pollock and salmon species. No cumulative adverse effects are likely for target or non-target species with this action (EA section 4).

Comparison of Alternatives and Selection of a Preferred Alternative

Alternative 1 does not meet the need or the purpose of this action, to allow for a scientific study to develop a salmon excluder device for pollock trawl vessels in the Bering Sea. The status quo would not meet the need to reduce the amount of salmon bycatch in the pollock trawl fishery. Alternative 2 would provide an EFP that permits the continued development and testing of such a device in a scientifically valid manner and within groundfish regulations (50 CFR 679 and 600), meeting the need and purpose of this action. Without the EFP, the testing would not be conducted following the carefully conceived experimental design, potentially resulting in no development of the bycatch reduction device and no potential tool for lowering salmon bycatch in the pollock trawl fishery. Therefore, Alternative 2 is the preferred alternative.

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Appendix A: Application for a new exempted fishing permit (EFP) to continue research on salmon bycatch reduction devices

Date of Application: December, 2013

Name, mailing address, and phone number of applicant:

Signature of Applicant:

EFP Applicant and Principal Investigator:

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Purpose and Objectives of the EFP: This application requests that the Alaska Region of the National Marine Fisheries Service (NMFS) issue another exempted fishing permit (EFP) to assist the Bering Sea pollock industry's continuing efforts to develop salmon excluders. Since 2003, research to develop and test salmon excluders in the Bering Sea has been conducted by the applicant under the direction of the North Pacific Fisheries Research Foundation (NPFRF). Dr. Craig Rose of the Alaska Fishery Science Center and Mr. John Gruver of United Catcher Boats Association have collaborated in this work and will continue to do so under this permit.

The two focus areas for this new EFP come out of the findings from EFP 11-01 (Attachment 1 to this application) which provides a detailed assessment of productive areas of focus for further excluder development. These are: 1) Refinements and tuning to the O/U excluder to increase chum escapement and 2) Improvement of Chinook escapement rates with use of the O/U excluder. These areas for improvement have some overlap for the two salmon species and both objectives were high priorities for Bering Sea pollock fishermen who provided feedback at the conclusion of EFP 12-01.

In summary, considerable headway has been made on excluders for the Bering Sea pollock fishery but additional improvement is extremely desirable. Under the management constraints and incentive programs, fishermen continue to need better tools in their bycatch-management toolbox and further development of salmon excluders is extremely important according to input from fishermen received during NPFRF's outreach efforts.

The stage of excluder development for the Bering Sea is that a workable "flapper-style" excluder for Chinook is in wide use in the pollock fishery. Based on data from several field tests, if rigged according to the specifications described in the EFP final report, this device achieves Chinook escapement rates of 20-40%. At the same time, the pollock escapement rate is well under one percent by weight. These results are based on systematic testing methods employing recapture nets in 2011-2012.

Specific to chum bycatch reduction, the new excluder design which allows escapement at the top and bottom of the net did reduce chum bycatch considerably more than previous devices. This over and under (O/U) excluder tested in the fall of 2012 resulted in chum escapement of approximately 20% along with low pollock escapement rates. This is encouraging but the applicant feels improvement is likely attainable with systematic adjustments to that excluder.

A better salmon excluder is highly desirable at this time because the North Pacific Council is concurrently reviewing existing measures for managing Chinook bycatch and additional steps to reduce chum bycatch.

While progress on excluders is encouraging, not all of the areas slated for improvement in Chinook and chum bycatch reduction set out in the 2011-2012 EFP were successful. Winter 2012 work to further improve Chinook escapement rates with the addition of artificial light encountered problems with controlling effects of lighting. Additionally, chum salmon escapement still lags behind Chinook. After considering what has been done and ideas for further development, the applicant and NPFRF believe there are several potentially productive areas for improvement and have made these the focus here.

Past experience has shown that EFPs for salmon excluder development are an effective way to make progress on excluder development. One aspect of this, in contrast to the typical *ad hoc* gear trails by fishermen, is that our EFPs follow a systematic testing protocol which measures performance as rigorously as possible given the need to test under conditions that are very close to actual fishery. Additionally, a big component of our process is outreach to fishermen. We feel the exchange of ideas is perhaps the most critical component of excluder development.

In workshops prior to and following EFP fieldwork, input from as wide a range of pollock industry participants is encouraged. This is useful to help us focus on the most promising excluder designs. In addition, following EFP field seasons we have conducted numerous workshops to update attendees on performance results and provide information on proper construction and installation/tuning requirements. These approaches have proven to be effective and at this point fishermen and gear manufacturers have come to rely on our EFPs for excluder development. This effort has led to an increasing use of salmon excluders as an integral part of the overall efforts of Bering Sea pollock fishermen to manage their bycatch under the hard caps and industry-managed incentive programs.

In the context of this EFP application, the successful development and adoption of excluders is highly dependent of rigorous field testing and concrete information about tradeoffs in target and salmon catch rates. To date, in the Bering Sea experience with excluders, pollock losses have been very small in comparison to reductions in catches of salmon with excluders. But as work to optimize excluder performance continues, the issue will likely be a more complex balance between reduction in salmon bycatch rates and increasing pollock escapement. As we have seen in our Gulf of Alaska EFP trials of excluder designs to date, pollock escapement rates approaching 5% are possible, particularly on lower horsepower vessels. If the efforts to improve salmon escapement lead to similar pollock escapement levels, it will be critical to have a true understanding of tradeoffs so that fishermen understand the advantages of excluder usage. This will empower fishermen to make informed decisions between excluder usage and/or alternative means of controlling salmon bycatch such as hotspot avoidance.

<u>Specific Areas of Focus for Further Development of Salmon Excluders in this EFP:</u>

To date the only rigorous testing of the O/U excluder occurred in fall of 2012 where chum salmon and pollock escapement rates were the focus. Since then, however, as part of our continuing outreach efforts with the fishery, several pollock fishermen have installed O/U excluders in their nets over the last nine months. Input from these informal trials has helped us better understand practicality aspects of the O/U excluder and fishermen's perceptions of pollock escapement. Loss rate for pollock in our 2012 EFP tests was somewhat uncertain because testing conditions that fall offered only low pollock catch rates which were fairly unrepresentative of the fishery. For this reason, the informal trails by fishermen have been helpful to confirm that pollock escapement was accurately assessed in 2012. Without the same ability to monitor salmon escapement as would occur in an EFP, however, these informal trials have not provided concrete information in that important area.

Plan for the focus areas for this EFP

1) Evaluate O/U excluder modifications to improve chum salmon escapement:

Two field seasons to look at ways to reduce chum salmon bycatch are proposed for this EFP. These would occur in August/October 2014 and August/ October 2015. One or two industry vessels would be used for this work depending on the specifics of what excluder modifications are studied. The testing would make stepwise adjustments to the baseline O/U device tested in September 2012 with the objective of improving chum escapement.

One adjustment we expect to consider is to reduce the degree to which the back edge of the O/U excluder's upper and lower panels provide access to escapement portals. The focus would be on reducing or possibly eliminating overlap in the construction of the O/U excluder. We use the term "overlap" to describe the degree to which the O/U excluder's floated panel (as part of the bottom escapement part of excluder) and the weighted panel (as part of top escapement), extend back behind the entry way to the escapement holes. The basic idea is that reducing overlap decreases the distance that salmon would need to swim forward to escape.

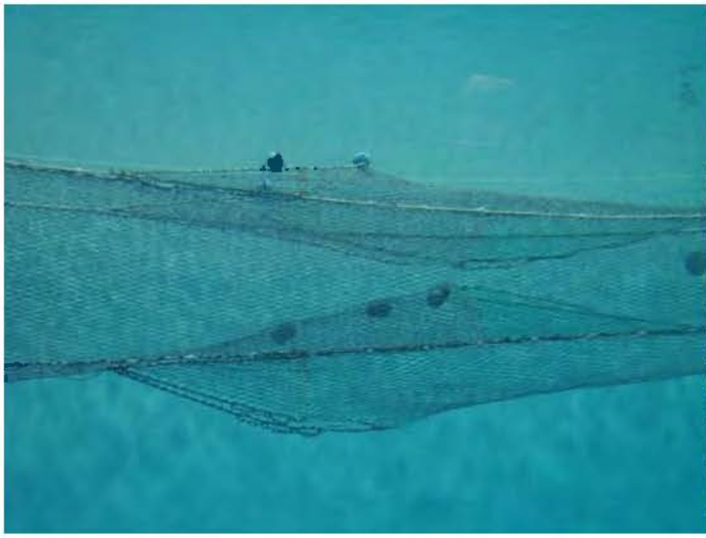
As background, it was widely held by fishermen initially that these panels needed to extend back a considerable distance past the aft edge of excluder's escapement portals in order to avoid high levels of pollock escapement. For this reason, the first O/U excluders, like flapper excluders, extended back typically at least 20% of the panels overall length. The need for this, however, was based on assumptions about differences in swimming ability between pollock and salmon. In the <u>flapper</u> excluder tests in 2012, however, overlap was reduced to evaluate the effects on chum salmon and pollock escapement rates. Although the flapper excluder is a quite different design (e.g. it does not allow escapement on the bottom), we did learn that reducing overlap in flapper exluders did not increase pollock loss rates (see fall 2011section of the EFP 11/01 final report). For the flapper excluder, chum escapement was not improved by reducing overlap but that may not be the case for the O/U excluder.

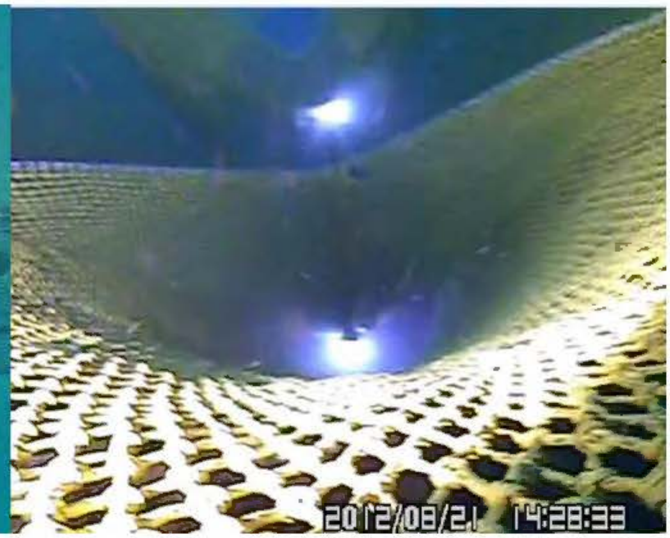
A key question for this work to look at reduced overlap for the O/U excluder will be whether it will increase chum salmon escapement and the associated tradeoffs in terms of pollock loss. In this regard, many fishermen are concerned that the failure to see increased pollock loss with reduction in overlap with flapper excluders is not necessarily applicable to the O/U. This is, they feel, because the O/U allows escapement from the bottom which they feel is a more natural place for pollock to escape, particularly on lower horsepower vessels.

A second focus of our new EFP will likely be to modify the way the lower and upper components of the O/U excluder come together. The original concept of the O/U excluder was that fish coming down the trawl are guided into the center. This was intended to create ample room aft of where the panels come together in the center to allow salmon can get out of the flow of pollock in the area where they can have access to the escapement portals above and below. Video from our first field trial of the O/U excluder in fall 2012 however, showed that we only achieved some of the shaping objectives for that excluder and that the panels on the top and bottom remained further apart than was intended. This failed to create as much room for salmon to move out of the flow of pollock as was intended.

To address this, there are two steps that make sense at this time. One might be to increase the weight and floatation on the upper and lower panels respectively. Another may be to change the way the tapers of the panels are cut. Using fast tapers for the construction of these panels may allow us to make it easier to pull them together with floatation and weight even where water flow is great. These fast tapers will also help us overcome the natural tendency of the net to achieve a square shape (rather than round) which serves to make the panels stay close to the bottom and top of the net. Resolution of the best way to proceed here will be first looked at in flume tank work during an upcoming trip to a flume tank at Memorial University in November. After evaluating both approaches, it will be critical to do fieldwork to resolve the actual water flow and drag tradeoffs in pre-EFP test tows prior to putting fish through the net to see if the additional room provides advantages for salmon escapement.

To help illustrate how adjustments to the excluder via the two approaches described above, we have included two photos below. The picture on the left side shows the model of an O/U excluder used in our 2011 flume tank work. The right side is a photo from video of the actual O/U used in our fall 2012 field trials on the Pacific Prince. Note the difference in distance between the upper and lower panels in the model and field trial gear. In the flume tank model, anything coming down the net would be ushered into the middle (in a latitudinal sense) whereas in the first real world test of an O/U excluder, fish could move back along the top or bottom with little incentive to come into the middle. The upcoming flume tank work should help resolve which way is the most expeditious to attain the desired shape but pre-EFP tows with full scale materials and water speed will be required to confirm if changes to weighting/floatation or construction are successfully able to achieve the desired shape under with meshes spread under full towing force of pollock fishing.





One additional focus to consider for changes to the O/U excluder comes out of our 2012 field trials where we observed that chum salmon were able to use both the upper and lower escapement portals of the O/U excluder. Previously, escapement of chums in flapper excluders was very low and we believed it to be due to behavioral differences with that species of salmon. This appeared to make sense given that Chinook escapement in the same flapper excluders with top-only escapement was consistently higher than for chums (even when tested simultaneously as occurred in fall 2011). But seeing the much higher chum escapement rates with the O/U excluder increase and noting that most of it occurred out the upper escapement portal has forced us to rethink of the way the O/U excluder works. This has spawned interest in working to optimize the way the O/U affects water flow and currents that occur aft of the excluder panels.

At this point we are unable to know how this work on how the O/U excluder affects water flow will lead to changes in the O/U excluder to make it more effective for chums. The upcoming flume tank trip is expected to help us understand measure the water direction and force aft of the excluder's panels. This should then provide insights for how O/U excluder performance might be optimized for chum escapement.

Fieldwork to investigate any and all of the modifications discussed above will consist of stepwise adjustments to the excluder over two August-October field seasons. These will help us evaluate how changes affect chum salmon escapement while hopefully maintaining negligible pollock escapement from the fall 2012 low baseline escapement rates.

2) Evaluate the baseline O/U excluder for Chinook salmon escapement and made improvements:

The second focus is to evaluate the effectiveness of the baseline O/U excluder for Chinook bycatch reduction and evaluate adjustments to improve performance. This will occur in winter 2015 (pollock A season), likely during the months of February or March when Chinook bycatch rates tend to be highest.

The O/U excluder has never been systematically tested in the Bering Sea to see how Chinook escapement it compares to the flapper excluder. As noted in the final report for EFP 11-01, the

O/U excluder appears to work on chums with minimal pollock loss and may have considerable advantages in terms of reducing the need for vessel-specific (horsepower-specific) adjustments. These factors combined make looking at the O/U for Chinook bycatch reduction a logical focus. The primary question will be to see if the O/U actually reduces Chinook catch rates as well as the flapper excluder so that is the starting point for the Chinook-specific part of this EFP.

One intriguing aspect of what we know about excluder performance for Chinook salmon is that they appear to escape at a lower rate on tows with high pollock catch rates. From catch per hour data and from video footage collected during our flapper excluder tests it appears that that when high volumes of pollock pass through the net this affects the Chinook salmon's access to the excluder's escapement portal. To address this, the O/U may have advantages because it includes a second escapement path at the bottom which may be accessible when the one at the top is blocked by pollock.

To accomplish our objectives for Chinook, testing in the winter of 2015 will start with a baseline test of the O/U for Chinook escapement. Once we have a solid understanding of escapement rates and we have collected sufficient video to evaluate whether the top or bottom escapement pathway is utilized more frequently by Chinooks, we will be ready to consider adjustments to improve Chinook escapement. Like the ones we will evaluate for increasing chum escapement, adjustments could take the form of adding floatation to the bottom panel and/or weight to the top panel to increase the amount of room created for Chinooks to swim out. Alternatively, changing the tapers of the inserts that comprise the hood and scoop at the top and bottom so as to affect the shaping under water flow may be a more productive approach.

Once the baseline testing is completed, the process of making adjustments for the second stage of testing would be done in the following manner. Adjustments in the weight and floatation on the appropriate panels or changes in the construction of the panels themselves to achieve the desired shape would be done. Next, a set of pre-test video tows in mid-water (not attempting to catch fish) would be done iteratively by the vessel(s) selected for the tests. This would confirm whether the adjustments achieved the desired shape and distance between panels. Once the desired shape is achieved, effects of the change on Chinook and pollock catch rates would be measured systematically by making approximately another set of 12 -15 tows with the device as modified.

Names of participating vessels, copies of vessel Coast Guard documents, names of vessel masters: For each stage of our field testing under the new EFP, the principal investigator will notify the Alaska Regional Administrator of NMFS (or his agent) in writing of the name of the vessel selected including associated document numbers. The principal investigator will also notify all relevant enforcement agencies of the vessel documentation and dates and area of operations for the EFP work. This will include ADF&G, NMFS, and the US Coast Guard.

Exemptions needed to regulations affecting regular pollock fishing during 2014 and 2015

1. **While conducting EFP testing under this permit, the EFP vessel must be exempted from the "Rolling Hot Spot" area closures (now promulgated under Amendment 94) so that the EFP field work can be conducted in the salmon bycatch hotspots areas as necessary.**
2. **Exemption from the regulations applying to the Sea Lion Conservation Area (SCA). This area is normally open to pollock fishing as long as this area remains open for the regular pollock fishery and would like to have access to the area unconditionally.**

3. **Exemption to the regulations that prohibit catcher processor (CP) vessels from fishing inside the Catcher Vessel Operations Area (CVOA) during B season. Catcher processors are normally excluded from this area in pollock B season, but at times the CVOA has preferable conditions for EFP testing so an exemption to this regulation for our testing on catcher processors is needed.**
4. **Exemption from regular observer coverage requirements for vessels when participating in our salmon excluder EFP field tests. We need to be able to place up to two sea samplers working directly for the principal investigator and field project manager on vessels participating in this EFP. Additionally, we need to redirect sampling to concentrate on effects of the excluder on salmon and pollock catches. This is the same exemption we have had in the past salmon excluder EFPs.**
5. **All groundfish and salmon catches during the EFP will not count against the regular groundfish TACs or any salmon bycatch caps affecting the regular pollock fishery or other in-season salmon bycatch control measures in place for the regular pollock fishery (e.g. SIP agreements promulgated under Amendment 94).**

Proposed catch limits for the salmon excluder EFP

Field work season	MT of groundfish (in pollock target)	Number of Chinook salmon	Number of non-chinook salmon
Fall 2014	2,500	250	2,500
Winter 2015	2,500	600	250*
Fall 2015	2,500	250	2,500

*small allowance of chum salmon species to avoid premature closure of EFP

The requested amounts of groundfish (in a pollock target fishery) and salmon in the table above are based on previous experience in salmon excluder EFP testing where similar amounts have provided sufficiently powerful tests to produce meaningful results in terms of confidence intervals around estimated mean escapement rates. For each individual test of an excluder design/configuration, 12-15 tows would be made. During these tows no modifications to the device/rigging/net would be made and vessel speed and net rigging would be held constant. As will be explained below, this amount of testing has in the past been sufficient to have the expectation that confidence intervals around the mean escapement rates from the test tows are meaningful for making decisions about the utility of the changes in the excluder configuration. A more detailed explanation of how we arrived at the proposed limits and an explanation for why we feel these quantities are sufficient for rigorous salmon excluder tests is provided in Appendix 2 below.

