

Report to the North Pacific Fishery Management Council  
on the 2009  
Bering Sea Pollock Intercooperative Salmon Avoidance  
Agreement

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This report is to the North Pacific Fishery Management Council and covers the Bering Sea and Aleutian Islands Management Area (BSAI) Pollock Intercoop Salmon Avoidance Agreement (“ICA”). During the course of the fishery, the pollock Intercoop closed 25 areas to fishing in the 2009 A season and 39 areas during the 2009 B season, based on high bycatch rates of chinook or chum salmon experienced by vessels working in the area. In addition, the “Chinook Conservation Area” (approximately 735 sq. miles) was again closed during the 2009 A season. Maps of the closures are shown in Appendix 1.

Under the terms of the ICA, applicants are to submit to the Council a report analyzing:

1. Number of salmon taken by species during the experiment
2. Estimated number of salmon avoided as demonstrated by the movement of fishing effort away from salmon hot-spots.
3. A list of each vessel’s number of appearances on the weekly dirty 20 lists for both salmon species
4. A compliance/enforcement report that will include the results of an external audit designed to evaluate the accuracy of the approach used by Sea State to monitor compliance with the agreement, and a report on the effectiveness of enforcement measures stipulated under the ICA in cases of non-compliance. Examination of a randomly selected subset of vessel/days representing 10% of the catch during the experiment will be used as the basis of the audit.

**Number of salmon taken by species during the experiment:**

For the sake of comparison we have included catch and bycatch amounts running back to 2000. These data are compiled from plant landing information for catcher vessels delivering to shoreside processors, and observer data for mothership catcher vessels and catcher-processors. The “other salmon” category includes all non-chinook salmon. Observer data for both offshore and shoreside deliveries show that only very small numbers of salmon other than chum in this category (for example, 152 unidentified, 31 pinks, and 5 silvers for the 2006B season EFP).

*Table 1. Catch and bycatch of pollock and salmon in the directed pollock fishery by season and for full years, 2000 – 2009.*

Year	A pollock	A other salmon	A chinook	B pollock	B other salmon	B chinook	Full year pollock	Full year other salmon	Full year chinook
1991								30,262	48,880
1992								41,450	41,995
1993								243,270	46,014
1994								94,548	43,821
1995								21,875	23,436
1996								78,060	63,205
1997								66,994	50,530
1998								66,612	55,431
1999								46,568	13,521
2000	418,285	235	3,418	631,755	57,228	1,793	1,050,039	57,463	5,210
2001	538,107	1,867	16,464	813,022	50,948	13,663	1,351,130	52,815	30,126
2002	570,464	387	21,989	866,034	83,033	13,309	1,436,498	83,420	35,298
2003	576,868	3,274	30,981	876,784	170,688	13,444	1,453,651	173,963	44,425
2004	579,816	419	22,011	858,799	427,234	29,238	1,438,615	427,653	51,248
2005	573,887	574	26,678	878,618	637,957	41,499	1,452,505	638,531	68,178
2006	579,112	1,210	57,637	874,435	276,779	24,024	1,453,547	277,989	81,661
2007	544,273	8,038	70,845	775,261	82,641	49,020	1,319,534	90,679	119,866
2008	387,606	344	13,409	572,384	14,453	4,270	959,990	14,797	17,678
2009	313,763	31	10,618	469,128	38,040	2,262	782,891	38,071	12,881

*Estimates of salmon bycatch for 1991-1999 are for all groundfish fisheries, including CDQ, and are available on the NOAA Fisheries, Ak Region web site.*

*(<http://www.fakr.noaa.gov/sustainablefisheries/catchstats.htm>)*

*Estimates for 2000 – 2009 (compiled by Sea State, Inc) are for the pollock fishery only and were made using observer data when available and numbers of salmon counted at shore plants and reported on fish tickets for unobserved shoreside vessels.*

**Evaluation of salmon savings.**

The evaluation of the number of salmon saved by the IC program is based on tracking vessels that fished in a closed area before it closed, and then comparing their subsequent bycatch to see if it was lower than expected if the area had not closed. Put more simply,

we perform a before-and-after comparison of the bycatch observed and expected from the vessels that triggered the closure. The procedure is as follows:

1. Extract all observer data for haul locations falling inside a closure area, for a 5 day period preceding the closure. For shoreside catcher vessels, aggregate the hauls that have the same “start fishing date” so that hauls with the same bycatch rate are not artificially repeated. As an example, if 2 hauls from the same catcher vessel trip show up in the closed area, they will have the same bycatch rate because observers pro-rate bycatch evenly across all hauls. Consider them a single observation with a value equal to the sum of the two hauls’ pollock and salmon.
2. Consider all of independent offshore sector (C/P and mothership) hauls, and combined “trip-level” hauls to be estimates of the bycatch ratio  $R_i = \sum y_i / \sum x_i$ , where y are counts of chinook or chum salmon, and x is the pollock catch from individual hauls (offshore sector) or grouped, same-trip hauls (shoreside), and i indicates a separate closure.
3. Extract the same haul or “grouped” haul information, for the same vessels, for the duration of the closure (either 3 or 4 days). Their associated bycatch is available from either observer or plant delivery information. Compute their expected bycatch had they been able to stay and fish inside the now-closed area, by summing the pollock catch of all vessels in this category, and multiplying this summed pollock catch by the matching bycatch ration,  $R_i$  above.
4. Compute the standard error of this estimated Y (overall salmon bycatch if vessels had stayed in the area and fished with bycatch rate R) treating R as a ratio estimator (Snedecor and Cochran, Statistical Methods, 8<sup>th</sup> Edition, p 452).

