

Report to the North Pacific Fishery Management Council
on the 2013
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 B season fishery, the pollock Intercoop closed 32 areas to fishing based on high bycatch rates of chum salmon experienced by vessels working in the area. Maps of the closures are shown in Figure 1.

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

1. Estimated number of salmon avoided as demonstrated by the movement of fishing effort away from salmon hot-spots.
2. 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 each season will be used as the basis of the audit.

Number of non-Chinook salmon taken during the fishery:

For the sake of comparison we have included catch and bycatch amounts running back to 1993. 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 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 “other” salmon in the directed pollock fishery B season, 1993 – 2013.

Year	B season pollock*	B season other salmon bycatch
1993	740,569	242,473
1994	718,582	89,117
1995	647,865	17,625
1996	633,639	77,028
1997	546,988	64,504
1998	539,432	60,040
1999	511,211	44,261
2000	631,755	57,228
2001	813,022	50,948
2002	866,034	83,033
2003	876,784	170,688
2004	858,799	427,234
2005	878,618	637,957
2006	874,435	276,779
2007	775,261	82,641
2008	572,384	14,453
2009	469,128	38,040
2010	471,983	13,585
2011	681,480	191,517
2012	705,716	22,149
2013	738,693	124,661

** For the years 1993-1999, total groundfish from P and B targets, available on files from NMFS site (below), were used instead of pollock.*

Estimates of salmon bycatch for 1993-1999 are for all P and B trawl target fisheries, including CDQ, and are available on the NOAA Fisheries, AK Region web site. (<http://www.fakr.noaa.gov/sustainablefisheries/catchstats.htm>)

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, 8th Edition, p 452).

Avoidance results from the 2013 Intercoop Agreement
Locations of the 2013 closures are shown in Figure 1.