Groundfish and salmon allowances proposed here are essentially the same as what was granted for our 2011-2012 EFP with one exception and that difference merits explanation here. For our fall 2014 and 2015 tests focusing on chum salmon escapement, we are requesting somewhat higher allowances of Chinook relative to the earlier EFP. This is based on previous experience where we have found conditions with relatively high chum salmon abundance with sufficient Chinook mixed in to make simultaneous testing for the two salmon species possible. In the past, this occurred relatively close to Dutch Harbor on the shelf area east of the Pribilof Islands, an ideal area for excluder testing for logistical reasons. If we can find these conditions once again, it would afford the opportunity for simultaneous assessment of excluder performance for the two species of salmon. This would of course be quite useful for understanding behavioral differences between the two species. This was made possible to a limited extent in 2011 but, with only a small limit for fall Chinook testing (125 at that time), EFP activities had to move to another area before we did sufficient testing to make full use of this opportunity. We feel that a higher limit of Chinooks (250) proposed here would allow sufficient observations to complete a valid test for that species, should such an opportunity recur.

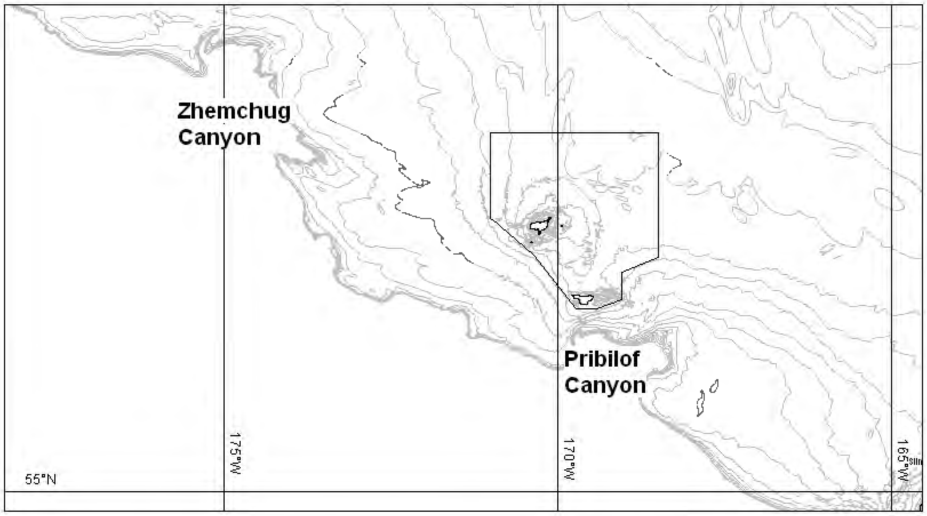
Areas where EFP testing is expected to occur during fall (2014 and 2015) and winter 2015 testing:

For valid tests of salmon excluders, we need to be able to conduct EFP testing in areas with sufficiently high concentrations of salmon as has occurred in the past EFPs. We also need to conduct our testing where pollock catch rates are representative of actual fishing conditions. This is important for evaluating the effects of the excluder on pollock catch rates and salmon escapement rates under realistic conditions.

Predicting where adequate concentrations of salmon and pollock will occur from year to year is inherently difficult. For this reason, it is impossible to specify exactly where the EFP testing will occur for the fall testing in 2014 and 2015. During earlier salmon excluder EFP tests focused on chum salmon escapement, we have found suitable testing conditions in the northern portion of the Catcher Vessel Operations Area (CVOA). Previous EFPs have also successfully found adequate areas for testing for chum salmon escapement in the Horseshoe (Bering canyon) during late September and October. This could be ideal because it is relatively close to Dutch Harbor in case there are equipment failures or a need to obtain materials to repair our excluder.

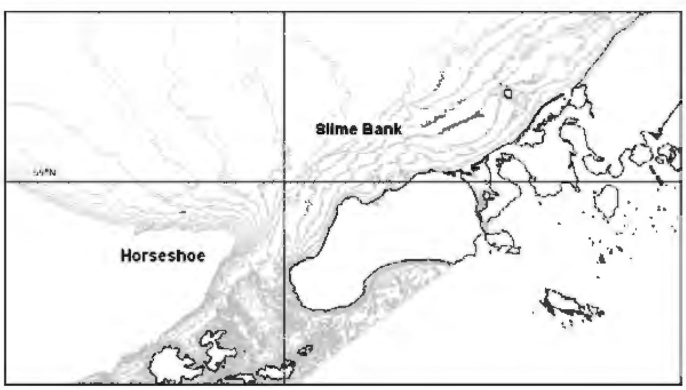
If suitable pollock and salmon conditions cannot be found in the CVOA or Horseshoe, then we may have to conduct testing on the shelf area adjacent the Pribilof no trawl zone or in the headlands of Pribilof or Zemschug Canyons. These areas are identified in Figure 2 below. In most cases, areas of the shelf between 80-200 fathom outside of the Pribilof Islands no trawl zone or at the headlands of the Bering Sea canyons would be where we would expect to find adequate concentrations of chum salmon and pollock. In years when the Bering Sea "cold pool" water temperature feature extends onto the shelf, pollock tend to school in the canyons themselves and in that case we might need to conduct testing in those canyons.

Figure 2: Common fishing areas around the Pribilof Islands



To address our objective of testing the O/U excluder design for Chinook salmon escapement, our best guess is that Winter (A Season) in February or March 2015 would occur somewhere in the areas known as the "Horseshoe" or the Slime Bank (see Figure 3 below). If these areas do not offer suitable conditions for the test, then winter testing could be conducted in the "Mushroom" area northwest of Unimak Pass or in the areas around the Pribilof Islands that are commonly used by the pollock fishery during the Winter A Season.

Figure 3: Common Winter A Season pollock fishing areas adjacent to Unimak Pass



Administration of the EFP: The administration of the EFP will follow the same procedures used for the previous salmon excluder EFPs by the same EFP researchers. The exempted fishing permit holder (EFP applicant) will be responsible for the overall responsibilities of the EFP including carrying out and overseeing all the field research and associated responsibilities of the EFP. This includes hiring qualified personnel to manage the field experiments to ensure objectives of the EFP are accomplished. The permit holder will also be responsible for working with the NMFS-certified observer provider companies to ensure the experiments utilize qualified sea samplers. The permit holder will ensure that sea samplers are provided with instruction and briefing materials to understand their sampling duties for the EFP. Likewise, the permit holder will prepare materials for and conduct periodic meetings to get feedback from pollock captains and gear manufacturers on excluder designs that will be tested during the EFP. As with the earlier EFPs, decisions on gear modifications to be tested and field testing protocols will be the shared responsibility of the PI and co-investigators.

Prior to starting any field testing, the permit holder will draft request for proposals (RFPs) and the other explanatory materials needed to solicit applications for qualified EFP vessels. Personnel in the RACE Division with experience in contracting for vessels charters will review applications for vessels to participate in the EFP testing and advise the EFP holder on vessel/crew qualifications to conduct the EFP testing.

The permit holder will be responsible for informing the Alaska Region of National Marine Fisheries Service of field testing dates and required EFP vessel information prior to each field test.

At the completion of the EFP field testing activities, the permit holder will be responsible for data analysis and preliminary and final report drafting in consultation with Dr. Craig Rose of the Alaska Fishery Science Center or other RACE scientists that RACE may assign to this project. The permit holder will present results from the different field work seasons to the pollock industry, North Pacific Fishery Management Council (Council) and its advisory panels according to the direction of the Council.

Attachment 1: See Appendix B

Attachment 2: Supplemental Section Detailing Methods and the Rationale for Proposed EFP Catch Allowances

Our first three salmon excluder EFP applications (2003, 2005, 2008) based the requested catch allowances on power analyses fashioned from catch data and expectations for how much the excluder would affect the catch rate for salmon. Statistical power relationships included a desired level of power to detect an expected proportional effect of the excluder (on salmon catches) assuming a simple binary relationship with two possible outcomes (capture or escapement). In the format of the field testing, the two possible outcomes were that salmon would 1) end up in the vessel's codend if they failed to make use the escapement opportunity provided by the excluder or 2) be accounted for in a secondary net used to collect escaping fish (called are recapture net). Additionally, without data or an *a priori* expectation for proportional effect of the excluder, the most conservative proportion, the one that would be most difficult to detect (namely 50%) was used for the power equations. This was done to help ensure sample size would be sufficient. Finally, we selected the standard 95% level of statistical confidence as the desired level of certainty for the power analyses.

EFP field testing methods were well suited to the proportional effect approach because the excluder's effect would be accounted for in terms of the fraction of salmon (or pollock) that "escaped" (were recovered in the recapture net) relative to the total number (counted in the vessel's codend plus the number in the recapture net). This would be tracked on a tow by tow basis and the data could also be pooled if differences in testing conditions were significant over the course of test fishing.

To arrive at catch allowances, early estimates of sufficient sampling started with the target sample size for salmon species of interest from the power analyses then based catch allowances on how much fishing in a pollock target mode would be needed to ensure the desired sample size for the species of interest would be caught. Salmon catch rates from observer data in years prior to each EFP application were used for this purpose although from the outset it was understood that this was not an optimal data source. This is because the plan was for the EFP was to conduct the testing inside salmon bycatch "hotspot" which would be expected to have higher salmon abundance than areas where the regular fishery occurred.

Observer data were used because data to systematically characterize salmon catch rates inside hotspot areas were not available. These areas were typically closed as soon a single vessel had a "lightning strike" catch rates of salmon. Once triggered, in most cases no additional data were available because the areas typically remained closed for the remainder of the season. Recognizing that average salmon catch rates in areas open to pollock fishing was not necessarily representative of catch rates inside the hotspots, upper quartile salmon bycatch rates in the observer data were used in the development of catch allowances for the EFP as a proxy of expected salmon catch rates in the hotspot areas.

To explain our use of proxy information for salmon bycatch rates and our "hardest to detect" expected proportional effect of the excluder in the power analysis, the EFP applications argued that our approach was sufficient because it tended to err on the side of caution in terms of ensuring target sample size was obtained. Looking back, however, it is clear that in reality our attempt to apply a rigorous methodology for estimating sample size involved a string of assumptions and proxies for missing information.

The upside, however, was that these methods did provide a starting point for field testing and this led to experience and data for assessing methods. The experience with field testing has provided much more relevant data and experience, providing more reliable estimates of the amount of fishing needed to provide meaningful results. From this we can now base the catch allocation on this real-world experience which is simpler and more workable and realistic. In describing this improved approach and how we intend to continue its use in this EFP, we examine below how well it has performed in the various field seasons since it was adopted.

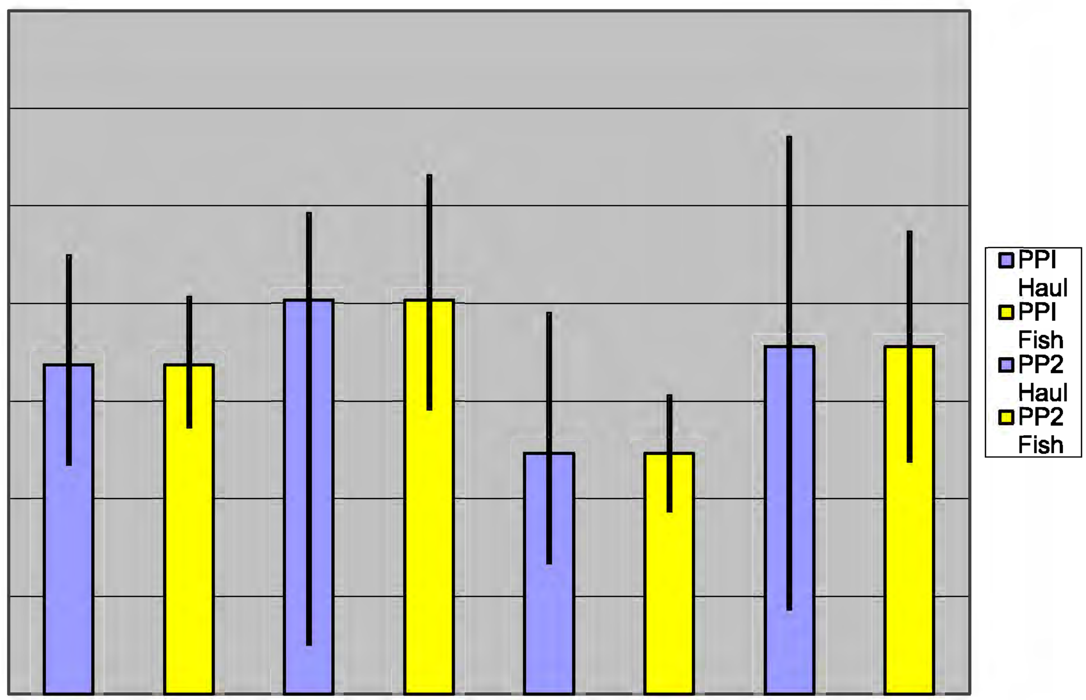
The alternative approach was first proposed for the EFP application prior to this one (EFP 11-01) where we planned to do a prescribed number of tows with pollock catch amounts that are representative of the fishery. The set of tows would follow a testing protocol that holds constant many testing parameters (e.g. excluder design/rigging as well as some of the key vessel fishing parameters such as towing speed, net). Others factors, that are part of the normal variation in pollock fishing conditions, are recognized as likely to affect excluder performance, and variation in these is explicitly sought during the testing. To do this, testing is deliberately spread out over time to ensure we get a mix of conditions such as day and night fishing and differences in pollock catch rates. Testing was spread over these conditions by working with the test vessel to limit groundfish catches per tow to a target amount. This helped ensure the groundfish available for the test is not taken in a few very large catch quantity tows, which would actually be unrepresentative of today's pollock fishery where product quality is a big concern.

The work to spread the EFP catches out over different fishing conditions effectively means that the groundfish available for an excluder test on a CP vessel will typically be harvested over a period of approximately 7-10 days. For CV vessels where multiple trips are needed to catch the groundfish, we typically get 4-5 tows per trip and two and one-half to three trips per vessel per test. This means that testing of each configuration takes about two weeks.

Adopting an approach based on a prescribed amount of fishing was initially motivated by a retrospective look at results at the conclusion of EFP 08-01. In particular, results from the final stage of testing under that EFP in winter 2010 season showed relatively large reductions in Chinook catches with relatively tight confidence intervals around mean escapement rates. These results occurred from testing on two separate test vessels and the pattern held during two separate tests conducted on each vessel over that testing period.

In looking retrospectively, we asked ourselves what factors likely contributed most to the soundness of the results. One factor we agreed on was that the effect of the excluder on Chinook catches was relatively large (20-40% range) and effects of that magnitude, we reasoned, are probably easier to detect. Another aspect of the winter 2010 results, that indicated the stability of the escapement rates, was that confidence intervals around mean escapement rates were tight whether the data were pooled or whether variation between tows was accounted for. The testing had taken place inside the salmon hotspot areas, which we thought probably helped the stability of the results from the perspective of having consistency in catch rates of salmon over the EFP testing. Testing in the hotspot areas was also important in having demonstrable results because testing with very low numbers of salmon seemed to be unlikely to achieve much statistical significance regardless of the magnitude of the effect of the excluder.

To help illustrate the reasoning for our decision to adopt a "keep going with what has worked" approach, the figure below shows the 2010 results for mean salmon escapement. The 95% confidence intervals (alpha of 0.05) are shown by the vertical lines for each colored bar in the figure indicating mean escapement rate for the different excluder design/configurations tested that winter. In examining these results in the context of the number of tows done in each test, our thinking was as follows. The "PP1 and SB1", or phase one, results in the figure were for tests that included 12-15 EFP tows per test vessel (12 for one vessel, 15 for the other). The confidence intervals around the P1 results were still rather narrow , even when variability between tows was accounted for in estimating the intervals. This can be seen in the figure where results labeled "haul" in the figure and "fish" indicates confidence intervals where all salmon are treated as if coming from a single tow.