### **Avoidance results from the 2009 Intercoop Agreement**

The results from these calculations for the 2009 A and B seasons are shown in tables 2a - 2c below. (Charts showing the closures issued for both seasons may be found at the end of this document. Because so many closures were issued, we have not produced a chart for each closure and instead have grouped closures by season and species on three separate charts.) During the A season there were 25 closures in addition to the full-season Chinook Conservation Area closure. Of these, there were 8 for which before- and after-closure observer data could be found from vessels fishing inside the areas before they closed. The apparent scarcity of before- and after-closure data results from two situations:

1. Closures may be based on deliveries from catcher vessels that did not carry observers, and thus there could be closures for which there is no observer information prior to the closure.
2. Closures may be extended up to two weeks in absence of any new data if we feel that bycatch rates were likely to have remained high inside an active closure.
3. Shoreside catcher vessels may have had an observer aboard before the closure but then delivered and come back to the grounds without an observer, thus removing the boat from before/after comparisons.

Table 2a summarizes of the results for both chinook savings resulting from these closures (Appendix Tables A1a-c show the underlying data, by closure, with associated standard errors). The results indicate that for the approximately 8,400 mt of observed groundfish associated with boats that fished inside areas before they were closed, and that also had observers after closures, 2,333 chinook were avoided. This represents a reduction of 95% from the bycatch of chinook that would have been expected had the vessels continued to fish in those closure areas for the duration of those closures. Table 2a also shows observed and expected chum numbers, but since chum bycatch during the A season is such a small part of the overall chum bycatch for the year, these numbers are not particularly significant.

Table 2b shows results obtained in a similar fashion for the B season. Thirty-nine closures were put in place during the B season, and of these, 18 closures had both pre- and post-closure observer data that allowed for an analysis of reductions. As with the A season, some closures were based on shoreside delivery information and VMS track inspection alone, leaving no pre-closure information for analysis. Table 2b indicates that the combination of chinook and chum closures resulted in 11,936 mt of pollock catch that could be tracked, with an associated 64% reduction in expected chinook take and 74% reduction in expected chum bycatch. Table 2c shows that for the entire year the chinook and chum reductions were 90% and 74%; thus the 2009 overall percentage reductions are among the best we have managed since the IC program received an exemption from the area closures (Table 3).

*Table 2a. Summary of 2009A Chinook closure effectiveness*

A season results	Chinook closures
Pollock catch (after closure)	8,373
Actual chinook bycatch (in moved tows)	117
Expected chinook bycatch	2,185
Chinook savings	2,068
% reduction	95%
Actual chum bycatch	1
Expected chum bycatch	2
Chum savings	1
% reduction	50%

*Table 2b. Summary of 2009B chinook and chum closure effectiveness*

B season results	B Chinook closures	B Chum closures	ombined B closures
Pollock catch (after closure)	6,235	5,701	11,936
Actual chinook bycatch (in moved tows)	101	51	152
Expected chinook bycatch	314	103	417
Chinook savings	213	52	265
% reduction	68%	50%	64%
Actual chum bycatch	607	2,001	2,608
Expected chum bycatch	1,775	8,271	10,046
Chum savings	1,168	6,270	7,438
% reduction	66%	76%	74%

Table 2c. Full year chinook and chum closure effectiveness

Full year results (A + B)	A and B closures
Pollock catch (after closure)	20,309
Actual chinook bycatch (in moved tows)	269
Expected chinook bycatch	2,602
Chinook savings	2,333
% reduction	90%
Actual chum bycatch	2,609
Expected chum bycatch	10,048
Chum savings	7,439
% reduction	74%

### Compliance/ Enforcement

One apparent violation was referred to the Akutan coop on November 2, 2009. The coop has until May 2, 2010 to resolve the issue.

An audit of Sea State compliance monitoring has again been awarded to ABR Inc of Fairbanks, Alaska. ABR is performing an independent review of 10% of the coop fishing records and associated VMS information but audit are not yet available. However, to date ABR has not found any differences from Sea State determinations for 2009.

### Comments on the 2009 season

Table 3. Hot spot closure effectiveness, 2006 - 2009.

Summary item	2006B	2007A	2007B	2008A	2008B	2009A	2009B
Pollock harvest moved from closures	41,691	102,592	182,111	44,782	7,419	8,373	11,936
% of pollock harvest affected	7%	19%	23%	12%	1%	3%	3%
Chinook savings	1537	35,550	14,576	4,953	-533	2,068	265
% reduction	20%	70%	54%	66%	-100%	95%	64%
Chum savings	15,419		86,410		965		7,438
% reduction	67%		70%		73%		74%

During the 2009A season, relatively little pollock effort appears to have been displaced by the IC closures (Table 3). It is incorrect to think that only 8,373 mt of pollock was directly affected by closures because many of the closures were triggered by high bycatch rates seen in the exempted fishery that was testing salmon excluders from late January to mid-February. During that time, 6 trips carried out on two test boats resulted in a bycatch of 3,236 salmon for 1,820 mt of pollock, in contrast to the commercial fishery that took 10,618 chinook in 313,763 mt of pollock. The very high bycatch rates found by the

exempted fishery provided essential supplemental information that allowed us to place closures over the highest bycatch areas without actually having vessels in the commercial fishery testing these waters. The EFP trips and associated closures are shown in Figures 1- 6.

Additionally, in 2009 the timing of the pollock harvest was shifted to later in the A season and earlier in the B season (Figure 7, immediately below). The delay of operations in the A season can be attributed to several factors: some shoreside vessels remained tied up in price disputes, some shoreside vessels stood down when salmon bycatch was highest early in the season, and catcher-processors and motherships delayed operations in anticipation of a late roe season. All of these factors combined to shift the pollock harvest away from the period that is traditionally the time of highest bycatch in the A season. In contrast, B season harvest timing was moved forward as vessels found reasonable fishing on grounds to the north and were able to catch the relatively small B season TAC before chinook bycatch rates reached their traditional peak in October.