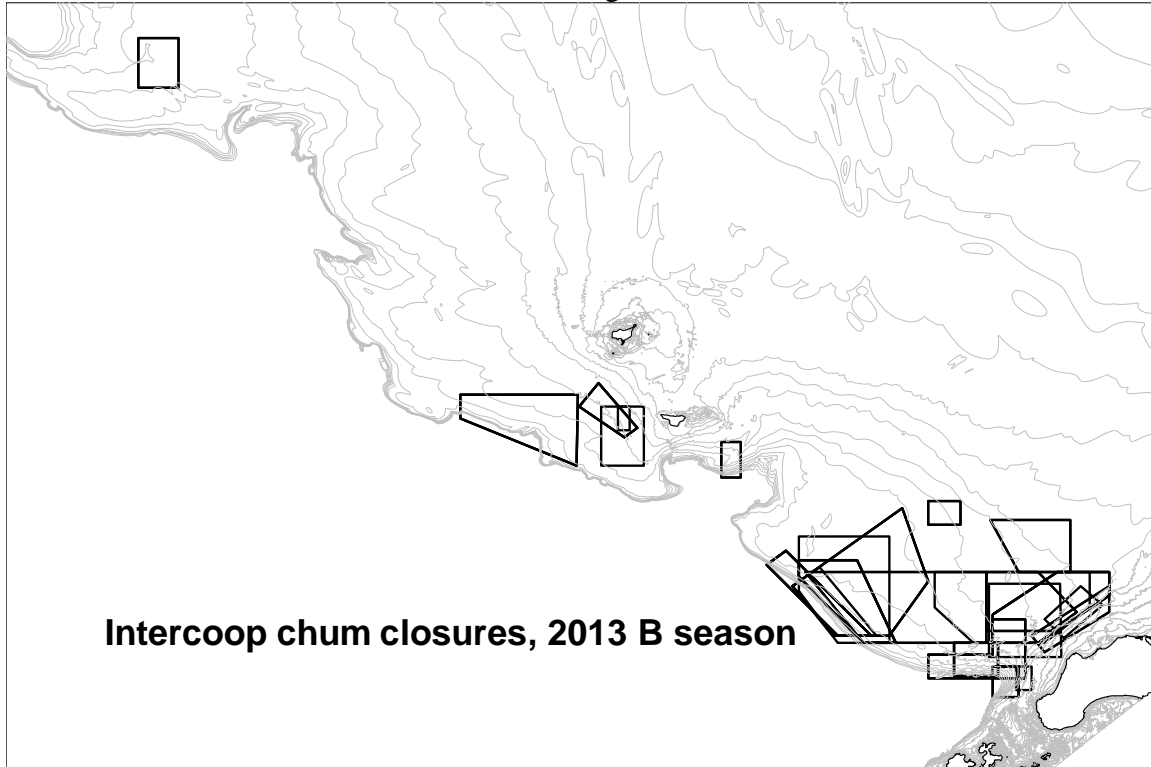


Figure 1. 2013 IC chum closures

Table 2 summarizes the results for both chum and chinook savings resulting from these closures (Appendix Tables A1 and A2 show the underlying data, by closure, with associated standard errors). A total of 30,869 mt of pollock was associated with boats that fished inside areas before they were closed. These same vessels caught 49,818 mt of pollock in the closure interval following the associated closure date. An estimated 34,231 fewer chum were taken outside the closures than would have been expected if the same amount of pollock had been taken inside the closures, based on the comparison of rates inside and outside closure areas. Chinook reduction was significant: 376 were taken outside the chum closures versus and an estimated 1,427 that would have been caught at within-closure rates, or a reduction of 1,051 chinook. These bycatch reductions represent a 65% decrease in expected chum bycatch (for boats that fished in closures, for the 3 or 4 day period after the closure), and a 74% decrease in expected chinook bycatch.

Table 2. Chum salmon closure effectiveness for the 2013 B season

Closure statistic	Bycatch species	
	Chinook	Chum
Pollock catch (inside, before closures)	30,869	30,869
Pollock catch (outside, after closures)	49,818	49,818
Actual bycatch (outside, after closures)	376	18,410
Expected bycatch (at pre-closure rate)	1,427	52,641
Savings	1,051	34,231
% reduction	74%	65%

A comparison with results from chum closures from previous years is shown in Table 3. The “After-closure pollock” column shows the total tonnage of pollock harvested after closures by vessels that fished inside closures during the closure duration (3 or 4 days, depending on the day of closure). This amount of pollock can be viewed as having been moved from inside the closure area to outside due to the closures. The 2013 amount (49,818 mt) is relatively large, although smaller than some figures from high-bycatch years. The chum savings estimated by the methods outlined are likely to be very conservative, as they do not account for any change in behavior of vessels that did not fish in closures in the 5 day period preceding the closure announcement. The estimated 22% reduction in chum catch for the entire fishery (Table 3) in 2013 is slightly less than the long term average of 26%. Chum-related closures continued through October 15, which is coincidentally when the old Chum Salmon Savings Area used to re-open if that closure had been triggered.

Table 3. Comparison of the effects of chum closures across years.

Year	After-closure pollock	% of harvest affected	Chinook savings	Chinook % reduction	Chum savings	% reduction	Actual chum catch	Percentage reduction
2006	23,049	3%	-97	-21%	65,299	64%	276,779	19%
2007	107,646	14%	2007	56%	75,970	82%	82,641	48%
2008	3,448	1%	53	82%	768	73%	14,453	5%
2009	5,701	1%	52	50%	6,270	76%	38,040	14%
2010	12,537	3%	61	85%	1,808	84%	13,585	12%
2011	146,846	22%	73	7%	79,657	63%	191,517	29%
2012	12,246	2%	48	11%	3,530	50%	22,149	14%
2013	49,818	7%	1051	74%	34,231	65%	124,661	22%
Totals					267,533		763,825	26%

Compliance/ Enforcement

Nine violations were referred to coops for enforcement actions. Of these nine, 5 were comprised of a single point out a the vessel's track for an entire haul, while 4 were characterized by multiple points for a single haul being found inside the closure area. The coops involved have until June 1, 2014 to respond to the notice of apparent violation.