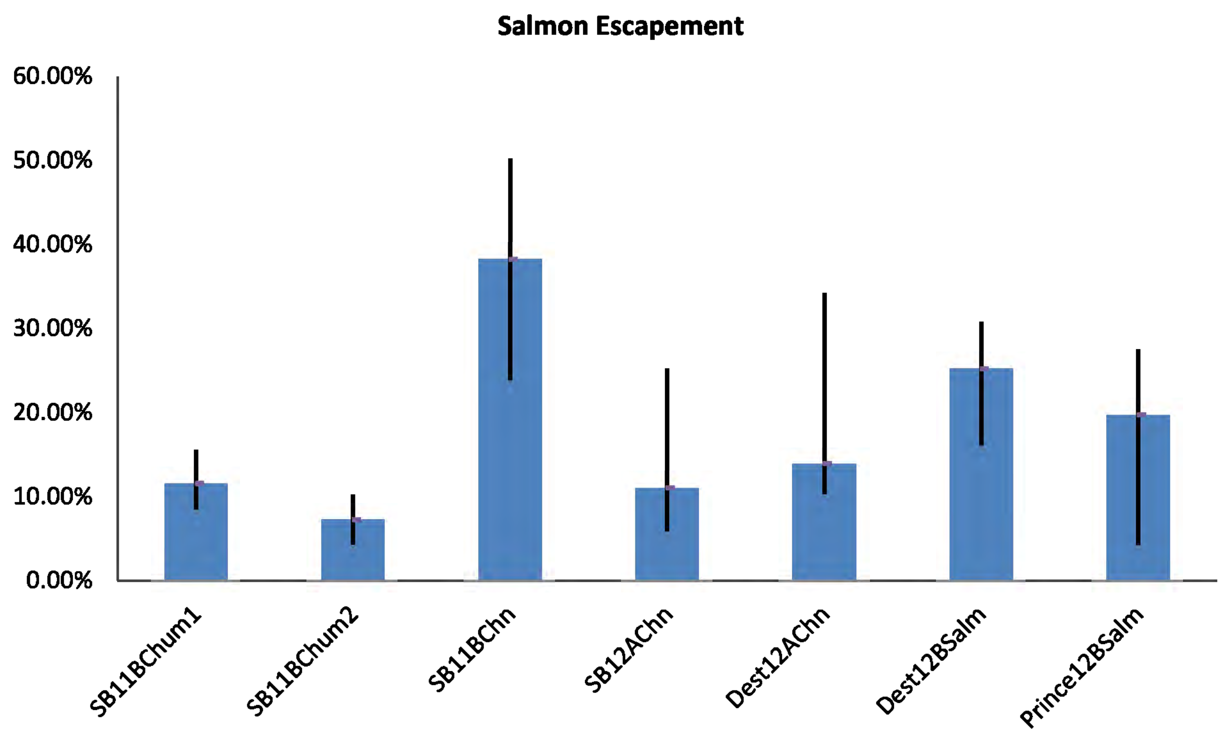
Characterizing the importance of this in terms of progress on the excluder, we noted that even the low end of the range for the results were good excluder performance in terms of escapement. Given that pollock escapement was very low and the test vessels encountered little to no problems for using the excluder, this was a sign that this excluder was a valuable tool for fishermen to manage their salmon bycatch.

On the other hand, the results from a second set of tests involving a modification to the device tested in the first test showed wider confidence intervals. This can be seen for the "PP2 and SB2" or phase two results. Due to an insufficient amount of groundfish available for the second phase of testing, only eight EFP tows were completed for these tests. The wider range of confidence around mean escapement, we surmised, was likely due to the smaller number of EFP tows.

Reviewing the thinking behind the adoption of the change from simple power analysis, based on general data, to a more targeted amount of testing used during EFP 11-01, and proposed to be used again here, begs the question of how well the approach worked for that EFP (11-01). That is the last Bering Sea salmon excluder EFP and it is where we first employed the approach of a prescribed number of tows during its three field seasons (fall 2011, winter 2012, fall 2012). The focus of that EFP was to examine whether the flapper excluder would be effective for chums (with adjustments), whether adding light would improve Chinook escapement, and of course the first test of the O/U excluder see if it improved chum salmon escapement over flapper excluders.

The specific objectives and progress made towards them are detailed in the final report included as Appendix 1 here. Of interest in this discussion of methods is whether what the 12-15 tow standard, based on the EFP 08-01 analysis, allowed us to adequately determine the effectiveness of the different excluders during EFP11-01(while also employing all the other aspects of our testing protocol described above). The figure below, pulled from EFP 11-01's final report, provides a way to evaluate this question. In the figure, mean escapement rates and associated confidence intervals are shown. In all cases, confidence intervals in this figure include haul-to-haul variability.

EFP 11-01. Percent salmon escapement with 95% CI's by EFP segment and salmon species where appropriate



Looking at the figure, a few interesting differences from expectations emerge. First is that confidence for estimates of mean escapement was greater (intervals narrower) in the 2011 tests on chum where escapement rates are low. Based on our thinking in the adoption of these tow numbers targets one would expect that small effects of the excluder would be harder to detect. As discussed in the final report for this work, however, these low escapement rates were fairly consistent between tows and catch rates for chums were also quite consistent over the course of this stage of the EFP testing. Variability between tows in both escape rates and number of salmon have added considerable uncertainty to salmon escape estimates from most of the excluder tests to date and this test was a welcome exception.

The Chinook escapement rate result for 2011 was actually an unanticipated bonus to the work where chum salmon escapement was the focus. The area selected by the test vessel for the EFP, it turned out, had relatively high chum abundance and considerable numbers of Chinook as well. Unfortunately, the testing had to be moved to a different area after eight tows, however, because the EFP (permit) had a low limit of Chinook available to it that fall. The larger intervals around what is a bigger magnitude effect (38% Chinook escapement) are therefore probably attributable to the small number of test tows.

The remaining tests focusing on the different excluder configurations generally followed our expectations in terms of 12-15 tows being sufficient for useful confidence intervals around estimated escapement rates. The test of the O/U excluder on the F/V Pacific Prince in fall 2012 is probably the least useful result in terms of confidence in the outcome and the reason for this is not obvious. The number of tows and consistency in total salmon catch per tow were nearly the same as for the two test vessels (F/V Destination being the other), the testing occurred in the same areas for the most part and the excluder configurations are fairly close in design. This leaves us unable to come up with any good explanation for why these two results are so different in terms of confidence intervals.

It is worth mentioning that pollock escapement rates have been so consistent and low that any number of tows providing a useful measure of salmon escape rate also provides very strong confirmation that pollock escape is highly unlikely to be high enough to affect excluder use.

<u>Notes on video cameras to track escapement for tests of the O/U excluder.</u>
Given that we know of no viable recapture net that would work to capture escapement on the bottom portion of the O/U excluder and based on the success we obtained using video to rigorously track escapement in our first trials of the O/U excluder in fall of 2012, we intend to continue with this approach for some or all of the work under this new EFP. Our decision to go this route is based on the following evolution in our thinking regarding the utility of cameras for excluder testing under conditions we face.

For all trials in the last two EFPs except the fall 2012 work, recapture nets were used exclusively. The fall 2012 work required us to move away from using a recapture net in favor of using video to track escapement. In the past, we have had concerns that video would not be adequate for accurately determining the proportion of escapement in as rigorous a manner as is accomplished with recapture nets. The impetus for revisiting this issue came from the recognition that escapement from the bottom portion of the O/U excluder would require "flying" an additional recapture net on the bottom of the trawl. Our efforts to evaluate how this might be done in flume tank trials in 2011 did not provide any solutions to the problems that arose when we attempted to use water kites in an "upside down" fashion in the field in the past. So faced with the challenge of how to monitor escapement on the bottom part of the excluder, we decided to revisit video given the progress that NOAA technicians at the AKFC have made on their "trawl vision" camera.

NOAA's new "tube" cameras are integrated video systems entirely enclosed in a plexiglass tube. These systems include camera, battery, recorder, and lighting which are housed in a three inch diameter tube that is approximately two feet long. The camera lens collects images right through the clear tube that houses the system which avoids exposed cable and connections entirely. The rechargeable batteries allow for approximately eight to ten hours of continuous recording (depending on whether the light is powered on and water temperature where the camera is deployed. In contrast, the cameras we have used in the past had operational limits of approximately two to three hours. In fact, this extended operation capacity exceeds average tow time by a large margin. If needed, we could place a six or eight our limit on EFP tow duration without creating a burden on EFP vessels.

In learning about the greatly improved features/capacities of NOAA's new system and hearing the reports from "Beta testing" under fishing conditions/depths more adverse than pollock fishing, this spurred our interest in deploying these cameras in lieu of a recapture net for tests with the O/U excluder. The approach we opted for was to install four separate cameras at a time, two on each escapement portal of the O/U excluder. This was done to always have a backup camera in case a camera failed as well as providing two different video angles on the top and bottom to help us see salmon escapes even if the volume of pollock escapement was high periodically. With earlier cameras, mounting for separate cameras would have been a huge burden to the ease of attaching these small, lightweight cameras resolved this problem.

In arriving at this decision to use video to track escapement, it is important to point out that we were aware that getting the video reviewed independently would add to the cost and timing for completing our data analyses. With recapture nets, data collections on the boat provide solid preliminary results and the cost of at-sea personnel pretty much covers all the data collections costs. This is not so for independent review of video footage which can take several weeks and cost thousands of dollars. But, we reasoned, our at sea personnel would be able to do significant spot checking and fast review of video to get an idea of escapement rates sufficient for knowing gross escapement results so that decisions affecting what changes to make for the next phase of testing would be based on a solid notion of escapement performance.

Based on what we learned from our first O/U excluder trials, we feel that we can once again utilize cameras to track escapement for some or all of the O/U trials described above. As a cost saving measure, we expect to track escapement from the top escapement portal of the O/U with a recapture net while relying on video for the bottom portion of the excluder. This would result in reduced video review costs as well as allowing us some instantaneous information about escapement rates during fieldwork. Using two different methods to track escapement rates does potentially introduce complications in terms of using multiple methods but we feel the current video systems are capable of comprehensively tracking escapement and both are able to fully account for escapement so combining them should not be problematic.

Addendum to Bering Sea Salmon Excluder
John Gauvin, Gauvin Associates, LLC.
May 9, 2014

Please consider this an addendum to my EFP application for our continued research on salmon excluders in the Bering Sea. As we have discussed, the timing of our EFP permit became problematic based on the dates in our original applications and the timing issues of the NMFS review and permit issuance process. Under the timing we originally proposed, the permit would have needed to be finalized and effective by August 15, 2014 in order for us to be able to conduct our excluder tests when encounter rates for chum salmon are optimal as per our research objectives. The August 15 start was critical because performance of the excluder when chum encounter rates are highest is the objective of summer/fall work under this new EFP. Given that it has become clear that the permit review and issuance cannot be completed in time for an August 15, 2014 start of the EFP, we hereby request that the permit review and issuance be pushed back in time so that the start of the EFP would be January 20, 2015.

Given the inability to issue the permit would be in hand by August 15th, 2014, this change is now preferable from our perspective for several reasons. This first is that we have to conduct, in conjunction with the AFSC RACE Division, an EFP vessel selection process. If we relied on the original timing of the EFP and then had to then modify it later on it would have potentially made all the effort put into the vessel selection process null and void. This is because availability of vessels for the EFP is quite dependent on specific timing for the fieldwork and the vessels selected for the test might not have been able to do the EFP under the push back in timing. Likewise, last minute changes to the timing on short notice would be equally problematic for our field project managers and sea samplers. For all of the above reasons, it is simply more prudent to us to start January 2015 than to risk getting the permit finalized and in place later than August 15, 2014.

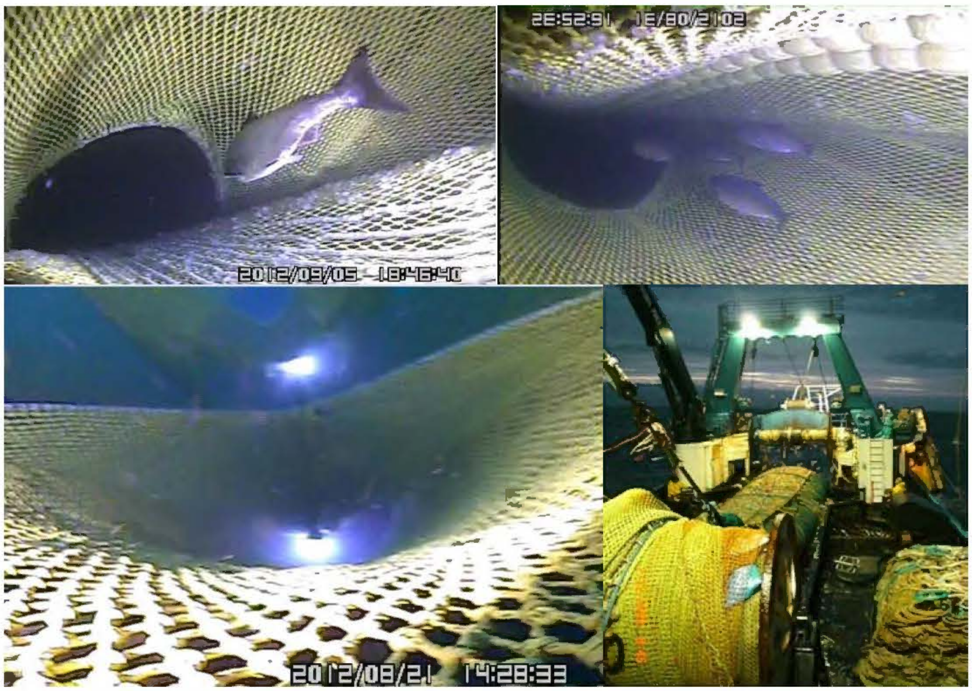
Under the new timing for the EFP, the field seasons would be as follows: January 20 through June 11, 2015, (pollock A season 2015), June 11 through November 2015 (pollock B Season 2015), and January 20 through June 11 2016 (pollock A season 2016). With this modification to the EFP timing, the catch allowances would be as listed in the table below. These changes reflect the switch from two fall seasons and one winter season to two winter seasons and one fall season.

Field work season	MT of groundfish (in pollock target)	Number of Chinook salmon	Number of non-chinook salmon
A season 2015	2,500	600	250*
B season 015	2,500	250*	2500
A season 2016	2,500	600	250*

*small allowance of chum or Chinook salmon for seasons when the salmon species is not a predominant focus of the research but can still occur as bycatch

Appendix B: Salmon Excluder EFP 11-01 Final Report

June 2013



John Gauvin, North Pacific Fisheries Research Foundation, John Gruver, United Catcher Boat Association, Katy McGauley, Alaska Groundfish Databank, and Craig Rose, Alaska Fishery Science Center

Executive Summary

Salmon excluder designs have evolved considerably since experimental trials in the Bering Sea pollock fishery started in the fall of 2003. Design changes have been influenced by a suite of exempted fishing permit (EFP) tests and by feedback from fishermen using the various designs over the years since the EFPs started. This report details the latest performance testing under EFP 11-01 approved in 2010 with the objective of improving Chinook salmon escapement rates and finding a more effective excluder for chum salmon.

Specific objectives for EFP 11-01 were to: 1) Test in fall of 2011 whether the winter 2010 version of the flapper excluder would be more effective for chum salmon escapement than previous excluders which have generally been ineffective for chum escapement; 2) Test in winter 2012 whether the addition of artificial light to the area around the escapement portal of the flapper excluder would improve Chinook escapement rates; 3) Explore in fall 2012 whether modifications to the current design, including escapement portals at both the bottom and top of the net, would improve chum and/or Chinook escapement rates.

With regard to the first objective, the result was from the fall of 2011 was an 11% chum escapement rate with the flapper-style excluder device that worked well for Chinook escapement in 2010 without any modification. A second phase of testing with a small modification to that device flapper intended to facilitate chum escapement out the top of the net resulted in a 7% escapement rate. Both versions of the device had a very low rate of pollock escapement. Overall these results indicate some improvement in chum escapement over earlier trials but still considerably lower rates than what had been achieved with Chinook salmon. A big take home from this was that increasingly it appears that chum escapement out the top of the net with flapper-style excluders is not going to be workable.

One unanticipated result from the fall 2011 fieldwork was that the testing location for the Phase One testing afforded a unique opportunity to evaluate the winter 2010 flapper excluder for chum and Chinook escapement simultaneously. The Chinook escapement rate for the Phase One test was 38% with the 95% confidence intervals ranging from 24% to 50% at the same time that the relatively low (11%) chum escapement rate occurred.

For the evaluation of whether the addition of artificial light increased Chinook escapement in winter of 2012, the overall finding was that escapement rates were not improved with the added light and were in fact actually lower (nominally anyway). Another finding was that using light to augment escapement is trickier than anticipated. Light may well serve as attractant and, depending on how it is rigged, could attract salmon to unintended areas where escapement is not possible. This could actually reduce escapement compared to not using artificial light. In this regard, it would be worthwhile to do additional work with lights to help discern how to better prevent the light from bleeding into areas where it may not be helpful and could be detrimental to escapement.

Another important follow-up from the winter 2012 trials would be to do more testing to look at the question of whether tows with smaller amounts of Chinook per tow have inherently higher escapement rates than tows with relatively high numbers of salmon. The possibility that Chinook escapement rates are simply lower when high numbers of salmon are caught is worthy of evaluation as a standalone factor in understanding how to make excluders effective.

Finally, the results from the fall 2012 stage of testing with a completely new approach to chum salmon bycatch reduction were quite encouraging. This new chum-friendly design, referred to as the "over and under" or O/U excluder, allows salmon escapement out the top and bottom of the net. Initial results were approximately 20% chum salmon escapement with very low pollock escapement. Interestingly, the escapement opportunity on the bottom of the net accounted for only approximately a small fraction of the

overall number of salmon escapes on the two test vessels in our EFP. It is therefore possible that for some reason the combination of the upper and lower components of the device changes water flow (or some other factor) that had previously limited chum escapement. It must be kept in mind, however, that testing conditions for the O/U excluder were not very representative of typical Bering Sea pollock fishing due to the September timing where pollock catch rates in the Bering Sea have tended to be rather low in recent years.

A very encouraging aspect of this new device is that this O/U excluder achieved the intended shape with minimal need for adjustments on two different vessels during our limited testing. This holds the prospect of more consistency in excluder shaping which could be important for eventually having an excluder that can be installed in a wider set of classes of pollock vessels (low vs. high horsepower) with less need for fine tuning.

Additional testing of the O/U device will be needed to answer remaining questions about the pollock and salmon escapement rates. As part of that work, hopefully a workable version of a recapture net can be installed on the bottom of the net so that the next set of tests can identify species of salmon for escapement more definitively. Finally, there is potential for this new excluder design to be at least as effective for Chinook salmon as the current flapper excluder given what we know about the swimming ability of Chinooks. A dedicated test during the winter months is needed to allow this to be evaluated. A new EFP would be needed for future work on the O/U excluder to be done using the same systematic testing methods used in this EFP.

Introduction

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Because the objectives of EFP 11-01 varied over the three seasons, this report will describe each stage of fieldwork and results separately. First, a summary of findings from our previous salmon excluder EFPs in the Bering Sea pollock fishery is provided to give the reader some perspective on the evolution of the excluder designs.

Summary of excluder development prior to EFP 11-01

Initial work on the salmon excluder started in the fall of 2003 with the period from 2003-2006 focusing primarily on tunnel and funnel design excluder devices. These devices had different specific fundamentals but each was based on fast-tapered square-mesh panels to rapidly change the diameter of the net's intermediate section. This was intended to create an area with slower water flow above or around the square mesh section where salmon could get out of the flow of water/fish and escape out the top and sides. While the various designs at times produced promising Chinook escapement rates, square mesh panel excluders proved to be impractical for many Bering Sea pollock vessels due to their tendency to create bulges in the trawl and cousequent net damage. Damage occurred from pollock becoming pinned at the entrance to the excluder. This problem tended to occur when pollock catch rates were high, a fishing opportunity most pollock fishermen were unlikely to forgo just to avoid damaging their excluder.