Chum bycatch rates from shoreside deliveries in the 2009B season were much higher than those seen in the last several years. However, with significant shoreside effort directed to the north, relatively little fishing effort displacement was required to keep chum bycatch at a reasonable level. Had the fleet been fishing in a pattern like those seen in 2004 - 2006, much more effort would have been displaced to respond to the apparent high abundance of chums on the grounds.

Figure 7. Percent of pollock catch by week.

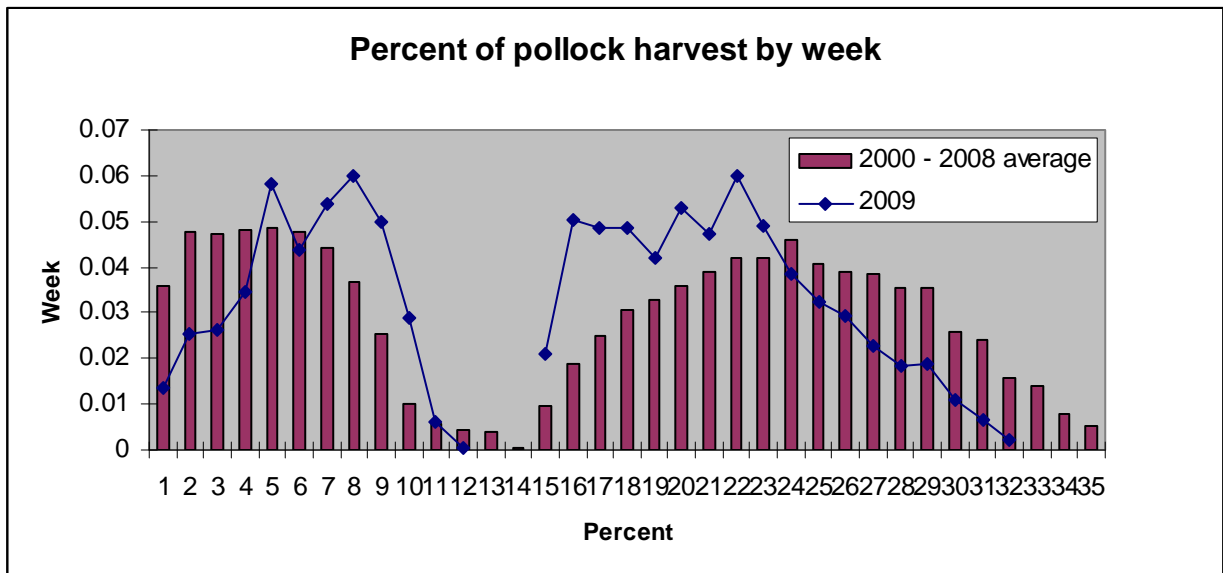


Figure 1. Pacific Prince EFP trip: 1/29/09 to 2/1/09.  
269 mt pollock, 681 chinook. Closure 1/30/09 and the Chinook Conservation Area shown in red.

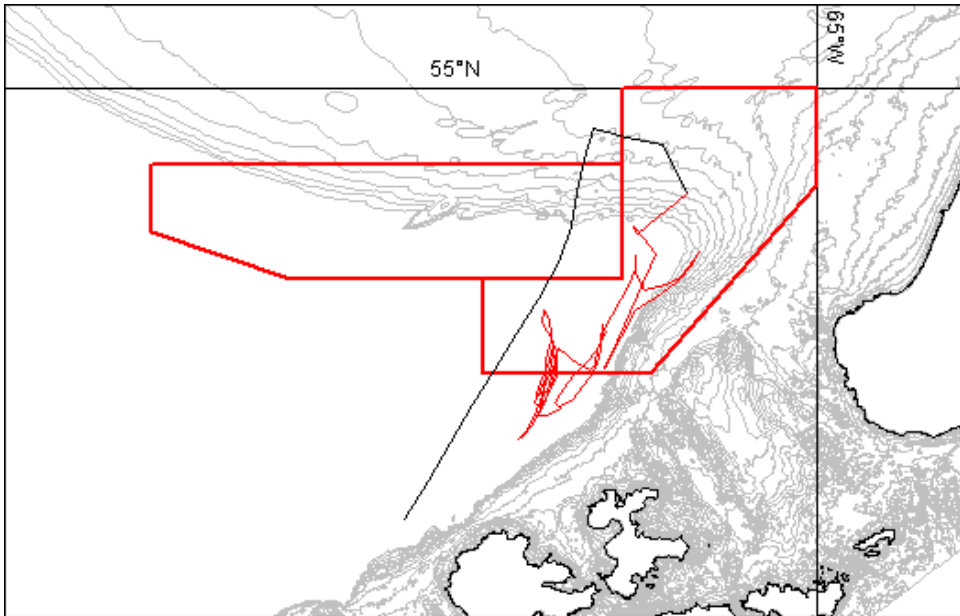


Figure 2. Pacific Prince EFP trip: 2/2/09 to 2/5/09.  
306 mt pollock, 211 chinook. Closure 2/6/09 and the Chinook Conservation Area shown in red.

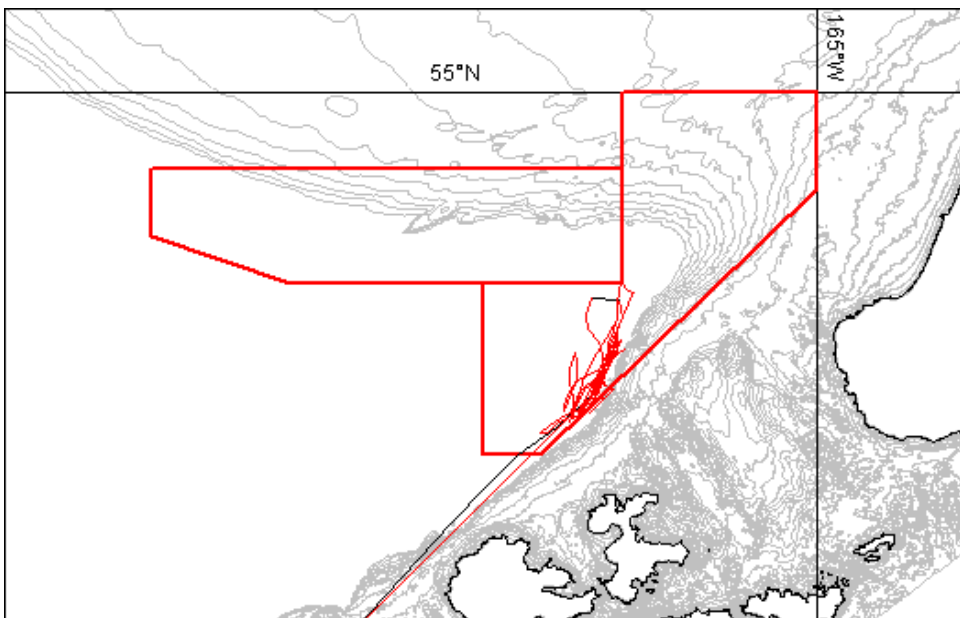


Figure 3. Pacific Prince EFP trip: 2/15/09 - 2/19/09.  
128 mt pollock, 140 chinook. Closures for 2/13/09 and 2/17/09 and the Chinook Conservation Area shown in red.

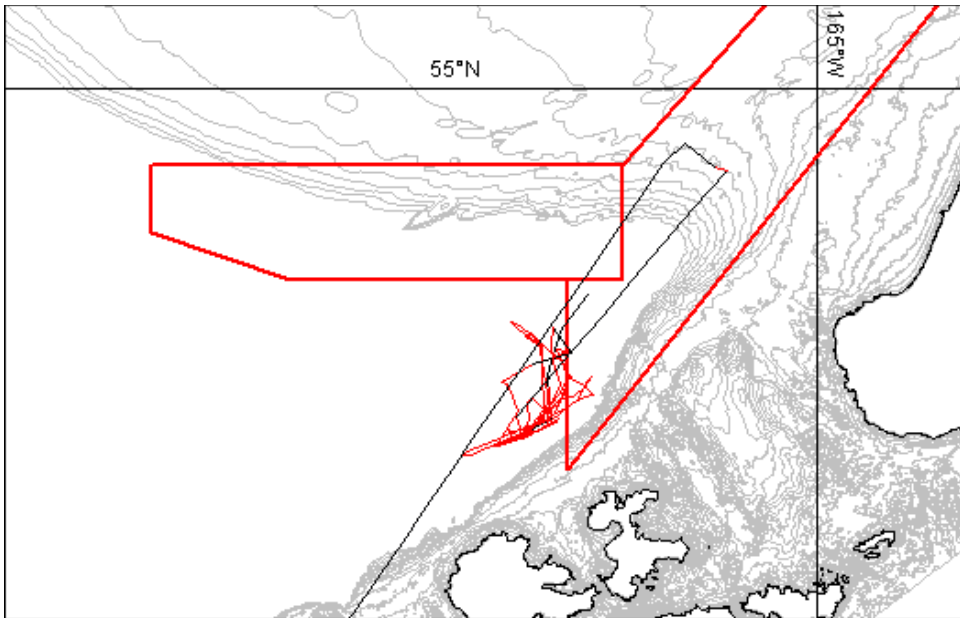


Figure 4. Pacific Prince EFP trip: 2/19/09 - 2/24/09.  
393 mt pollock, 141 chinook. Closure 2/20/09 and the Chinook Conservation Area shown in red.

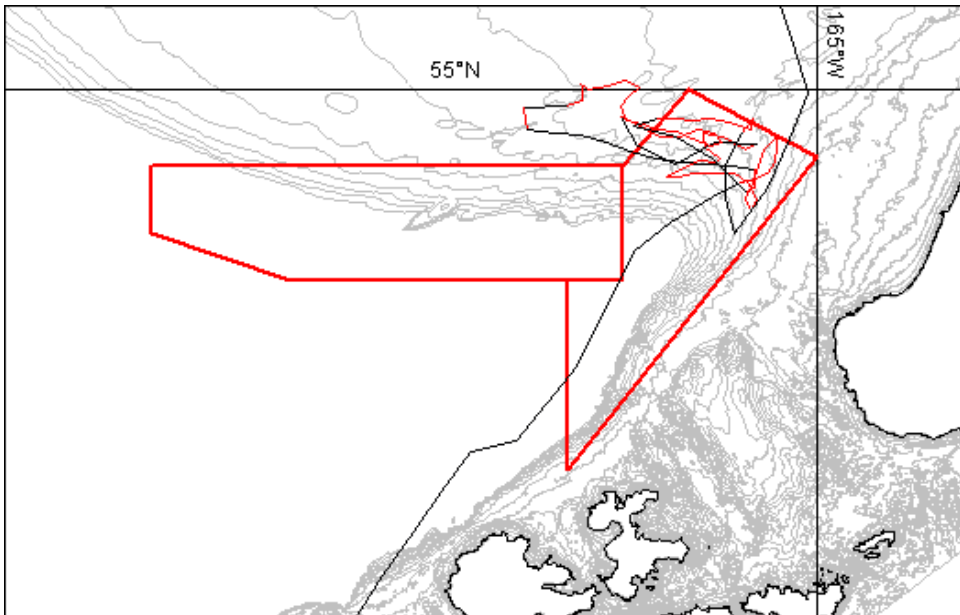




Figure 5. Pacific Prince EFP trip: 2/26/09 - 3/2/09.  
350 mt pollock, 1163 chinook. Closure 2/27/09 and the Chinook Conservation Area shown in red.