Experience with tunnel and funnel excluders led to a different focus in 2009 and 2010 -a shift to what are now called "flapper style" excluders. The directional change was, at first anyway, motivated in large part by the desire to avoid restricting the flow of fish through the net to the highest degree possible in order to eliminate the bulging and associated problems.

The starting point for the flapper design excluders was to use excluder panels that simply blocked access to a top escapement portal at normal towing speeds but allowed access for escapement when the vessel reduced its speed (Figure 6). This approach required periodic slowing of vessel speed for a sufficient duration to allow the panel to descend and salmon (and other escaping fish) to move forward and out of the top of the net (Figure 7). Typical reduction in vessel speed was from 3.5 or 4 knots to about 2 knots and duration was approximately 5 minutes at each slowdown. Slowdowns were conducted approximately every two hours for fishing conditions requiring longer tows.

Initial tests of this first flapper excluder design, however, resulted in relatively low escapement rates for Chinook. Additionally, many fishermen reported that the slowdowns themselves were not necessarily problematic in terms of impacts on fishing efficiency but the merits of an excluder requiring slowdowns were eventually questioned. The issue was that to conduct the slowdowns, fishermen had to retrieve the net slowly while the vessel speed was reduced thereby elevating the net in the water column. This could actually increase the time the net was located where salmon catches would likely be higher. Assuming this was the case, even if some of the salmon were able to escape, the net effect might be to effectively negate some or all the benefits of the device and possibly result in a net increase in salmon bycatch.

Figure 6. Initial Flapper excluder design (generation one).

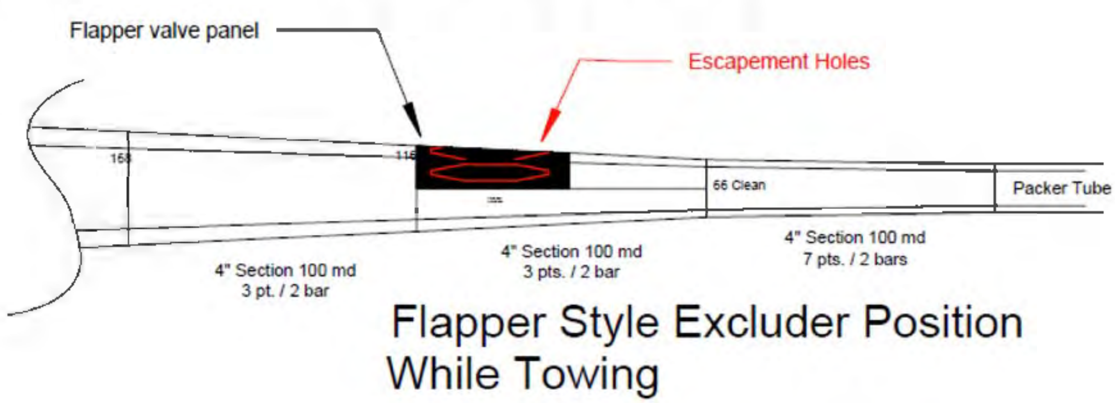
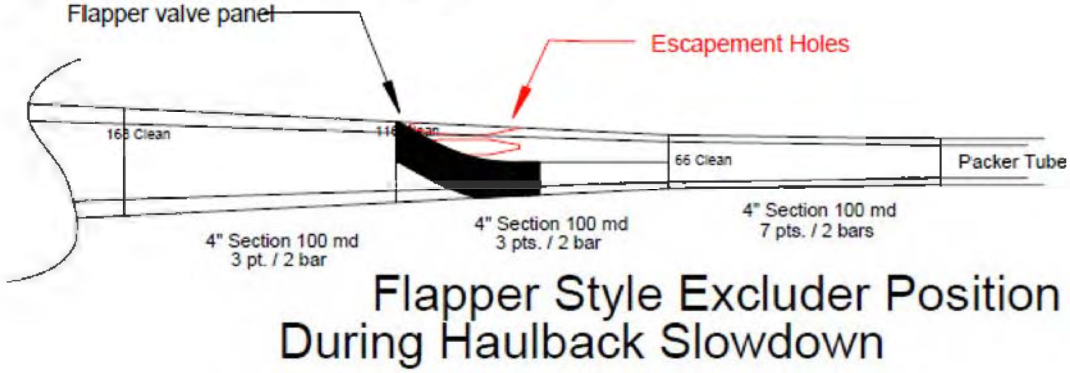


Figure 7. Initial flapper design at slowdown.



To address the problems identified with the first generation flapper, modifications were made to the design to continue to take advantage of the flapper's ability to accommodate high catch rates of pollock without net bulging while allowing for salmon escapement during normal towing operations. This was achieved by modifying the weight distribution on the flapper panel wherein instead of applying it evenly across the aft section of the panel it was concentrated in the forward section. The intent of this was to allow that section to sink down more effectively so that it would remain down to approximately half of the vertical distance of the intermediate during normal towing speeds. The rest of the flapper panel would trail back from the weighted section. This weighting scheme, in conjunction with the addition of an expanded hood at the top of the intermediate, provided salmon an adequate escapement pathway during normal towing operations with no required slowdowns.

This modified flapper configuration would still allow for large pulses of pollock to move through the excluder section, avoiding any bulge problems. If a large burst of pollock catch past through the excluder rapidly, the flapper panel would push up (flush with the top panel of the net) to restore the full diameter of the trawl's intermediate where the excluder was installed. Schematics of the second generation flapper excluder are shown in Figure 8 and Figure 9.

Figure 8. Side view of generation two flapper design.

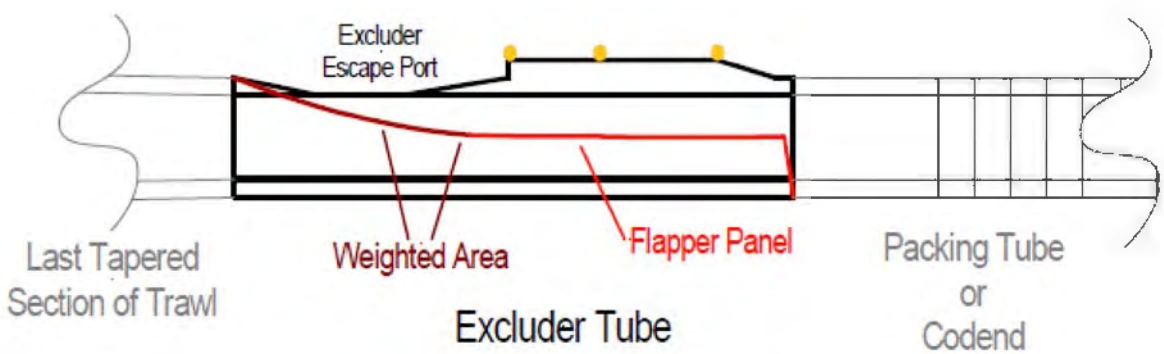


Figure 9. Functional schematic of generation two flapper style salmon excluder

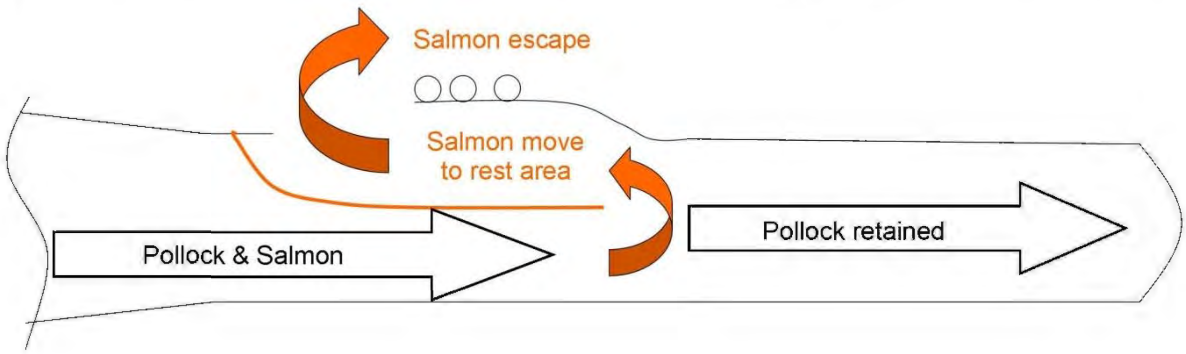


Table 1 displays salmon escapement rates for Chinook (winter tests) and chum (fall trials) for each stage of EFP 08-02. Chinook rates with the first generation flapper ranged from 8-16% (winter 2009 results in two phases of testing for one EFP vessel (P1 and P2) and a single test on the other) and jumped to 25-34% during the winter 2010 trials using the second generation flapper that allowed escapement during normal towing speeds (winter 2010 results for two EFP vessels). The 95% confidence intervals around mean escapement rates in winter 2010 were relatively narrow for these trials as well with pollock escapement well under one-percent by weight. Additionally, there were no bulge issues with the second generation flapper design.

In contrast, chum salmon escapement rates were low with the first generation design of the flapper (fall 2009 results in two testing phases) just as they have been throughout all stages of excluder development since 2003. Opinions for the poor chum escapement rates varied but there was considerable speculation that chums have less ability to swim forward against the flow and/or are less likely to utilize an escapement portal located at the top of the net (some fisherman believe than they tend to swim downward rather than up). EFP 08-02 did not allow for a test of the second generation flapper excluder for chum salmon escapement so one objective for EFP 11-01 to focus on chum escapement with the improved flapper design.

Table 18. Salmon escapement results EFP 08-02 (P1=phase I, P2=phase 2).

Test /date	Vessel	Codend salmon #	Recap salmon #	Salmon escape %
Winter 2009 P1	Pac Prince	726	91	11.1%
Winter 2009 P2	Pac Prince	1079	209	16.2%
Winter 2009	Starbound	720	70	8.9%
Fall 2009 P1 (chum)	Starbound	196	5	2.5%
Fall 2009 P2 (chum)	Starbound	643	34	5.0%
Winter 2010	Pac Prince	122	62	33.7%
Winter 2010	Starbound	150	49	24.6%

<u>**EFP 11-02 Fall 2011: Evaluate the current flapper excluder design for chum salmon**</u>
The flapper excluder rigging for the first phase of testing on chums in the fall of 2011 replicated as closely as possible the rigging of the excluder tested in the winter of 2010. The flapper panel was

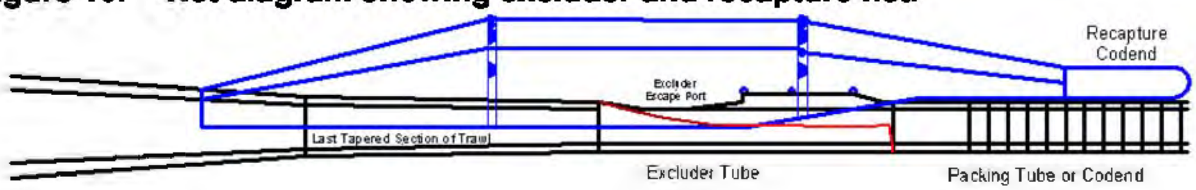
comprised of 3" knotless polyester webbing in the aft section and 4" knotted polyethylene netting and its forward section. The length of the panel was essentially equal to what it would have been with 100 meshes of 4" netting. The 100 meshes of 3" netting were sewn one-for-one to the 4" front section meaning the mesh counts across the flapper panel were the same for both the 3" and the 4" netting. That part of the panel was installed in the typical diamond orientation.

Weighting on the flapper panel totaled 160 lbs in the form of leadline strips oriented fore and aft attached to the forward section of the flapper panel (Figure 8). The leadline was cut into 10 lengths of the 8 lb. per fathom center-core leadline (approx. 8' long). This type of leadline is typically manufactured with 2 braided covers over a lead core. To reduce drag, the outer cover was removed before installing it on the flapper panel.

To create the hood, six 8-inch hard plastic trawl floats were added to the webbing just aft of the escapement hole as shown Figure 8. These floats were arranged in two rows of three. The purpose of the hood was to create additional room for salmon to be able to swim forward above the flapper panel even when a large pulse of fish was pushing the flapper panel up towards the top of the net.

As in previous trials, a recapture net was used to measure escapement (number/quantity retained in the recapture net compared to total number which is number/quantity in the recapture net and codend combined). A diagram of the recapture net is shown in Figure 5. The recapture net achieves its elevation above the trawl intermediate from lift provided by water kites and some supplemental trawl floats attached in two locations ahead of and directly aft of the escapement portal.

Figure 10. Net diagram showing excluder and recapture net.



Testing in the fall of 2011 occurred on the *Starbound*, a 240 foot factory trawler selected to participate in the EFP by an application review panel comprised of RACE Division personnel from the Alaska Fisheries Science Center. The *Starbound* had also been one of the two EFP vessels in the winter 2010 EFP so this provided an opportunity to reduce some of the variability that might otherwise result from inherent differences in the use of different test vessels. Under our EFP vessel selection process, vessels are not necessarily selected with preference to previous EFP experience but in this case the selection of one of the 2010 EFP vessels eliminated this "vessel effect", allowing for an opportunity to better compare Chinook escapement rates across trials.

The catcher vessel *Destination* was initially slated to participate in these trials as well. Because the fall 2011 Chinook limit was very constraining (125 Chinook for two vessels) compared to previous EFP's (Table 19, Table 20), the permit holder opted to cancel the *Destination's* trial prior to its expected start date. This occurred because once *Starbound* started its test fishing, it was realized that Chinook salmon catch was occurring at unexpectedly high levels for the fall season when chum salmon is normally the only salmon taken incidentally in pollock fishing. Because the EFP had such a small allowance for Chinook in the fall season, it was decided that *Destination's* test fishing would be cancelled to avoid all the costs of gearing up for testing with the possibility of the fieldwork having to stop prematurely (*Starbound* had already caught 53 Chinook of the 125 limit after only 2 days of fishing).

Table 19. EFP 11-01 initial salmon and groundfish limits by season

Season	Groundfish limit (mt)	Chinook limit (no.)	Non-Chinook limit (no.)
Fall 2011	2,500	125	2,500
Winter 2012	2,500	600	125
Fall 2012	2,500	125	2,500
Total	**7,500**	**850**	**5,125**

Table 20. EFP 08-02 salmon and groundfish limits by season

Season	Groundfish limit (mt)	Chinook limit (no.)	Non-Chinook limit (no.)
Fall 2008	2,500	2,500	5,000 no seasonal limit
Winter 2009	2,500	2,500	
Fall 2009	2,500	2,500	
Winter 2010	2,500	2,500	
Total	**7,500**	**7,500**	**5,000**

The fall 2011 testing on *Starbound* occurred September 14-27, 2011 in two phases. The first phase was comprised of 14 tows (930 mt groundfish catch) where the focus was to evaluate escapement of chum salmon (and Chinook as it turned out) as well as pollock with the same version of the flapper excluder used in the winter of 2010. The second phase (14 tows, 1,027 mt groundfish) included a small modification to the excluder panel: the removal of 20 meshes from the back section of the flapper panel. This was done to evaluate whether chum salmon escapement increased by reducing the degree to which the back edge of the excluder panel extended aft of the escapement hole.

Extension of the flapper aft of the back edge of the escapement hole is referred to as "overlap" in salmon excluder parlance. The term refers to the distance salmon would have to swim forward to access the escapement hole. The obvious tradeoff here is that at some level too little overlap would presumably result in large amounts of pollock escapement as well. From underwater video collected during past experiments, we know that pollock can swim forward in short bursts. From this we have assumed that reductions in overlap could result in increased pollock escapement, but this assumption had never actually been tested. Phase 2 testing was intended to help us learn how reducing overlap would affect both chum and pollock escapement.

The specifics of the changes to reduce overlap were as follows. During Phase One of the winter 2010 trial, the overlap was approximately 15 feet. The plan was to examine how well the Phase One test reduced chum bycatch and the related pollock escapement and then cut back the aft edge of the flapper panel accordingly. Since chum and pollock escapement were minimal during Phase I, we opted to make a moderate reduction in overlap (approximately 4.75 feet) with the removal of 20 meshes from the back edge of the flapper. A measured approach was adopted to avoid large amounts of pollock escapement which is particularly problematic for a recapture net test as well as industry buy-in for excluder use.

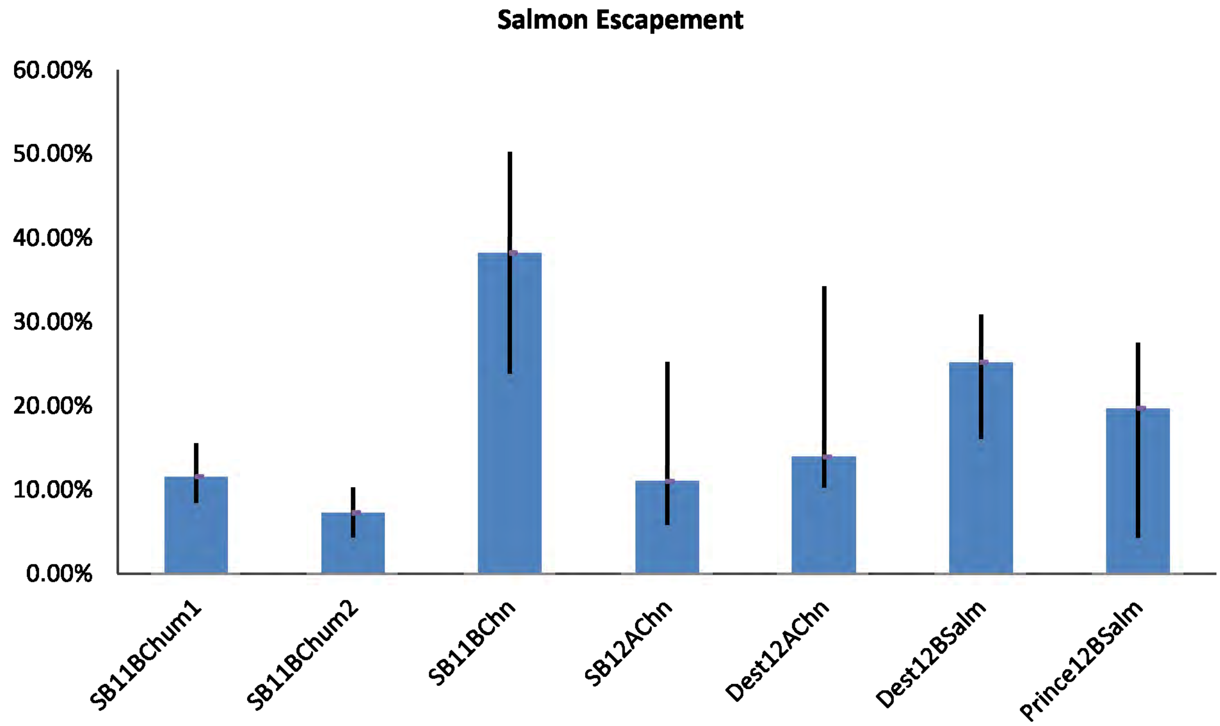
<u>Fall 2011 Phase I results</u>

Chum salmon escapement during Phase I was 11% (48 out of a total of 431 chums over 14 hauls) with a 95% confidence interval (calculated using MS Excel's resampling package with one-thousand resamples) ranging from 8.7% to 15.3% (Figure 11). This indicated some improvement over earlier trials but still a considerably lower rate than what had been achieved with Chinook salmon. Additionally, because escapement rates and numbers of chum per tow were reasonably stable over the EFP tows, the confidence around the mean result was tight and shows a range of results better than in previous tests with other excluder designs that focused on chum escapement.