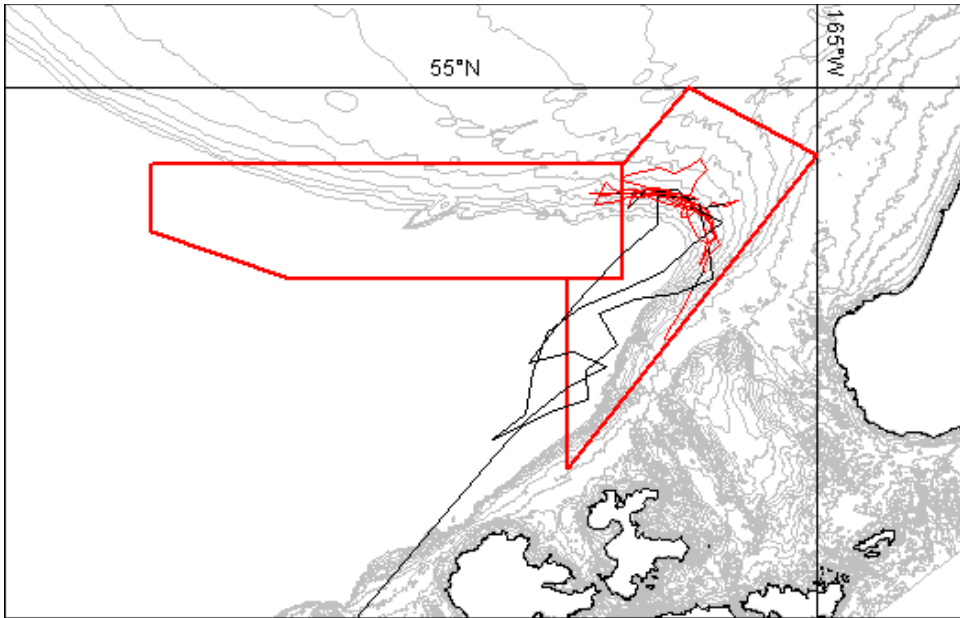
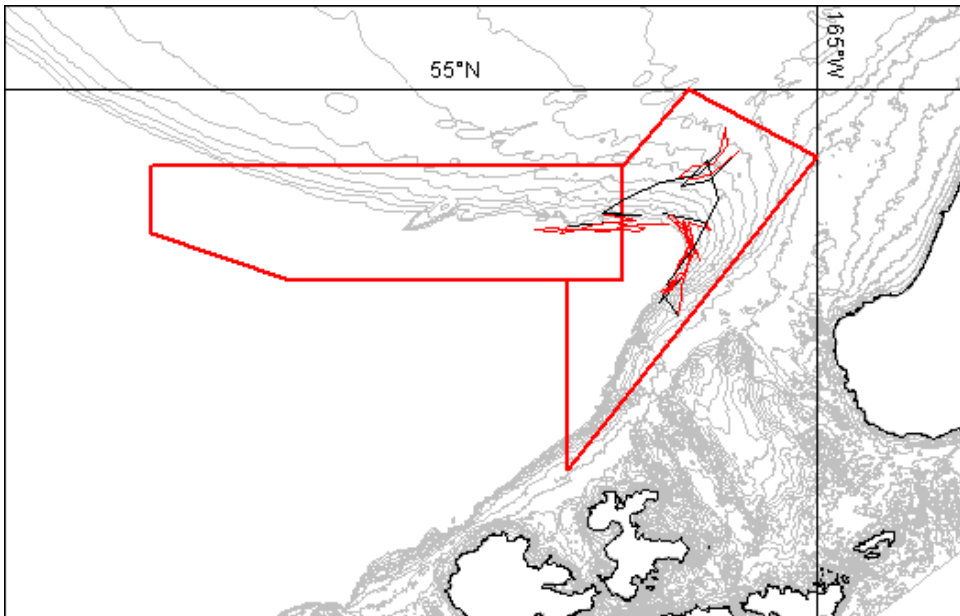


Figure 6. Starbound EFP trip: 3/9/09 to 3/11/09.  
374 mt pollock, 900 chinook. Closure 3/10/09 and the Chinook Conservation Area shown in red.



**Appendix 1. Before-and-after closure fishing comparisons, by closure.**

*Table A1a. Chinook and chum salmon closure effectiveness, 2009 A season*

Closure Type	Date	"After" closure pollock catch	"After" closure chinook	Estimated closed-area chinook catch	Chinook reduction (estimate-actual)	Std Err chinook	Estimated closed-area chum catch	Chum reduction (estimate-actual)	Std Err chum	Number of samples prior to closure	Number of samples after closure
Chinook	01/30/09	2,414	44	1,011	967	79	2	2	1	12	6
Chinook	02/13/09	773	11	705	694	19	0	0	0	4	3
Chinook	02/20/09	147	3	47	44		0	0		1	1
Chinook	02/24/09	84	0	0	0		0	0		1	1
Chinook	02/27/09	1,691	28	141	113	7	0	0	0	5	2
Chinook	02/27/09	315	3	0	-3		0	-1		1	2
Chinook	03/03/09	1,860	18	200	182	14	0	0	0	2	2
Chinook	03/27/09	1,088	10	81	71	8	0	0	0	7	3
Totals		8,373	117	2,185	2,068	128	2	1	1	33	20