Table 21. Fall 2011 EFP data by haul (F/T Starbound, Sept 14-27 2011).3 test tows not included (1.33 mt, one Chinook)

Haul No.	Total Catch (mt)	Catch Rate (mt/hour)	Avg. btm depth (fa)	Total Chinook (no.)	Total Chum (no.)	Chinook Escape Rate	Chum Escape Rate	Pollock Escape Rate
1	68.4	12.1	57	6	6	66.67%	16.67%	0.06%
2	99.0	16.5	52	18	125	38.89%	12.00%	0.41%
3	99.8	26.0	50	11	123	18.18%	9.76%	0.25%
4	44.8	7.5	51	17	76	47.06%	7.89%	0.20%
5	27.5	14.4	49	1	18	0.00%	5.56%	0.21%
6	69.8	26.2	45	2	2	0.00%	0.00%	0.28%
7	87.8	14.2	44	0	0			0.13%
8	32.5	6.2	50	0	0			0.47%
9	30.8	5.6	52	0	2			0.15%
10	84.4	16.1	56	0	0			0.20%
11	17.4	4.0	54	0	0			2.00%
12	92.8	14.5	50	0	2		50.00%	0.21%
13	95.1	11.4	51	0	65		18.46%	1.00%
14	80.1	8.1	56	0	12		0.00%	0.14%
Total Phase 1	**930.4**	**12.1**	**51**	**55**	**431**	**38.2%**	**11.14%**	**0.34%**
15	46.6	7.4	52	0	0			0.66%
16	9.0	6.0	70	0	100		12.00%	0.35%
17	52.3	11.0	70	0	182		9.34%	0.20%
18	93.2	22.4	70	0	205		0.98%	0.30%
19	101.1	13.5	71	0	26		7.69%	0.28%
20	86.1	16.7	70	0	53		1.89%	0.37%
21	94.0	13.4	71	0	851		7.05%	0.23%
22	100.1	11.2	71	2	101	0.00%	3.96%	0.34%
23	59.2	9.1	71	0	187		11.76%	0.26%
24	98.2	12.3	59	0	4		0.00%	0.23%
25	84.4	8.5	52	1	0	100.00%		0.10%
26	53.1	8.3	53	0	2		50.00%	0.52%
27	40.3	7.6	57	0	20		15.00%	0.54%
28	109.7	11.3	52	0	3		33.33%	0.36%
Total Phase II	**1,027.3**	**11.3**	**64**	**3**	**1,734**	**33.3%**	**7.21%**	**0.31%**
Season Totals	**1,957.7**	**11.6**	**57**	**58.0**	**2,165.0**	**37.3%**	**7.99%**	**0.32%**

Figure 11. EFP 11-01. Percent salmon escapement with 95% CI's by EFP segment and salmon species where appropriate



The pollock escapement rate in Phase One was also quite low (0.34%). This rate is comparable to that obtained in winter of 2010 testing with the same excluder device and test vessel. The 95% confidence interval was 0.2% to 0.6%. This was also quite similar to the confidence range seen in 2010 result when testing focused on Chinook escapement.

One unanticipated aspect of the fall 2011 fieldwork was that the location for the Phase One testing (east of the Pribilof Islands) afforded a unique opportunity to evaluate the winter 2010 version of the flapper excluder for both chum and Chinook escapement simultaneously because both species were being caught. Unfortunately, our EFP was issued only a small allowance for Chinook catch for the fall of 2011 (Table 19) so even at the low catch rates per tow (relative to chum salmon), the field personnel had to keep close attention to how many Chinooks were taken along with the chums to avoid attaining the limit of 125 Chinook which would have stopped the project before both phases could be completed.

While Chinook catches in the Phase One testing of the EFP (55 salmon) were not large relative to what is has normally been encountered in our EFP testing in winter, the small but steady numbers of Chinook per tow offered an opportunity to see if the fall 2011 Chinook escapement rates would be similar to winter 2010 trial. Accordingly, the Chinook escapement rate for the Phase One test was 38% (21 out of a total of 55) with the 95% confidence intervals ranging from 24% to 50%.

While not necessarily a confirmation of the escape rate seen in winter 2010, achieving escapement rates in this range was seen as a very positive sign. Additionally, the opportunity to test the excluder for Chinook and chum simultaneously lent further credence to the idea that chum behavior in a net as it relates to use of an excluder may differ from that of Chinook.

Fall 2011 Phase 2 results

Following Phase 1, the back edge of the flapper panel was shortened by 20 meshes thereby reducing the overlap by about 30%. To avoid risking curtailment of the EFP due to early attainment of the limit placed on Chinook salmon, the EFP vessel relocated to west of the Pribilof Islands and later all the way up into the Bering Sea canyons. The pollock industry's bycatch avoidance program's information on bycatch rates indicated these areas would have very few Chinook salmon but considerably higher chum salmon catch rates. Pollock catch rates per hour were expected to be higher in the new locations as well.

The expectations for catch rates in the new locations proved to be accurate for chum and Chinook salmon with chum catch rates per ton of pollock approximately four times higher and nearly no Chinook in the new locations. Pollock catch rates were, on average, slightly lower (12 mt/hr compared to 13 mt/hr in phase I).

The expectation that chum escapement would increase with the shortened flapper was not realized. Chum escapement averaged only 7% (95% CI 4-10%Figure 11) in Phase Two (125 out of 1,734 chum escaped). While lower than the chum escapement rate in Phase One, the values within the 95% confidence intervals overlap considerably indicating that there is unlikely to be any statistically significant difference between the rates. The Phase Two results may actually be a better indicator of chum escapement with the flapper excluder (whether full length or shortened) because the second phase of testing encountered a much greater number of chum salmon over the 14 tows.

Pollock escapement in the second phase was also 0.3% with the 95% confidence intervals from 0.2 to 0.4. The reduction in overlap did not appear to have any significant effect on pollock escapement.

Given these results for chum and pollock, the question arises as to what we can say about how reducing the amount of overlap affects escapement. One possibility is that reducing overlap would increase escapement (of chums and/or pollock) but we did not reduce it enough or enough to detect a difference. Alternatively, it may be that reducing overlap will not achieve the desired effect in terms of increasing chum escapement because something other than the distance that chums would have to swim forward against the flow is not what is affecting chum escapement (e.g. chums are resistant to swimming out of an escapement hole on the top of the net). Unfortunately, we have no way of answering even the first question because our groundfish catch allowance for the Fall 2011 trial did not allow for further testing.

Regarding the industry's concerns over how pollock escapement might increase with reduction in overlap, it appears these were not realized. One has to keep in mind, however, that this result is probably only really applicable to a higher horsepower boat like the Starbound where water flow through the net is optimized given the higher towing speed. Our video observations during this second phase of testing did appear to show that pollock that attempted to escape were able to make it closer to the escapement hole than they appeared to with the longer flapper panel. It is therefore possible that a boat with lower towing force and lower net spread/water flow might incur more pollock loss than was seen in this test. At the same time, the limited video obtained did not indicate any positive effect on chum salmon escapement (in fact a lower rate, nominally, was achieved) relative to the Phase One test so there may not be any upside in terms of chum salmon anyway to reducing overlap and at the same time there may be a downside for some vessels with reduced overlap.

Winter 2012 test of the current flapper device with light added to increase Chinook escapement

The objective in the winter of 2012 was to evaluate whether the addition of artificial light would augment Chinook escapement above the levels seen with the same excluder in the winter of 2010. The genesis of this objective was input from captains conducting the winter 2010 testing. At the conclusion of the test, the question was posed as to what changes to the excluder they would like to examine to increase escapement. In this context, the captains came up with the idea of adding artificial light to the area above the escapement hole.

It is important to recognize that since the outset of this project (since 2003) the use of artificial light has been rigorously avoided in underwater camera placements during EFP testing under the assumption that it could influence fish behavior. We therefore had very little in the way of knowledge in terms of changes to fish behavior that would occur when lights were added. When asked why they were interested in adding light, the EFP captains explained that they expected salmon would be attracted to the light and they felt escapement rates were higher in the daytime tows of the 2010 EFP. While daytime escapement was higher for that specific test, the reverse had been the case in past EFP testing with other excluder designs. Additionally, winter fishing in the Bering Sea occurs mostly under conditions of fairly limited natural light, particularly at typical winter fishing depths (> 100 meters). For this reason, the effect of light was not straightforward in their observation that daytime escapement rates were higher.

In considering the issue of how ambient or artificial light may affect fish behavior in the excluder trials in winter 2011, the larger issue of unknowns became evident with respect to how pollock or salmon use light as they navigate through the net or how it affects their response to the excluder. Our strict use of low light cameras without adding artificial light in our fieldwork had frankly left us "in the dark" regarding such simple considerations such as how bright artificial lights appear at typical fishing depths.

Lacking prior video observations to determine how light affects fish behavior, we decided to look to the lowest common denominator in terms of what we did know from our previous tests. The most basic information we had was that salmon escapement occurs in both daytime and nighttime conditions and that rates were variable with no clear correlations. From our use of cameras with sensors designed to work with low levels of light we also knew that tows done during non-daylight hours did not have enough ambient light for any useful video, nor did daytime tows deeper than 120 meters. From this we deduced that salmon can find their way to the excluder's escapement portal with levels of light that are lower than what is required for video with low-light camera lenses.

From this we theorized that adding artificial light to the area around the excluder could increase escapement if salmon are attracted to light as the captains had assumed but had little more than intuition regarding how much light would be the right amount. The methods for placing the light in manner that would be effective were not clear as well. To look at this issue, one approach would be to aim the light above and out of the escapement portal and not back into the net where the excluder was installed. This made sense because light shining down into the net might actually entice salmon to remain in the net if they were attracted to light. Another approach would be to evaluate whether a lighted pathway might increase escapement of salmon under the assumption that they might be able to navigate their way out of the net more effectively.

Given that both of these approaches were worthy of testing, both were adopted into our testing plan as separate tests - one for each EFP vessel. Ideally, one would test both light configurations on each EFP vessel in a controlled experiment but this was not possible given the limits on groundfish and salmon. As was explained in the EFP application, our examination of whether light would increase escapement was therefore essentially a "pilot study" approach that would hopefully provide some information but was not expected to result in any definitive answers.

One final part of this included the recognition that using light with a recapture net was potentially different from how light might affect escapement without a recapture net. This is because the recapture net material reflects the light in an area outside of the escapement portal, a condition which would not exist in the regular fishery. In the event that having a surface outside the escapement portal to reflect light was needed to make the addition of light effective for increasing salmon escapement, captains and crews were asked to think how something could be done in the future without a recapture net. This would be important if attraction to light did show promise for increasing escapement and one wished to mimic the effect in the regular fishery without using a recapture net.

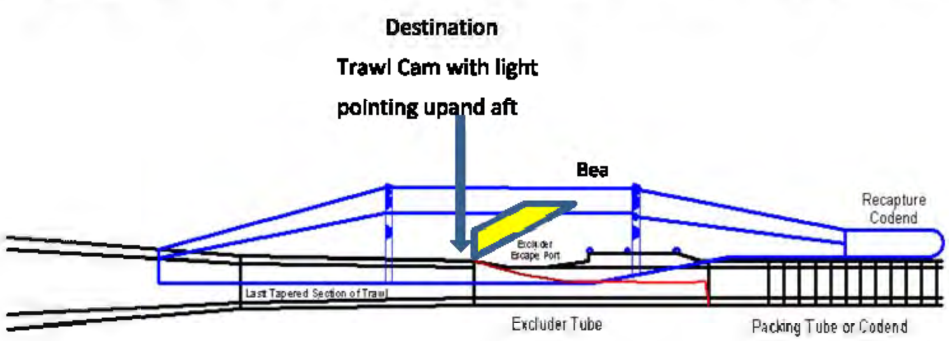
<u>Specifics of winter 2012 testing to evaluate effects of artificial light added to the flapper excluder</u>

In addition to the *Starbound*, the *Destination*, a 180 foot catcher vessel participated in the winter 2012 trials. These vessels were selected by an application review team from the Alaska Fishery Science Center and both vessels had extensive experience with EFPs. Prior to adding artificial light, both vessels started with the flapper excluder as rigged for the fall 2011 Phase One testing (prior to cutting back the flapper panel by 20 meshes to reduce overlap). Video observations in mid-water tows were done just prior to the EFP on each vessel to confirm that the flapper panels for both excluders were achieving the desired shape and to verify that each flapper panel was hanging down approximately half of the vertical height of the trawl intermediate at normal towing speeds.

The *Destination* was selected for the simpler test to evaluate whether light attracted salmon and increased escapement rates by aiming light outside the escapement hole. The lighting supplied for the test was from the vessel's 'trawl cam' system. This is an integrated camera/ recorder/LED light system with a steel frame that houses all three components. Floatation was added to the trawl cam system to achieve neutral buoyancy.

The light in the *Destination*'s trawl cam system was a wide-beam LED light achieving 900 lumens. To project the light out of the escapement hole, the underside of the trawl cam frame was attached to the top of the trawl intermediate (inside the recapture net) at the forward edge of the escapement hole. The camera system faced aft with the light aimed up and back (Figure 12). The use of the trawl cam to provide the light instead of a stand-alone light was selected to take advantage of previous experience with installation of the camera system in a manner that would provide a relatively stable base for the lighting.

Figure 12. Destination net with excluder and light configuration.



The plan for the *Starbound* was also to use their trawl cam to light the area above the escapement hole in the same manner and to use multiple smaller lights to lightthe pathway from the rear to the escapement hole. The smaller lights used were "Lindgren Pittman" pressure activated "swordfish" LED lights. These self-activating lights were attached individually to the flapper panel with cable ties and reflectors to direct the light in one direction. The lighting of the escapement pathway amounted to 15 of the swordfish lights evenly spaced along the center line of the top of the flapper with the lights projected upward. To help prevent light from shining down below the flapper panel (assuming this might attract salmon to an area underneath the flapper where access to the escapement panel was not possible), strips of plasting backing sheets were attached to each swordfish light. An additional 3 lights were placed close together at the aft end of the flapper with the light projected downward to light up the slower water area at the back edge of the flapper panel(see Figure 13 and Figure 14).

Figure 13. Schematic of light distribution pattern on flapper panel, Starbound, winter 2012.

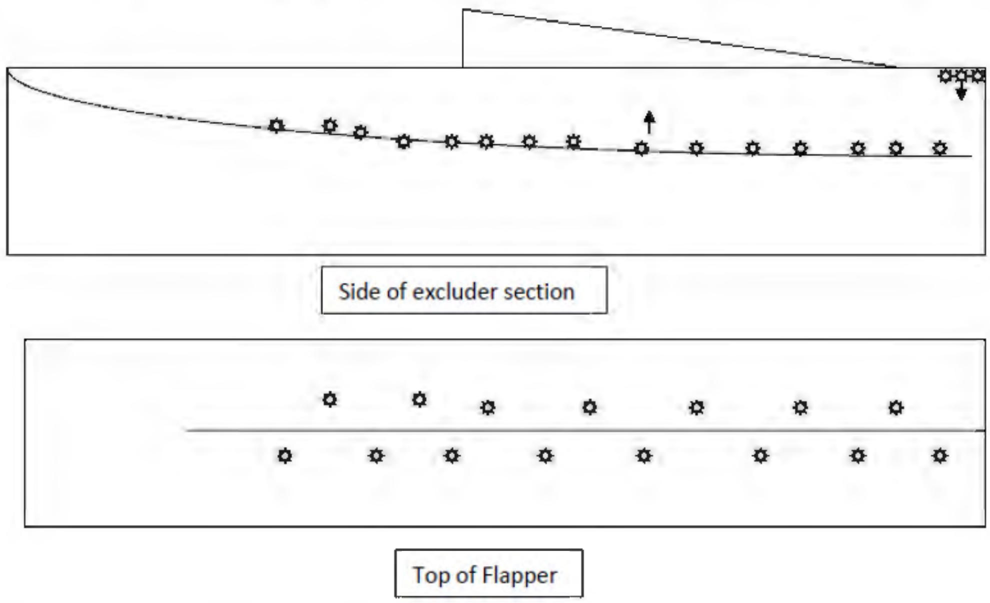


Figure 14. Lindgren-Pittman (swordfish) LED light.

Based on the manufacturer's estimate of battery capacity for the swordfish lights, the batteries would be replaced approximately half way through the excluder test on the *Starbound* to ensure that the pathway would remain lighted for each tow.

An additional camera without lights was used to observe the lighting and any fish behavior for both EFP vessels throughout the trails.

Field trials on the *Destination* were conducted from February 15-23 (18 tows, 1,280 mt groundfish). Fishing depths ranged from 115 to 290 meters with an average towing depth of approximately 200 meters.

Starbound 's testing occurred from February 11-17 (17 tows, 1,250 mt groundfish). Fishing depths ranged from 100 to 320 meters with an average towing depth of 205 meters.

Winter 2012 Results:
The *Destination*'s testing occurred in locations north of Unimak Pass where the pollock fishery had encountered relatively high Chinook bycatch rates prior to being closed under the rolling hotspot bycatch avoidance program. Following a set of video tows to evaluate how the lighted recapture net appeared at fishing depths, the EFP tows were started. The testing comprised 18 EFP tows during three dedicated EFP trips. Overall, Chinook catch rates were highly variable with the majority of the overall Chinook catch occurring in a single tow (Haul 3, 170 of a total of 223) and much lower Chinook catch rates for the remaining hauls (0-10 salmon per tow). Across all the EFP tows, the Chinook escapement rate for *Destination* was approximately 14% (31 out of a total of 223) with an associated 95% confidence interval from 10.5% to 34% (Figure 11 and Table 5).

This overall result for Chinook escapement was clearly driven by the low escapement rate on the tow with the high number of Chinook. That tow had an escapement rate of only 11% (19 out of 170).

Pollock escapement averaged 0.41% with the 95% confidence interval ranging from 0.13 to 0.78.

Table 22. EFP 11-01 Destination Winter 2012 data.

Haul No.	Total Catch (mt)	Catch Rate (mt/hour)	Avg. btm depth (fa)	Total Chinook (no.)	Chinook Escape Rate	Pollock Escape Rate
1	80.94	11.04	57	1	0.00%	0.26%
2	88.65	118.21	74	0		0.06%
3	90.26	16.92	145	170	11.18%	0.11%
4	65.40	31.39	77	3	0.00%	0.20%
5	8.58	3.81	82	1	0.00%	0.08%
Trip 1	**333.83**	**18.81**	**87**	**175**	**10.86%**	**0.15%**
6	134.66	101.00	81	2	0.00%	1.86%
7	65.05	65.05	88	2	50.00%	0.45%
8	73.97	59.18	92	2	0.00%	0.24%
9	2.42	14.54	100	0		0.00%
10	81.60	27.20	104	3	33.33%	0.07%
11	88.50	27.23	108	3	66.67%	0.17%
12	63.40	76.08	112	1	100.00%	0.21%
Trip 2	**509.60**	**47.04**	**98**	**13**	**38.46%**	**0.65%**
13	89.79	41.44	125	9	0.00%	0.06%
14	77.67	56.15	130	6	50.00%	0.07%
15	21.82	52.37	79	3	0.00%	0.40%
16	70.43	76.84	110	5	20.00%	0.02%
17	76.11	23.42	112	6	50.00%	0.07%
18	101.28	86.81	138	6	0.00%	1.18%
Trip 3	**437.11**	**47.00**	**116**	**35**	**20.00%**	**0.33%**
Total	**1280.53**	**33.80**	**101**	**223**	**13.90%**	**0.41%**

The low Chinook escapement rates begged the question of whether the addition of artificial light had any positive effect or possibly even had negatively affected escapement. The fact that a very high proportion of the salmon catch occurred in a single tow complicates our assessment of these results. Given that the average escapement rate for the other tows (25% without tow 3) was in the range of expectation for the device (without the addition of light), it's possible that the poor escapement rate for haul 3 simply overpowered the results for Destination. Ideally, another test under the same conditions without light was needed to observe any differences in the rates. Unfortunately, there was not sufficient groundfish or salmon available to allow for further testing. Additionally, although the flapper excluder design and rigging matched what was used in the earlier tests, the test vessel in this case was a different catcher vessel from the one used in the winter 2010 so the possibility of a "vessel effect" on the results cannot be dismissed.

The *Starbound* 's EFP testing was done in the same general area as Destination's although some tows were done in the deeper, more off-shelf waters further west. Following a set of video tows to verify that the lights were working and desired lighting scheme was achieved, the *Starbound* made 17 EFP tows. While the majority of Chinook catches occurred over more than a single tow, 4 of the 17 tows accounted for the vast majority of the Chinook catch (accounting for 206 of the 236 total catch). Chinook numbers for the other tows ranged from nine tows with zero Chinook and four with 1-15 Chinook. The *Starbound*'s overall Chinook escapement rate was 11% (26 of 236) with the 95% confidence intervals ranging from 6% to 25%. See Table 23.

Similar to what was seen on the *Destination*, the *Starbound* had low escapement rates on the tows where most of the Chinook salmon were caught (5% to 14% escapement per tow). For tows with lower Chinook numbers, escapement rates on a per haul basis were at times around 40%.

Pollock escapement rate for the *Starbound* averaged 0.2% with a 95% confidence interval of 0.1 to 0.4%.

Table 23. EFP 11-01 Starbound winter 2012 data.

Haul No.	Total Catch (mt)	Catch Rate (mt/hour)	Avg. btm depth (fa)	Total Chinook (no.)	Chinook Escape Rate	Pollock Escape Rate
1	102.98	41.19	170	5	0.00%	0.02%
2	82.71	17.00	177	15	46.67%	0.13%
3	6.35	3.81	158	9	44.44%	2.88%
4	78.56	47.13	144	42	7.14%	0.01%
5	78.79	51.39	145	33	9.09%	0.03%
6	71.71	78.23	112	28	14.29%	0.66%
7	105.43	64.55	110	103	4.85%	0.01%
8	73.91	46.68	69	0		0.24%
9	81.99	98.39	67	1	0.00%	0.01%
10	70.65	40.37	65	0		0.00%
11	58.15	24.92	67	0		0.05%
12	107.09	107.09	51	0		0.01%
13	64.08	15.38	55	0		0.15%
14	63.57	152.57	55	0		0.35%
15	75.10	29.07	57	0		0.35%
16	91.85	61.23	57	0		0.46%
17	39.11	234.65	59	0		0.18%
Total	**1252.02**	**40.13**	**95**	**236**	**11.02%**	**0.17%**

As with *Destination*'s overall results, the explanation for why Chinook escapement was lower with artificial light is not clear. But some possible explanations can be offered. For the *Starbound*, most of the Chinook catch occurred in a roughly one-fourth of the tows and rates per tow for these were quite low. On balance, however the escapement rate for a single tow did not effectively determine the overall outcome as was the case for *Destination and Starbound's* result was driven by a considerably larger fraction of the hauls (roughly one-fourth). In past experiments, we have been more comfortable accepting results that arose from that kind of proportion of EFP hauls recognizing that salmon bycatch rates per tow are always going to be variable even if testing occurs inside salmon hotspot areas. From this perspective it is harder to attribute the low escapement result for *Starbound* as driven by the chance outcome that a very small number of tows with low escapement rates caught a large fraction of the overall Chinook catch in the EFP. Additionally, potential for a "vessel effect" was not a consideration for interpreting the difference because *Starbound* was one of the EFP vessels in the 2010 test (escapement rate of 24% then and 38% in the fall 2011 testing).

In reviewing the possible explanations for the low escapement results with the addition of light, one possibility is that lower escapement rates tended to occur on tows with lots of salmon and higher rates on tows with lower numbers. Looking back to the winter 2010 results, the relatively high escapement rates achieved at that time occurred with consistent but fairly low numbers of Chinook caught per tow. There were in fact no other tests with this excluder device that encountered a high proportion of the salmon in the test in one or a small proportion of the test tows. For this reason, the possibility cannot be dismissed that this excluder design, with or without light, does not perform as well for hauls when large numbers of Chinook are caught. The reason why the excluder would not work as well for tows with high numbers of salmon is not clear at this time. In reviewing our results over the course of EFP testing with flapper devices, some fishermen have stated that the device would not be as likely to perform well on tows with high pollock catch rates. This is plausible because high catch rates of pollock could serve to block access to the escapement hole. As for why large catches of salmon would reduce performance, no persuasive explanation has emerged.

Another possibility is that the addition of artificial light did negatively affect escapement rates and for some reason this may have had a bigger effect on tows with high numbers of salmon for some unknown reason. To examine this possibility, we looked to the video footage from the test with this in mind. While we were able to get video observations on both vessels, we obtained far more on the *Starbound* due to some equipment problems on the *Destination* so most of information below comes from *Starbound's* footage. On that vessel, the lighting was far brighter than what we anticipated even if our expectations for light brightness at fishing depths were based on little more than a guess. Part of the discovery that lights were brighter than we had envisioned is probably explained by the use of low-light lenses on the cameras to look at our lighting arrangements.

But another part of the story is the lack of any ambient light at the fishing depths even during daytime tows. Noting the degree of brightness in the test tows, we agreed that this was not especially problematic for the trawl cam lighting designed to project out of the escapement hole - as long as the light did not illuminate inside the intermediate there would not be much downside to extra brightness. If the light penetrated back into the intermediate, however, we were concerned it could potentially negatively affect escapement. This is because if salmon are attracted to light, they would encounter the light before reaching end of the flapper panel where access to the escapement hole became available.

From the camera placements done in the pre-EFP tows, however, it became clear that no matter what we did to prevent it, the trawl cam light did bleed down through trawl intermediate. Hence the excluder pathway and trawl intermediate itself were illuminated on F/V Destination which was not what we had intended. This was surprising given that the housing of the trawl cam system was expected to shade below the unit. Attempts were made to aim the lights at angle that would reduce the chance of illuminating the area below the lights but nothing was actually fully successful in this regard. This can be seen in the picture below where the brightness of the light that was supposed to project out of the escapement hole on the *Destination* can be seen in Figure 15 and Figure 16. The first photo (looking aft) shows the hood at the top of the excluder at the entrance to the recapture net which is illuminated to a far larger extent than we intended. The second shows a group of Chinook salmon swimming in the recapture net -the light hitting them is aimed more than a meter away from where these fish are located.

Figure 15. Destination trawl cam projecting light into the recapture net and down into the intermediate (looking aft).

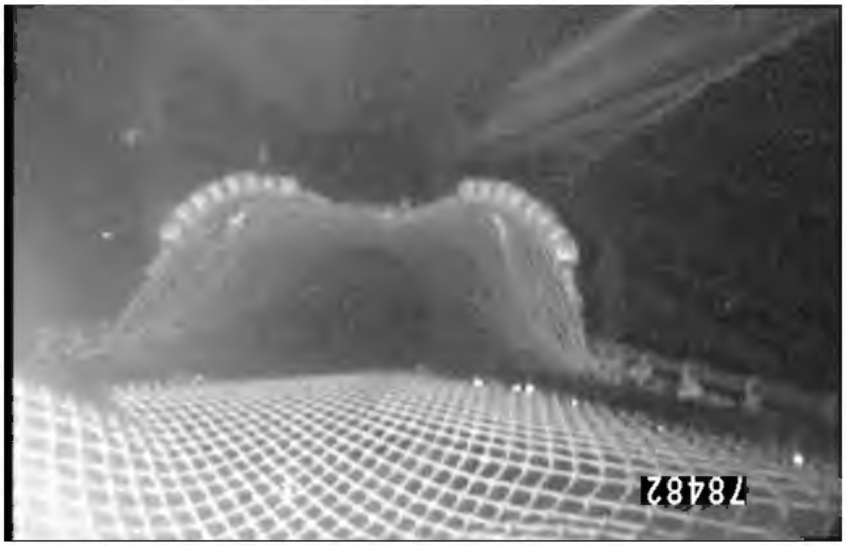
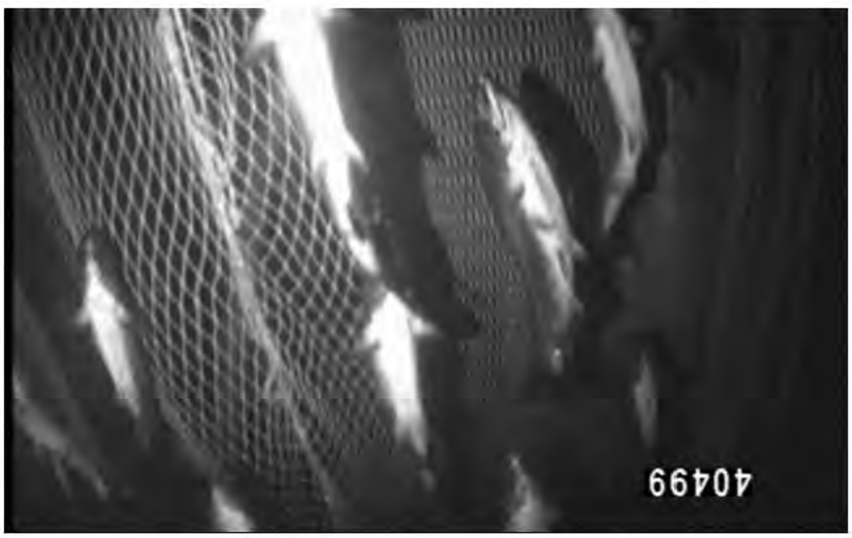


Figure 16. Destination trawl cam looking further upward at the top of the recapture net.



Video footage from the *Starbound* also revealed very bright lighting. In selecting the swordfish lights, it was noted that these barely produce enough light for a human with good vision to read large text in close proximity to the lights in a dark room. For this reason, we were surprised to see how bright they appear in our video footage. Also, as with *Destination*, the trawl cam light illuminating the area above the escapement hole on the *Starbound* was very bright. During the pre-test tows on the *Starbound* we decided that the overall amount of light generated by the trawl cam light in combination with the swordfish lights was simply too great. To address this, the lower portion of the trawl cam light elements were covered to reduce the brightness and to help prevent the light from bleeding down into the trawl intermediate.

Figure 17 below shows that despite this reduction in light focused above the escapement hole on *Starbound*, the brightness and degree that the area was illuminated remained quite large. Figure 18 shows how bright the swordfish lights appear at fishing depth. As was mentioned above, plastic backings on the swordfish lights were installed to help shield the light from penetrating under the flapper. This was deemed to be accomplished in the pre-trials based on views from under the panel even if our overall feeling was that the swordfish lights seemed far brighter than we had hoped they would be.

Figure 17. Views of hood and recapture net on Starbound. Swordfish lights (on top of the flapper) can be seen in the distance (top photo).

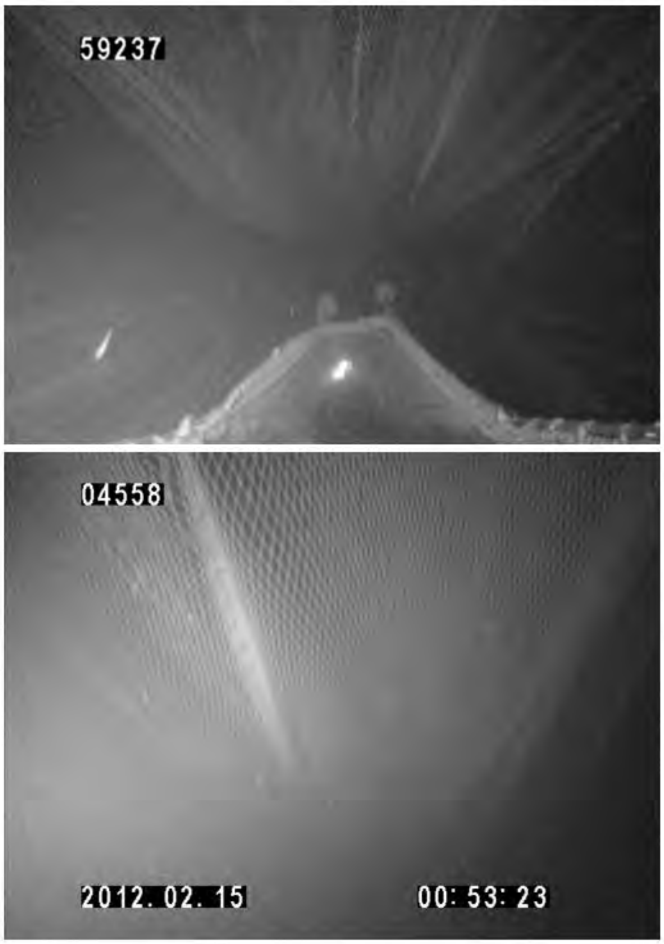


Figure 18. Swordfish lights on the Starbound flapper (looking forward from the codend at depth).

One final insight from the *Starbound* video was that some salmon moving up the lighted flapper panel escapement pathway were observed to stop and remain in the area where the first set of lights was installed. This can be seen in Figure where a salmon is "parked" in the area where the lighted pathway begins. The video shows that this fish remained in this area for quite a while and returned to it after moving forward and then finally moving up the panel and outside of the visible range of the camera.

The attraction of salmon to the swordfish lights was observed on only a limited number of occasions because most of our video deployments were located above the escapement hole. Given our low number of camera deployments in this area, we cannot fully assess how often it occurred. In any case, available observations suggest that attraction to light may be important for salmon moving through the excluder section. In this context, a lighted pathway at least as was done in our experiments on the *Starbound* could actually confound escapement rather than augment it.

Figure 19. Starbound lighted flapper with salmon hesitating at light.

In summary, the video observations do not provide any definitive explanation for the low escapement rates but do provide some possible factors to consider. One is that using light as an attractant is more difficult than we anticipated. In this regard, it would be worthwhile to do additional work with lights to help discern how to better prevent the light from bleeding into areas where it may not be helpful and could be detrimental to escapement. This assumes that light is an attractant and affects escapement which is somewhat suggested in the video observations but this issue is far from resolved. This is where being able to test with and without light would have been important but we did not have sufficient groundfish to do a follow-up test without the lights. Another important follow-up would have been to do more testing to look at whether tows with smaller amounts of Chinook per tow had higher escapement rates than tows with lots of salmon. The possibility that Chinook escapement rates are simply lower when high numbers of salmon are caught cannot be dismissed. Given the limits on our testing, this was also not possible.

Fall 2012: New innovative design (called the "Over and Under" excluder) for chum escapement

Given the disappointing results from the fall of 2011 tests for chum bycatch reduction (with and without the reduction in overlap), the focus for fall 2012 turned to a new approach that would address the shortcomings related to flapper excluders and chum salmon escapement. This new direction involved designing an excluder that allows for escapement from the bottom of the net without letting large quantities of pollock out of the net. While there was no definitive evidence that the relatively low chum escapement with past excluders was due to an inherent behavioral difference with chum salmon, after repeated tests with generally low success despite adjustments to make escapement out the top easier, the possibility that the low chum escapement was due to behavioral differences certainly pervaded the thinking of everyone involved with the question of where to turn next to address chum bycatch reduction with excluders.

The task of coming up with an excluder design to accomplish escapement out the bottom was shouldered by John Gruver as part of his gear design role for this project since 2003. Mr. Gruver's approach was to make use of the concept of the flapper but to utilize the concept in both the top and bottom of the net.

Located in the last tapered section of the trawl, the new design incorporates two escape routes that are mirror images of each other. Rather than adding flapper panels to the device, the new designs utilizes the existing top and bottom net panels to serve as "flappers"; the upper panel is weighted towards the center of the net while the lower panel is floated towards the center. Escapement portals are cut into the aft end of the top and bottom panels as well. Large hoods, similar to the flapper excluder hood, are attached over the upper and lower escapement portals. The upper hood is floated upwards to open it and the lower is weighted to "sink it open" as well.