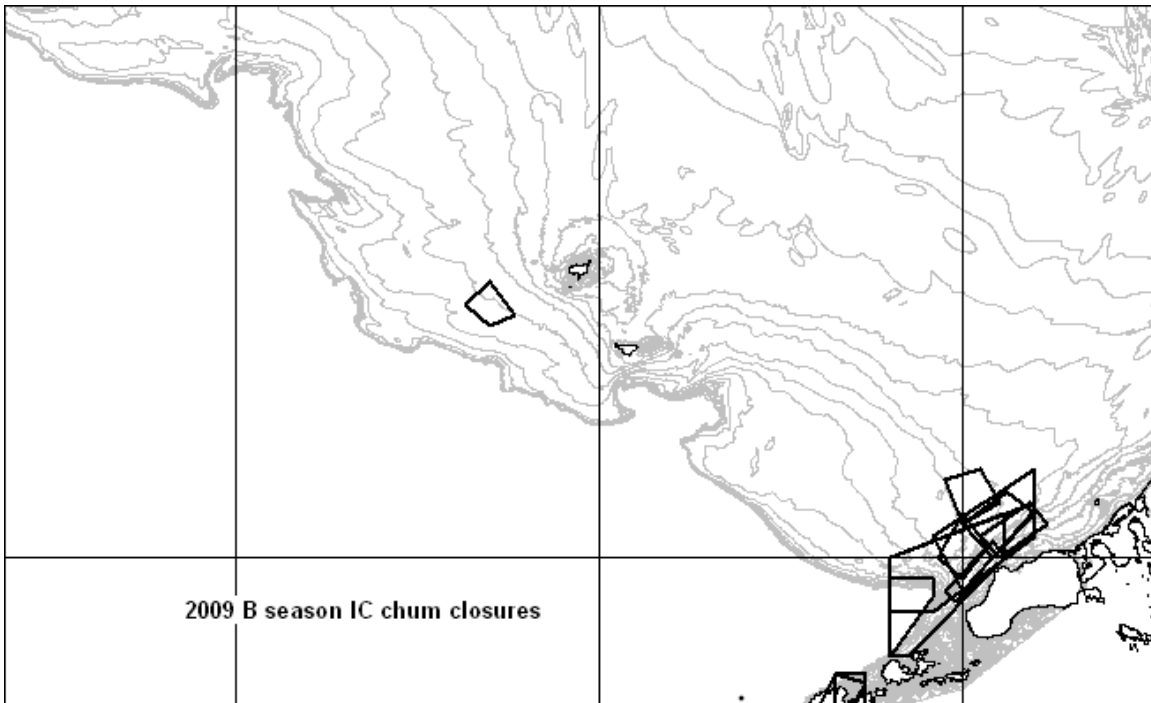
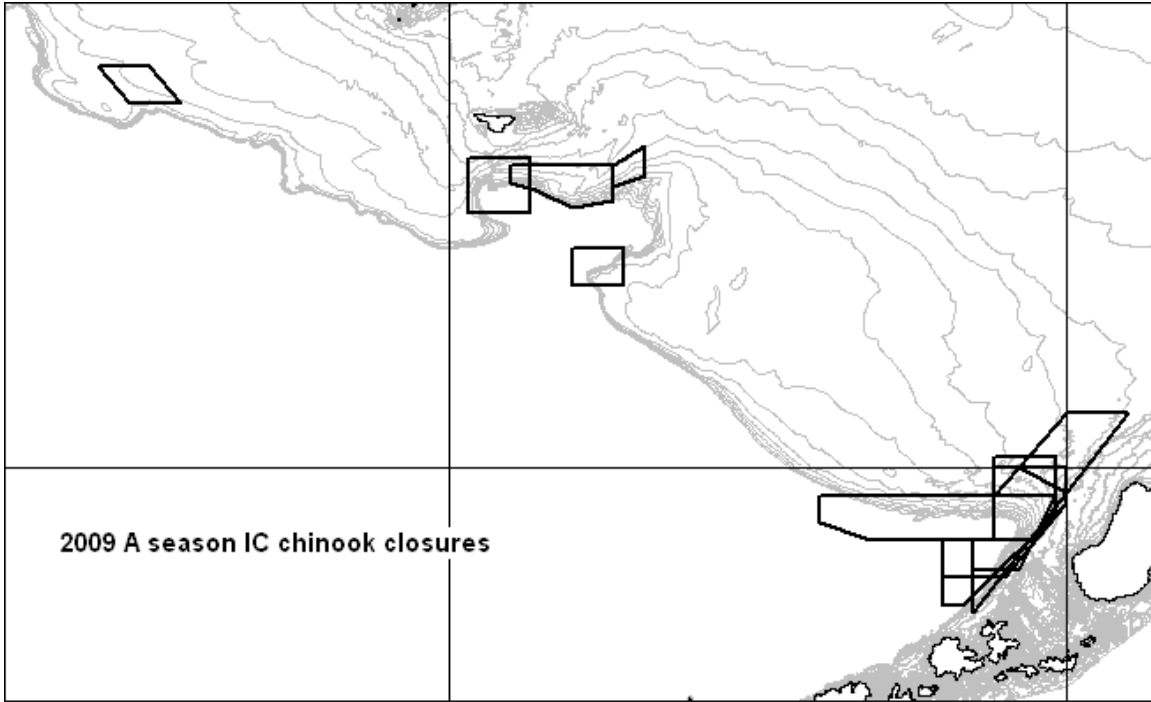
*Table A1b. Chinook and chum salmon closure effectiveness, 2009 B season, by chinook closure.*