Rigged as such, fish coming back through the net would pass between the panels and once behind them could swim forward in the slower water and access the escapement portals on either the top or bottom (hopefully only salmon would be able to do this). The hoods will take a "scoop" shape that, in combination with water flow, weight, and floatation, would provide relatively large cup-shaped escapement pathways out of the trawl.

As a starting point for this concept, Mr. Gruver made a half scale model of the Over and Under conceptual design. With this model, work began in a flume tank facility in Memorial University in St. Johns, Newfoundland in the fall of 2011. At that time, approximately three days were spent investigating ways to take the "Over/Under" concept from a rough design to a well-shaped device. This involved refining taper cuts in the hood netting and escape portals, adding and removing netting in strategic areas, and adjustments to floatation and weighting so the excluder design was ready to be built at full scale and tested in the field trials.

Locating this over and under (O/U) excluder design in the tapered section was intended to help prevent unacceptable Pollock loss. The reasoning here was that in earlier work we noted that the much stronger water flow in the aft tapered sections generally resulted in low pollock escapement. Figure 15 illustrates the O/U excluder concept developed in the fall of 2011. Figure 21 is a photograph from the flume tank work of a half scale model of the device using floatation and weight (chain instead of leaded line). See also Figure 22, underwater view of full scale O/U excluder taken during the field trials in B Season 2012.

With the two escapement pathways located one on top of the other, salmon moving to the back of the net would be shunted into the center thus providing them a section of slower water flow where they could react according to their instinctive preference for escapement (top or bottom). If a large burst of pollock was moving down the net, the upper and lower panels would push up (for the top panel) and down (for the bottom panel) to accommodate the large amount of fish. This would avoid the problem of pinning fish and creating a bulge in the net as was seen in earlier efforts on excluders.

All attendees at the flume tank who worked on this design thought that it would be important to build a full scale version of this excluder and evaluate it in the field. Expectations for what would happen when it was "put in the fish", however, ran the gamut from massive pollock escapement out the bottom to low pollock escapement due to the location of this excluder in the tapered section. Many on both sides of the pollock loss expectation debate thought, however, that salmon escapement (both chum and Chinook) would be improved. A few captains even said they were ready to put this new device in their net in preference to the flapper excluder as soon as some field testing was done to verify that the two panels could achieve the desired shape on a consistent basis.

Figure 20. Conceptual schematic of the Over and Under excluder

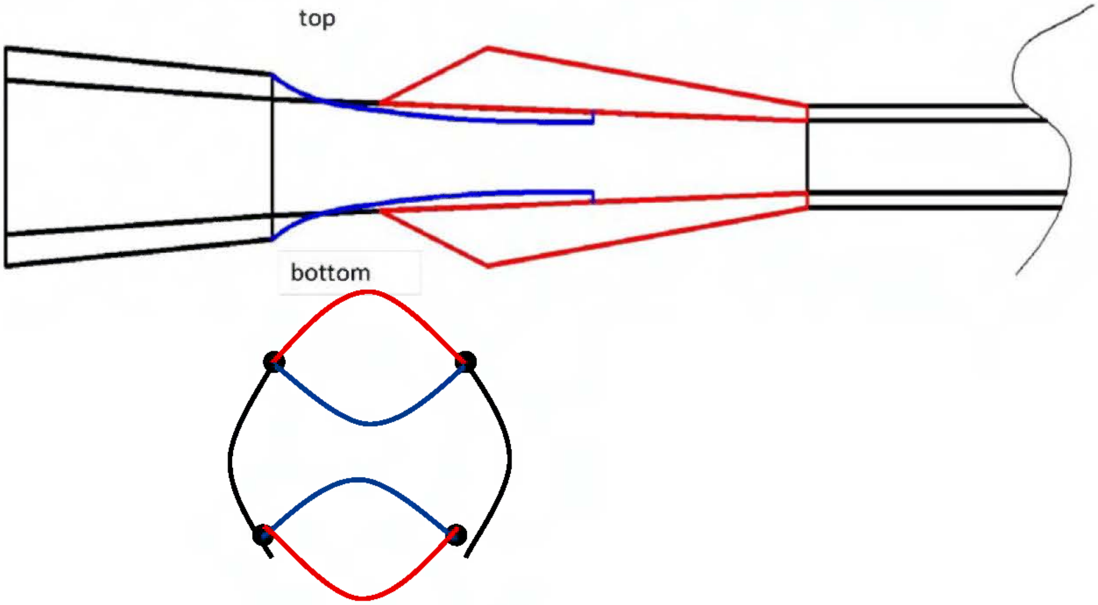


Figure 21. Flume tank model of the Over and Under excluder

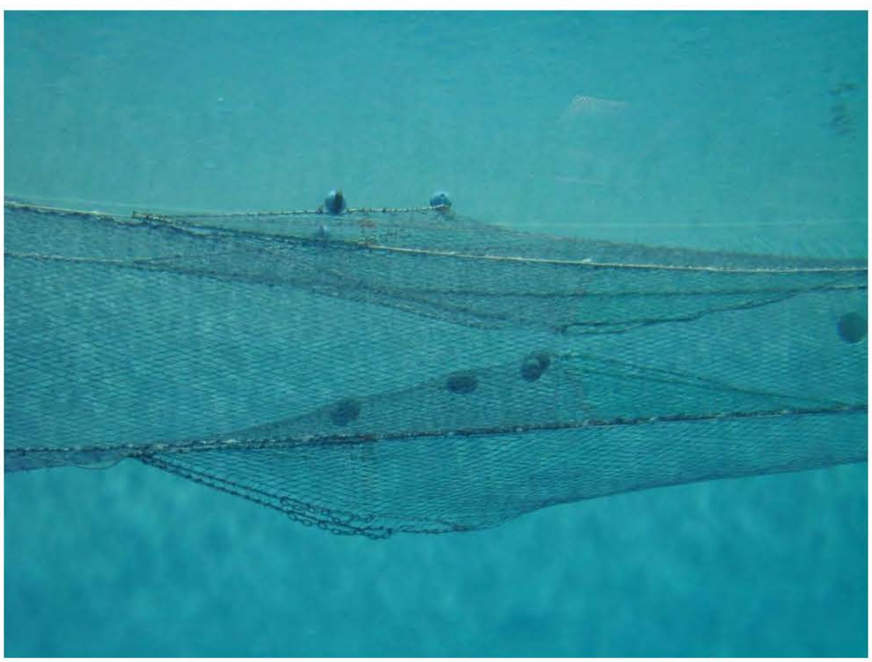
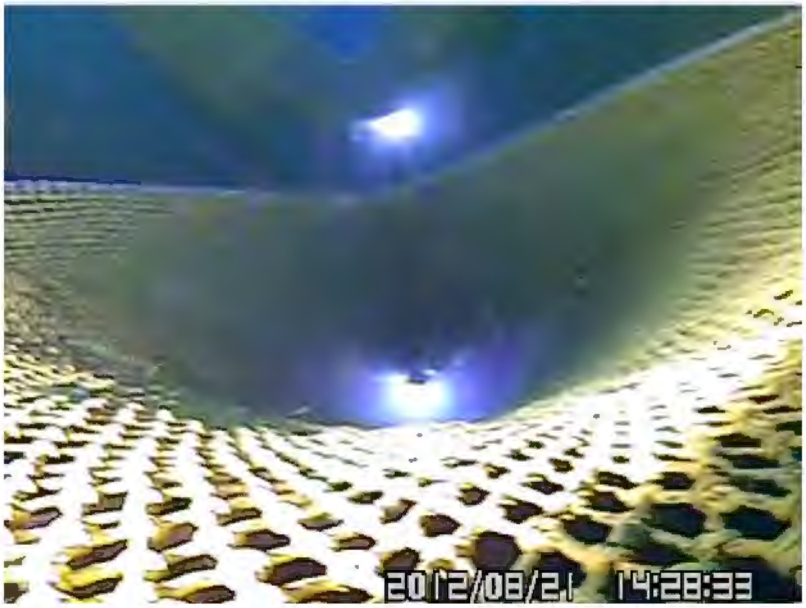


Figure 22. Top and bottom excluders (over/under)



One can see from the conceptual drawing in Figure 15 that the upper webbing panel (in blue) functions much like the flapper panel attached to the top section of flapper excluder that was the focus of winter 2012 EFP testing. Fish passing through the net (left to right in the figure) should only be able to access the escapement hole at the top of the intermediate (in black) by swimming forward above the top panel. Leaded line attached to the upper panel holds it down so that it remains approximately half way down the intermediate at normal towing speed. The upper hood (in red) provides additional room for escaping fish where they can swim up and forward out of the flow of target fish that is moving backward through the net. Floatation on the sides of the front portion of the hood is used to create the shape of the hood as shown.

The bottom portion (also in blue) of the O/U excluder is based on the same concept as the flapper excluder on the top but uses floatation to bring the panel up from the bottom of the net. Fish attempting to access the lower escapement hole need to swim forward and down against the flow. The lower "scooped" escapement portal (in red) provides considerable room for fish escaping out the bottom. Like the hood at the top of the excluder, the scoop on the bottom is also designed to help retain the shape of the net and should serve as a counter force to whatever upward lift the hood on top creates while the net is being towed. The scoop achieves this shape by weight placed on its leading edge. The shape of scoop feature of the excluder is perhaps more easily visualized in the lower panel of Figure 15 which is a cross sectional view.

Given that the O/U excluder is a very new concept that has only been evaluated in one limited field trial (described below), we have elected not to provide detailed construction information from his report. Interested public can contact John Gruver directly for this (jgruver@ucba.org). It should be recognized from the outset, however, that this is a brand new excluder design with very little testing done to date. Based on our previous experience with the dissemination of information on new excluder designs, we want to be clear that our current knowledge on the performance of the O/U excluder does not allow us to know with any certainty how the device will work in conditions other than those encountered during the EFP trials in the Fall of 2012 (i.e. low catch rate fall pollock fishing).

The main difference in terms of construction of the flume tank model compared to the excluder tested in the fall of 2012, besides the scale difference, is that the trawl floats seen in the flume tank model were replaced by float rope. This was done to help reduce drag while towing and to decrease the chance that the hood or bottom panel of the O/U would become snagged during deployment of the net. Likewise to further avoid potential for materials to become snagged during setting and retrieval, lead line was used on the excluder that was field trialed in lieu of the chain seen in the flume tank model.

Testing plan for the fall 2012 Field trials of the Over and Under salmon excluder

Two catcher vessels (F/V Destination and F/V Pacific Prince) were selected to participate in the testing via the same NMFS-led application review process used in all prior salmon excluder EFPs. Given that the first trials of a new excluder have often required long hours of adjustment before formal testing can commence, only catcher vessels were sought in the request for proposals (RFP). We adopted this approach based on our previous experience where it has proven difficult for catcher processors to do "beta testing" of new excluder designs in early stages of development due to more down time and the higher associated costs.

The original plan during the flume tank work in fall 2011 was to reserve some time for the development of a model recapture net that would be used to figure out how to fly a recapture net on the bottom of the net to capture escaping salmon and pollock from the lower escapement portal. A workable recapture net on the bottom is not a trivial matter. Due to the number of days it took to get the O/U excluder to a workable concept, however, we ran out of time before we could start work on a model for a recapture net on the bottom.

Additionally, as we considered the possibility of large amounts of pollock escapement with the O/U excluder, the practicality of using a recapture net for the initial testing of this device was an issue. This is because there was no way of knowing how great pollock escapement would be. As was discussed above, recapture nets are a statistically powerful way to determine the effectiveness of an excluder device. However they can be impractical if the escapement fraction is large enough to create handling problems on deck or in the extreme if escapement is large enough to deform the shape of the net where the recaptured fish are collected. From our experience, pollock escapement of over 5 mt per tow is the practical upper limit and escapement of around 10 mt is likely to tear the recapture net and result in loss of the fish in the recap nets as well as the necessity for major repairs.

For all of the above reasons, we had to rethink our testing plan for the O/U in the fall of 2012. The only workable approach would be to rely on video to get some idea of escapement rates for this brand new excluder device. To do this, we decided that two underwater cameras would need to be installed at each escapement portal so that the space could be adequately covered and data could be obtained reliably even if one camera in each location failed. The only camera video system that we knew to be small enough and sufficiently easy to install so that four cameras could be used on each EFP haul was a "tube camera" system under development by a video expert at the Alaska Fishery Science Center. This new system encases a small LED light, battery, camera, and recorder with 16 GB data storage card within a piece of four inch diameter clear acrylic (plexiglass) tubing. These systems are lightweight and the camera records the video through the clear tubing. Each system is approximately twenty inches long and weighs only about six pounds on land, approximately 13 lbs when mounted on a small mounting board with stainless steel 'quick clips" for rapidly attachment and detachment to the net. Given the need to have four cameras in the water at once during the EFP testing, a total of six of these systems were purchased so that cameras could be rotated to allow for charging between tows.

The specific location for each camera was a big question for the EFP testing. From our pre-trial tows, we learned that cameras facing each other tended to create a shine or halo effect that reduced the quality of the imagery for counting fish escapement or even distinguishing between salmon and pollock. Cross-sectional views also presented problems for producing images for the purposes of our EFP. In the end, a V shaped orientation with the two cameras mounted fairly close together on each flapper looking out each escapement pathway was adopted as the most viable approach. With this orientation, the cameras were arranged to look out the escapement pathway with some overlap but with full coverage of the space. This reduced effects of the light from one camera system on the other as well. With some overlap in viewing area, a time-synchronized review of images would help us to distinguish salmon from pollock or even possibly help with detection of the species of salmon with a different camera angle on a single fish proving a better opportunity.

In recognizing the limitations of video for tracking escapement rates, the objective for our first look at this new device was a rough assessment/quantification of salmon escapement based on what we could detect from the video compared to the number of salmon collected in the codend of the main net for each haul (by species). Even this might not be possible if relatively high rates of pollock escapement occurred which could keep the reviewers of the footage from being able to detect all the salmon as they passed by the cameras if this occurred during high levels of pollock escapement. Even if pollock escapement rates were relatively manageable, the pace of fish swimming past the cameras would also need to be slow enough to distinguish individual fish.

In electing to use cameras to track escapement, we also recognized that if pollock escapement was high, counting pollock escapes would be impractical. Under this scenario, we would have to fall back creating an index of the rate pollock loss for each tow or sections of the video from each tow. This would only allow us to give a relative measure of escapement (i.e., low, medium, high).

Finally, the question of how artificial light affects escapement would need to be largely ignored for these preliminary trials of the O/U excluder. In recognition of what we learned in our one season of trials adding artificial light, we did strive to position the cameras as close as possible to the escapement holes to avoid effects from the added light. Assuming salmon are attracted to the light, at least they would be close to the escapement point where they might sense the proximity of an escapement opportunity and exit the net despite their attraction to light. The only other step taken to reduce the effect of the light was to adjust the brightness of the camera light to its lowest level.

With six cameras available for the EFP and the need for four per vessel, testing on EFP vessels was done in succession rather than simultaneously. As a result, fieldwork on Pacific Prince occurred first with the pre-EFP tows starting on August 19th. This involved about 1.5 days of pre-trials to perfect the camera placements. Formal testing occurred from August 20 to September 10. Once the actual EFP testing was begun, camera positions and excluder configuration were kept as constant as possible so as to avoid introducing possible effects on performance that result from changes to the testing methods themselves.

Escapement results of the first trials with the O/U excluder under relatively poor pollock catch rate conditions

Overall, the pollock fishing conditions during the trials on Pacific Prince were not very representative of the Bering Sea pollock fishery. This was due to the fact that the EFP vessels were not available to start the EFP until after their B season regular pollock fishing. This meant the EFP commenced at a time of year that catch rates can be quite low. Specifically, the average groundfish catch rate for Pacific Prince in the EFP was 4.5 metric tons of groundfish per hour across all EFP tows with per-tow catch rate ranging from as low as 1.9 mt per hour to as high as 15 mt per hour. The number of towing hours during the EFP tests on Pacific Prince was 190 hours during which approximately 1,200 mt of groundfish were caught.

Following the conclusion of testing on the Pacific Prince, the EFP personnel moved to F/V Destination where EFP testing occurred between September 12-20th and camera placements were in the same locations as those used on Pacific Prince. Pollock fishing catch rates were even lower for Destination's test with 94 hours of towing during the EFP for320 mt of groundfish. Average catch rate was approximately 3 mt per hour with the highest hourly rate per tow at 4.5 mt and the lowest about 1.5 mt per hour. In reality, the pollock catch rates were so low during the testing on the Destination that premature curtailment of the testing with only a fraction of the expected testing completed became the only viable option. This is because the primary objective was to evaluate the excluder's performance in conditions with relatively high salmon bycatch rates and representative pollock fishing conditions. With the latter not really being the case, we decided to stop the EFP once we were able to determine that the O/U excluder was taking the desired shape and appearing to perform as it had on Pacific Prince.

Over the course of month of testing on the two vessels, four cameras were successfully deployed in the desired locations on nearly all tows. The cameras systems were designed to have sufficient electrical charge and data storage to last approximately 8-10 hours per deployment. On a few occasions, however, only one camera functioned correctly and on several tows just one of the cameras had sufficient battery life to cover the entire tow when tow times exceeded 8 hours. Uneven charging of the battery packs by the charger systems or problems with the batteries themselves was likely the cause of this latter problem. Three of the tows over the month of testing had durations of considerably greater than 10 hours due to weather conditions and other gear problems that did not allow the gear to be retrieved at the scheduled time. For these, data were collected for the portion of the tows when the cameras were functioning only and we did not attempt to extrapolate escapement rates/amounts for the proportion of the time when video data were not collected.

Prior to the start of the EFP testing, a series of pre-trial tows were made on each vessel to evaluate whether the excluders were achieving the desired shape at normal towing speeds. The pre-trial tows were also intended to verify that the planned camera locations adequately covered the pathways out of the net so that escapement could be tracked when the footage from both the lower and upper escapement portals was reviewed following the EFP. Figure 23 shows the top escapement pathway and escape portal above the weighted panel. Escapement was tracked with the two cameras in this location (one aimed to the port side, the other one to starboard). The desired shape of the escapement tunnel was achieved in this section of the excluder, as seen in the figure.

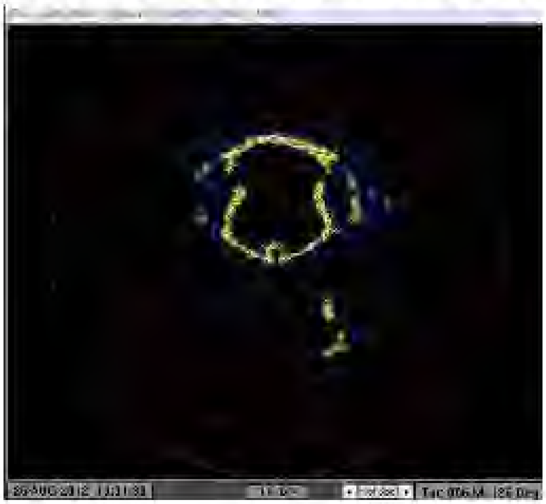
Figure 24 shows the bottom escapement portal including the scoop and the floated panel that creates the pathway on the bottom of the net. Some adjustments in the floatation on the webbing panel were needed during the pre-trial tows to get this panel to take the proper shape. Once these modifications were made, however, the bottom escapement panel achieved the desired shape without fail throughout the testing.

Finally, Figure 25 shows a cross section of the excluder panels taken with a sonar imaging device installed in the excluder section. This sonar cross-section shot confirmed that the upper and lower parts of the O/U excluder were taking the desired shape and the proportion between the upper and lower sections of the excluder was as designed. The sonar unit was installed on the side so the image shows top and bottom as left and right.

Figure 23. Upper escapement panel and upper escapement portal (port camera)

Figure 24. Lower escapement panel and scoop. Note float rope at the top of the figure.

Figure 25. Cross-section image of Over and Under excluder from recording sonar



Results from preliminary review of EFP video O/U testing on Pacific Prince

Following the EFP testing, the video from the EFP was reviewed by the project manager who supervised the fieldwork on both EFP vessels and another former salmon excluder project manager with extensive experience with video deployments on previous salmon excluder EFPs. Each reviewer reviewed portions of the 1,132 hours of video collected during the field trials on Pacific Prince alone with portions of the same video footage reviewed by the two reviewers to ensure that methods were consistent.

Note that we have arranged to have another detailed review of all of the video files under the direction of Dr. Brad Harris of Alaska Pacific University which is expected to be completed during the first half of 2013. The objective of the second review is to allow for an independent assessment of our methods and our assessment of the escapement results.

The initial video review by our project managers utilized a time synchronization of the footage approach for the two side-by side cameras that were monitoring the same escapement portal. Once synchronized, the reviewer played the two views at a relatively fast pace until there was evidence of activity (fish passing in front of the cameras monitoring the escapement portals). At those points in the footage, the video playback pace was slowed to allow the reviewer to count escaping fish, whether salmon or pollock. To evaluate pollock escapement rates reviewers noted the relative rate of pollock escapement (low, medium, high) or estimated the number of Pollock escaping, applying an average weight to the number to generate an escapement rate. Time-specific notes were kept of the tallies of salmon escapes as well as rates of pollock escapement.

After doing a pre-review of random sections of the footage, our reviewers determined that pollock escapement overall appeared to be low and that it was unlikely that our concerns over pollock obscuring salmon escapement would be realized. That pollock escapement was minimal was in fact consistent with the comments of the captain of the Pacific Prince during the EFP testing who thought that the catch rate of pollock was not affected negatively by the use of the O/U excluder. He based his determination on the amount of pollock sign entering the net as seen through the vessel's net sounder (third wire) output and the time needed to fill the codend.

After starting their review, the reviewers soon reported that they would be unable to definitively distinguish between chum and Chinook salmon for the majority of the salmon escapes. This determination was made based on the quality of the video images and the time that most salmon spent close enough to the camera where images might be suitable to make a determination as to salmon species. While not completely unexpected, this was a disappointing result because we were specifically interested in knowing if the device worked better than other approaches with chum salmon and based on our experience with earlier tests, we had to presume that Chinook escapement would possibly be higher than chum. Not being able to definitively distinguish what species was escaping complicated our assessment of the O/U device for its main intended purpose. This issue will be discussed further below.

Lacking the ability to determine species of salmon definitively from the video, based on the timing of the EFP, our expectation was that the vast majority of the salmon encountered would be chums. This was particularly true for Pacific Prince where most of the EFP occurred in August. Based on recent experience in the Bering Sea pollock fishery, Chinook bycatch can in some years start to increase in September but chums are still the predominant bycatch salmon species in the pollock fishery in September.

Based on salmon collected in the Pacific Prince's codend, chums were the predominant species with only 20 Chinook caught out of a total of 537 salmon recovered in the codend of Pacific Prince (97% chum). Likewise, there were 47 Chinook of 296 salmon recovered in the codend of Destination or 85% chum salmon. Because we have observed that Chinook can escape at different rates than chums in trials with past excluders, however, we are not able to assume that the codend salmon catch exactly reflects the proportion of chum to Chinook for escaping salmon. Nonetheless, we are comfortable with the assumption that most of the salmon escapement in our test of the O/U was comprised of chums based on the fact that the testing on Pacific Prince occurred at a time when chums would be expected to be the prevalent species of salmon in the catch.

Based on the preliminary video review, we estimate that the salmon escapement rate for Pacific Prince was approximately 20% by number (130 of a total of 667). The 95% confidence interval around this result is quite large due to the relatively high variability in escapement rates between tows (Figure 11). It is also important to recognize that this estimated escapement rate is the number of salmon confirmed to have escaped from the video relative to the total catch of salmon (number of escaped salmon divided by number of chums and Chinook recovered in codend plus escaped salmon from the video). Considering that we applied a conservative approach to our review methods (not to count a fish as escaped unless it could be definitively seen to swim out of the net), this may be a lower bound estimate of salmon escapement. In this regard, it was not uncommon to have salmon milling around at the escapement portal and some of these could not be confirmed to escape even if they were not seen to return to the field of view because of lapse in the footage or the limitations on visibility under different conditions.

To help the reader visualize a salmon escapement, Figure 26 shows a salmon escaping via the bottom escapement portal. Due to the good water clarity for this particular tow, reviewers noted that the fish escaped and also that it was likely to be a Chinook. This image from the video was taken by the camera on the starboard side of the bottom escapement pathway.

Figure 27 shows several salmon prior to their eventual exit from the lower escapement portal.

Figure 26. Salmon escaping from the lower portal of the excluder

Figure 27. Several salmon escaping from bottom excluder seen from port side camera

Based on review of the escapement sequences on Pacific Prince, escapement from the upper portion of the excluder appeared to be relatively effortless in many of the video frames. Figure 28 illustrates a typical view of a salmon moving forward and out of the net above the flapper panel with relative ease and in a matter of a few seconds.

Figure 28. Escapement out the top portion of the excluder during Pacific Prince EFP

One of the most surprising results from the video review from Pacific Prince testing was the fraction of escapement from the top escapement portal compared to the lower portal. Because we had never had much success with chum escapement with an excluder rigged to allow escapement out the top, our expectation was that if chum escapement rates were relatively high compared to results with past excluders, then it would be due to escapement out the bottom escapement hole. For Pacific Prince, roughly 80% of the escapes were out the top of the net, however, raising the issue of how having the two panels changing the water flow in the net, one above the other, might affect water flow and escapement behavior. Another possibility is that the hood on the top and the scoop on the bottom could be changing water flow as well.

Finally, it is difficult to compare results from tests with recapture nets to test with video for many reasons and it is possible that top escapement is more likely just due to the lack of a recapture net.

Another unexpected but rather welcome result was the negligible pollock escapement. As was mentioned above, some attendees at the flume tank sessions thought that pollock escapement rates might be unacceptable given the additional opportunity for escapement out the bottom. While our reviewers for this initial review did not actually count pollock, both have extensive experience examining video from salmon excluder trials in the past where recapture nets were used. This allowed them to estimate the amount of Pollock escapement. Both reviewers estimated Pollock escapement at less than 1%.

In considering this result, however, one should keep in mind that pollock catch rates were relatively low for the fishery at the time that our testing occurred (late August to early September 2012).

<u>Results for trials on F/V Destination:</u>
As was mentioned above, pollock fishing conditions were dropping off as a result of the normal dispersing of pollock that tends to occur in the Bering Sea in most years in the fall. With groundfish catch rates as low as they were on Destination, we decided to use the opportunity to observe whether the device seemed to take the same shape when installed in Destination's net and unless pollock catch rates improved over the time we had our EFP crew on the vessel, do just enough fishing to do a gross assessment of whether fish appeared to react to the excluder in the same way as what we observed on Pacific Prince.

With this scaled-down plan for work on the Destination, a series of pre-trial tows were done by which we were able to determine that the O/U's shape was quite similar to what was seen on Pacific Prince. One difference was that the mesh openings and relative rigidity of the netting in the excluder was lower on Destination compared to Pacific Prince. Another difference was that the net appeared to move up and down in rapid short pulses on the Destination which was something that was not seen on the P. Prince.

This latter could be caused by a number of factors including warp setting ratios and sea state during testing but this factor is not expected to have affected the performance of the excluder. The issue of tension on the netting could be a factor if the difference was great given that tension and mesh opening ratios are indicators of water flow which we know has an effect on escapement rates at some level.

Again because our testing conditions were not very representative of normal pollock fishing conditions, especially on the Destination, we have to be cautious about the applicability and representativeness of our observations on escapement rates. Review of the video from Destination showed escapement rates to be very similar to what was seen on Pacific Prince. For pollock, escapement rates were, according to the reviewers "very, very low", actually in the hundreds of fish over the course of catching roughly 320 mt of groundfish (at very low catch per hour rates). Keeping in mind the caveat about the low pollock catch rates during this testing and the small overall amount of testing hours on Destination, it is still notable how low pollock escapement rates were for this test.

Overall, salmon escapement rates were quite similar to those of P. Prince. The overall salmon escapement rate was 24% with 94 salmon escapes out of a total of 390 salmon. The breakout of salmon recoveries in the Destination's codend was 47 Chinook and 296 chums, indicating a larger fraction of Chinook in the catch relative to chums as would be expected for testing that stretched into the second half of September. The confidence intervals around the 24% escapement rates are in fact considerably tighter than those from the test on Pacific Prince (Figure 6) due to the lower variability in tow to tow escapement rates for Destination.

The significance of lower variability needs to be understood in the context of the lower groundfish catch rates for the Destination since groundfish catch rates are likely to be one of the most important determinants of salmon escapement. Salmon have to navigate their way to the escape portal against the pollock moving towards the codend. With low catch of groundfish, this task might have been easier for the salmon and therefore the conditions for this testing may not reflect performance with higher catch rates of groundfish.

Just as occurred with Pacific Prince, escapement from the bottom portal of the excluder comprised only a small fraction of overall escapement (in this case only about 8% of the confirmed escapes). As regards results from Pacific Prince, an explanation for this counter-intuitive result is not available but one has to keep in mind that this O/U excluder may change water flow conditions so profoundly that past observations of salmon behavior in response to an excluder may not be relevant.

Overall (preliminary) findings for the O/U excluder test

Recognizing the limited testing done on the first O/U excluder, the testing conditions not being very representative of typical Bering Sea pollock fishing, and the fact that our review of the video footage is preliminary until Alaska Pacific University's review is completed, some conclusions can still be made at this point.

First is that the O/U excluder achieved the intended shape on two different vessels during our limited test. This is important because the location of the O/U is in the tapered section of the intermediate where water flow is higher. This holds the prospect of consistency in excluder shaping which could be important for eventually having an excluder that can be installed in a wider set of classes of pollock vessels (low vs. high horsepower) with less need for fine tuning of weight and floatation between vessels within classes than the current flapper excluder. This is because water flow differences between vessels are likely to be lower in the tapered section than in the straight section where the 2010 flapper excluder was located.

Second, with the O/U installed, salmon escapement occurred at a meaningful rate with very low pollock escapement. The low pollock catch rate during testing needs to be considered. The low pollock catch rate conditions may possibly have led to higher escapement rates for salmon with little pollock to block or obscure the escapement opportunity. Further testing will be needed under more representative conditions to answer these remaining questions about the pollock and salmon escapement rates and hopefully some of this can be done with a recapture net so that at least species identification for salmon escapement can be more definitive.

While nothing definitive can be said about the prospects for the O/U excluder from our tests, there is good reason to believe that this excluder could reduce pollock loss rates to even lower than the flapper excluder due to its location in the tapered section of the intermediate where water flow is greater. At the same time, given that it showed some relatively high escapement rates for chums it may provide the first effective excluder to help fishermen reduce their chum bycatch rates. Finally, there is potential for this excluder to be at least as effective for Chinooks as the current flapper excluder. A dedicated test during the winter months would be needed to evaluate this potential but from the design aspects and what we know about the swimming ability of Chinook, there is considerable reason to expect that Chinook escapement will be improved with the O/U as well.

EFP Groundfish and Salmon Accounting

Table 24 and Table 25 detail groundfish and salmon accounting for the EFP trials by season, vessel and species. Of the 7,500 mt groundfish limit for this EFP, 5,868 mt were harvested (78.2%). Of this, 96.9% was pollock. Halibut bycatch was 8.86 mt or .15% of the total catch. For catcher vessels, ADF&G fish tickets were used for groundfish species. For the *Starbound* (CP), estimates for groundfish were derived from at-sea partial haul sampling. Weight of salmon sharks discarded from deck is included. The sea sampler counts (by haul, at-sea) were used for all salmon accounting.

Table 24. EFP 11-01 limits and harvests: 2011B, 2012 A/B. Starbound , Destination, Pacific Prince

	Limits	2011 B/SB	2012 A/SB	2012 A/Dest	2012 B/Dest	2012 B/PP	Totals	Remaining	% used
Groundfish	**7,500**	1,945	1,247	1,219	313	1,145	5,868	1,632	78.2%
Chinook	**850**	59	236	223	47	20	585	265	68.8%
non-Chinook	**5,125**	2,165	0	0	249	517	2,931	2,194	57.2%

Table 25. EFP 11-01 salmon and groundfish accounting by species, season and vessel (SB= Starbound, Dest = Destination, PP=Pacific Prince). Catcher vessels: Fish Ticket amounts for groundfish (mt), sea sampler counts for salmon; Starbound (CP): estimates for groundfish from partial haul sampling, sea sampler counts for salmon.

Species (mt)	2011 B/SB	2012 A/SB	2012 A/Dest	2012 B/Dest	2012 B/PP	Totals	% of total
King Salmon (no.)	59	236	223	47	20	**585**	na
Chum Salmon (no.)	2,165	0	0	249	517	**2,931**	na
Pollock	1,913	1,218	1,199	307	1,068	**5,705**	96.9%
Halibut	0.332	4.431	0.297	0.320	3.480	**8.860**	0.15%
Herring	0.002	0.000	0.000	0.000	3.370	**3.372**	0.06%
Cod	12.291	8.271	10.783	1.950	5.250	**38.545**	0.65%
Arrowtooth	4.380	1.972	0.600	1.230	3.010	**11.192**	0.19%
Kamchatka	0.383	0.141	0.000	0.000	0.000	**0.524**	0.01%
Flathead	10.209	5.167	5.529	0.670	2.880	**24.455**	0.42%
Bering Flounder	0.000	0.007	0.000	0.000	0.000	**0.007**	0.00%
Rock sole	0.565	5.813	0.943	0.040	0.230	**7.591**	0.13%
Yellowfin sole	0.000	0.369	0.001	0.000	0.000	**0.370**	0.01%
Rex Sole	1.098	2.750	0.790	1.100	4.600	**10.338**	0.18%
AK Plaice	0.000	0.006	0.001	0.000	0.000	**0.007**	0.00%
Turbot	0.002	0.003	0.000	0.000	0.000	**0.005**	0.00%
POP	0.001	0.154	0.005	0.040	11.560	**11.759**	0.20%
Northern rockfish	0.002	0.000	0.000	0.000	0.000	**0.002**	0.00%
Redstripe RF	0.000	0.006	0.000	0.000	0.000	**0.006**	0.00%
Dusky rockfish	0.000	0.000	0.001	0.000	0.000	**0.001**	0.00%
Shortraker	0.000	0.011	0.000	0.000	0.000	**0.011**	0.00%
Atka mackerel	0.000	0.000	0.013	0.000	0.850	**0.863**	0.01%
Octopus	0.000	0.000	0.000	0.000	0.000	**0.000**	0.00%
Squid	0.000	0.178	0.001	0.290	47.060	**47.529**	0.81%
Shark	0.970	0.129	0.000	0.400	0.110	**1.609**	0.03%
Sculpin	0.691	0.476	0.043	0.010	0.050	**1.270**	0.02%
AK Skate	1.048	2.751	0.000	0.000	0.000	**3.799**	0.06%
Bering Skate	0.051	0.037	0.000	0.000	0.000	**0.088**	0.00%
Aleut Sk	0.072	0.157	0.000	0.000	0.000	**0.228**	0.00%
Skate unid	0.000	0.000	1.451	0.050	0.510	**2.011**	0.03%
Sablefish	0.000	0.000	0.000	0.000	0.030	**0.030**	0.00%
Jellyfish	8.407	0.256	0.099	0.060	0.880	**9.701**	0.16%
Prowfish	0.015	0.000	0.000	0.000	0.000	**0.015**	0.00%
Starfish	0.001	0.002	0.000	0.000	0.000	**0.003**	0.00%

Species (mt)	2011 B/SB	2012 A/SB	2012 A/Dest	2012 B/Dest	2012 B/PP	Totals	% of total
Poacher	0.004	0.003	0.001	0.000	0.000	**0.008**	0.00%
Misc	0.002	0.000	0.000	0.000	0.000	**0.003**	0.00%
Eulachon	0.002	0.000	0.000	0.000	0.000	**0.002**	0.00%
Lumpsucker	0.165	0.159	0.023	0.010	0.000	**0.357**	0.01%
Snailfish	0.000	0.022	0.000	0.000	0.020	**0.042**	0.00%
Sponge	0.000	0.001	0.000	0.000	0.000	**0.001**	0.00%
Tanner crab	0.000	0.003	0.000	0.000	0.000	**0.003**	0.00%
Totals (mt)	**1,953.7**	**1,251.3**	**1,219.6**	**313.2**	**1,152.4**	**5,890.1**	**100.0%**
Total groundfish (mt)	**1,944.8**	**1,246.4**	**1,219.2**	**312.8**	**1,144.6**	**5,867.7**	

groundfish excludes prohibited and non-allocated species

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