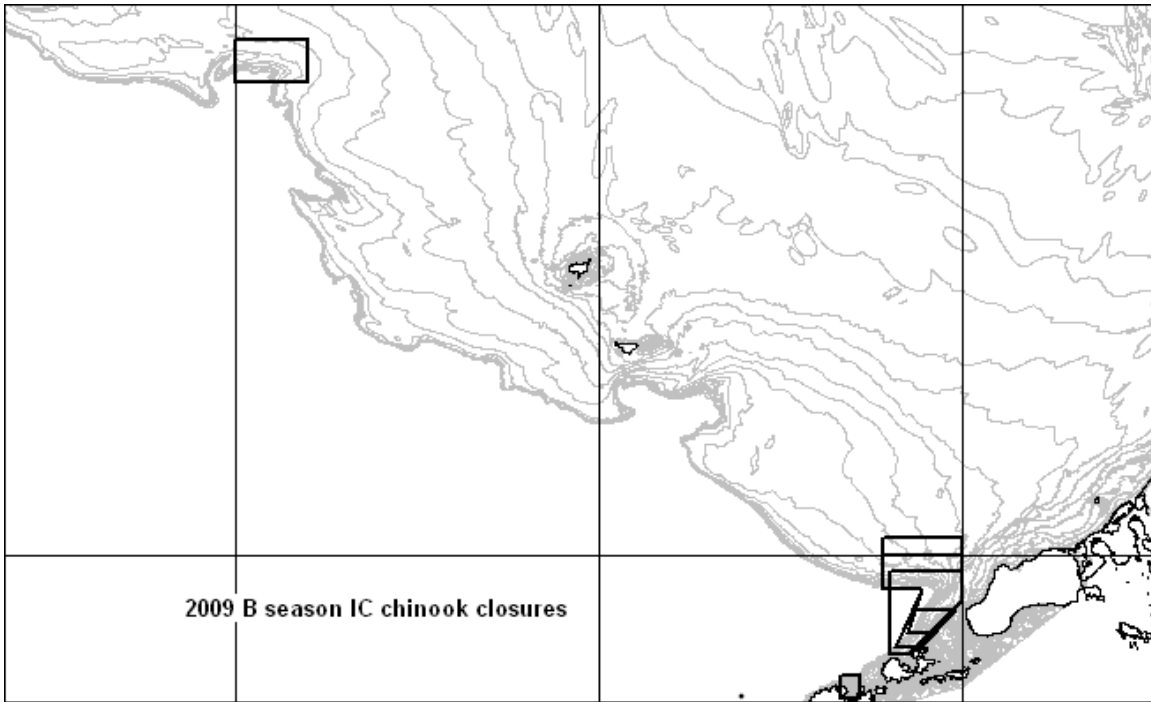
Closure Type	Date	"After" closure pollock catch	"After" closure chinook	Estimated closed-area chinook catch	Chinook reduction (estimate-actual)	Std Err chinook	Estimated closed-area chum catch	Chum reduction (estimate-actual)	Std Err chum	Number of samples prior to closure	Number of samples after closure
Chinook	09/08/09	1,615	11	93	82	4	14	-14	1	22	3
Chinook	09/11/09	915	56	35	-21	6	1,557	1,245	282	6	6
Chinook	09/11/09	3,224	3	155	152	2	0	-124	0	10	3
Chinook	09/15/09	225	22	8	-14	0	40	-97	1	3	2
Chinook	09/18/09	257	9	24	15	6	164	158	59	3	2
Totals		6,235	101	314	213	19	1,775	1,168	343	44	16

*Table A1c. Chinook and chum salmon closure effectiveness, 2009 B season, by chum closure.*

Closure Type	Date	"After" closure pollock catch	"After" closure chinook	Estimated closed-area chinook catch	Chinook reduction (estimate-actual)	Std Err chinook	Estimated closed-area chum catch	Chum reduction (estimate-actual)	Std Err chum	Number of samples prior to closure	Number of samples after closure
Chum	07/07/09	563	4	4	0	4	91	-15	47	7	9
Chum	07/10/09	275	0	4	4	1	481	461	73	6	3
Chum	07/14/09	1,617	1	9	8	2	1,531	1,300	155	25	14
Chum	07/17/09	473	0	1	1	0	301	298	74	9	3
Chum	07/28/09	496	0	40	40	16	1,324	1,169	237	3	4
Chum	07/31/09	88	1	1	0		355	286		1	1
Chum	08/04/09	324	0	0	0	0	2,293	2,293	251	3	2
Chum	08/21/09	584	0	0	0	0	1,484	1,442	13	3	4
Chum	08/28/09	323	2	5	3	4	174	132	94	3	3
Chum	09/01/09	165	0	3	3	0	45	31	5	2	1
Chum	09/07/09	566	42	32	-10	10	163	-576	43	3	4
Chum	09/07/09	193	0	0	0		0	-573		1	1
Chum	09/08/09	34	1	5	4	5	29	22	9	2	1
Totals		5,701	51	103	52	42	8,271	6,270	1,001	68	50

**Appendix 2: Charts showing closures**





### Appendix 3: Dirty 20 list appearances

Number of times each vessel was on a 2009 Chinook weekly dirty 20 list

Vessel	N times on list	Vessel	N times on list	Vessel	N times on list
AJ	0	GLADIATOR	4	PACIFIC CHALLENGER	3
ALASKA OCEAN	1	GOLD RUSH	1	PACIFIC EXPLORER	4
ALASKA ROSE	1	GOLDEN DAWN	4	PACIFIC FURY	0
ALASKAN COMMAND	2	GOLDEN PISCES	0	PACIFIC GLACIER	0
ALDEBARAN	5	GREAT PACIFIC	2	PACIFIC KNIGHT	0
ALEUTIAN CHALLENGER	1	GUN-MAR	0	PACIFIC MONARCH	0
ALSEA	0	HALF MOON BAY	0	PACIFIC PRINCE	2
ALYESKA	2	HAZEL LORRAINE	0	PACIFIC RAM	1
AMBER DAWN	0	HICKORY WIND	1	PACIFIC VIKING	7
AMERICAN BEAUTY	3	INTREPID EXPLORER	0	PEGASUS	2
AMERICAN CHALLENGER	0	ISLAND ENTERPRISE	3	PEGGY JO	3
AMERICAN EAGLE	3	KODIAK ENTERPRISE	1	PERSEVERANCE	1
AMERICAN TRIUMPH	2	LESLIE LEE	1	POPADO II	0
ANITA J	2	LISA MELINDA	2	POSEIDON	3
ARCTIC EXPLORER	5	MAJESTY	3	PREDATOR	1
ARCTIC FJORD	0	MARCY J	0	PROGRESS	2
ARCTIC STORM	3	MARGARET LYN	1	PROVIDIAN	0
ARCTIC WIND	2	MAR-GUN	0	RAVEN	4
ARCTURUS	4	MARK I	2	ROYAL AMERICAN	3
ARGOSY	2	MESSIAH	0	ROYAL ATLANTIC	1
AURIGA	1	MISS BERDIE	1	SEA STORM	0
AURORA	1	MISTY DAWN	0	SEA WOLF	2
BERING ROSE	2	MORNING STAR	4	SEADAWN	0
BLUE FOX	0	MS AMY	0	SEATTLE ENTERPRISE	1
BRISTOL EXPLORER	5	MUIR MILACH	0	SEEKER	3
CAITLIN ANN	1	NEAHKAHNE	0	SOVEREIGNTY	4
CALIFORNIA HORIZON	1	NORDIC EXPLORER	0	STARBOUND	3
CAPE KIWANDA	0	NORDIC FURY	1	STARFISH	1
CHELSEA K	0	NORDIC STAR	2	STARLITE	0
COLLIER BROTHERS	0	NORTHERN EAGLE	1	STARWARD	1
COLUMBIA	3	NORTHERN GLACIER	3	STORM PETREL	1
COMMODORE	3	NORTHERN HAWK	5	SUNSET BAY	0
DEFENDER	1	NORTHERN JAEGER	0	TOPAZ	0
DESTINATION	0	NORTHERN PATRIOT	4	TRACY ANNE	0
DOMINATOR	7	NORTHWEST EXPLORER	3	TRAVELER	1
DONA MARTITA	0	OCEAN EXPLORER	3	VANGUARD	1
ELIZABETH F	2	OCEAN HARVESTER	0	VESTERAALEN	1
EXCALIBUR II	0	OCEAN HOPE 3	1	VIKING	0
EXODUS	0	OCEAN LEADER	3	VIKING EXPLORER	4
FIERCE ALLEGIANCE	0	OCEAN ROVER	4	WALTER N	0
FORUM STAR	0	OCEANIC	1	WESTERN DAWN	1
				WESTWARD I	2

Number of times each vessel was on a 2009 chum weekly dirty 20 list

Vessel	N times on list	Vessel	N times on list	Vessel	N times on list
AJ	0	GLADIATOR	1	PACIFIC CHALLENGER	3
ALASKA OCEAN	0	GOLD RUSH	2	PACIFIC EXPLORER	0
ALASKA ROSE	0	GOLDEN DAWN	6	PACIFIC FURY	0
ALASKAN COMMAND	0	GOLDEN PISCES	4	PACIFIC GLACIER	0
ALDEBARAN	5	GREAT PACIFIC	2	PACIFIC KNIGHT	0
ALEUTIAN CHALLENGER	0	GUN-MAR	0	PACIFIC MONARCH	0
ALSEA	1	HALF MOON BAY	0	PACIFIC PRINCE	1
ALYESKA	0	HAZEL LORRAINE	2	PACIFIC RAM	0
AMBER DAWN	0	HICKORY WIND	0	PACIFIC VIKING	9
AMERICAN BEAUTY	3	INTREPID EXPLORER	0	PEGASUS	0
AMERICAN CHALLENGER	0	ISLAND ENTERPRISE	0	PEGGY JO	0
AMERICAN EAGLE	3	KODIAK ENTERPRISE	0	PERSEVERANCE	0
AMERICAN TRIUMPH	0	LESLIE LEE	3	POPADO II	0
ANITA J	4	LISA MELINDA	0	POSEIDON	4
ARCTIC EXPLORER	3	MAJESTY	6	PREDATOR	2
ARCTIC FJORD	0	MARCY J	1	PROGRESS	1
ARCTIC STORM	0	MARGARET LYN	0	PROVIDIAN	0
ARCTIC WIND	1	MAR-GUN	0	RAVEN	0
ARCTURUS	5	MARK I	0	ROYAL AMERICAN	3
ARGOSY	2	MESSIAH	0	ROYAL ATLANTIC	2
AURIGA	2	MISS BERDIE	0	SEA STORM	0
AURORA	2	MISTY DAWN	0	SEA WOLF	4
BERING ROSE	4	MORNING STAR	0	SEADAWN	1
BLUE FOX	0	MS AMY	0	SEATTLE ENTERPRISE	0
BRISTOL EXPLORER	2	MUIR MILACH	0	SEEKER	7
CAITLIN ANN	0	NEAHKAHNE	0	SOVEREIGNTY	2
CALIFORNIA HORIZON	0	NORDIC EXPLORER	0	STARBOUND	0
CAPE KIWANDA	1	NORDIC FURY	0	STARFISH	0
CHELSEA K	0	NORDIC STAR	2	STARLITE	1
COLLIER BROTHERS	0	NORTHERN EAGLE	0	STARWARD	1
COLUMBIA	5	NORTHERN GLACIER	0	STORM PETREL	8
COMMODORE	9	NORTHERN HAWK	0	SUNSET BAY	0
DEFENDER	2	NORTHERN JAEGER	0	TOPAZ	0
DESTINATION	2	NORTHERN PATRIOT	2	TRACY ANNE	0
DOMINATOR	1	NORTHWEST EXPLORER	0	TRAVELER	2
DONA MARTITA	0	OCEAN EXPLORER	3	VANGUARD	1
ELIZABETH F	1	OCEAN HARVESTER	0	VESTERAALEN	0
EXCALIBUR II	1	OCEAN HOPE 3	1	VIKING	0
EXODUS	0	OCEAN LEADER	4	VIKING EXPLORER	3
FIERCE ALLEGIANCE	1	OCEAN ROVER	0	WALTER N	0
FORUM STAR	0	OCEANIC	2	WESTERN DAWN	1
				WESTWARD I	1