An audit of Sea State compliance monitoring has again been awarded to ABR Inc of Fairbanks, Alaska. ABR reviewed 10% of the coop fishing records and associated VMS information. The report for this audit states that:

“ABR agreed with the determinations of Sea State for the 10% sample that we examined, and we found no closure zone violations. Of points examined, our determination agreed with Sea State for all 8,597 locations in our subsample.”

Comparison of the 2013 chum ICA program with previous years.

Comparison of the chum bycatch program with actions of the chum bycatch program from previous years is best confined to 2011 onward, since at that point Amendment 91 mandated a census count of chum salmon. Also, from that point onward all vessels were required by their chinook IPAs to stay under chinook caps, and those caps may have influenced behavior towards chums. Figure 2a shows that in 2013, salmon closures were necessary across much of the western extent of the Bering Sea shelf, but they were located generally south of the Pribilofs. The other recent high-bycatch year, 2011, was characterized by chum closures that were more centered on the pollock grounds in the middle shelf (Figure 2c), with closures also to the north and west of the Pribilofs. The extensive number of closures in 2013 on the western edge of the shelf is unusual: although salmon are often found along the edge, the area is generally not a highly productive pollock-fishing area and hence draws relatively little effort.

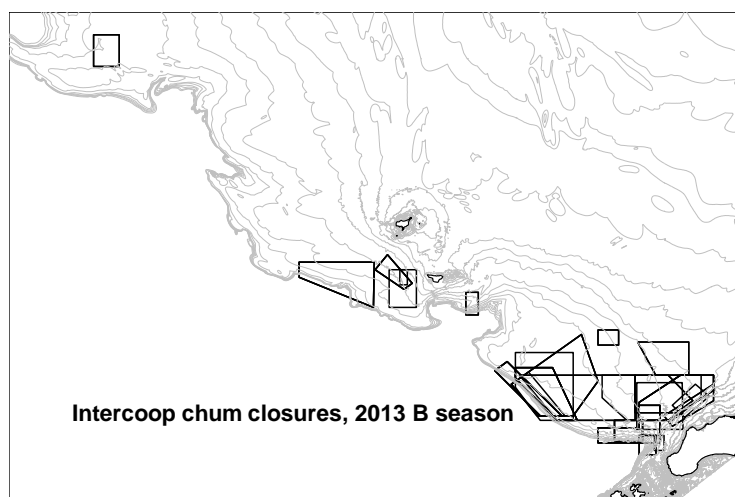


Figure 2a

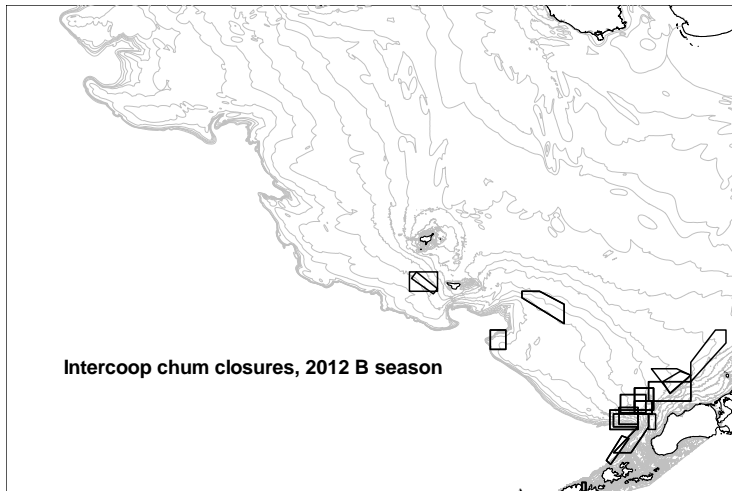


Figure 2b

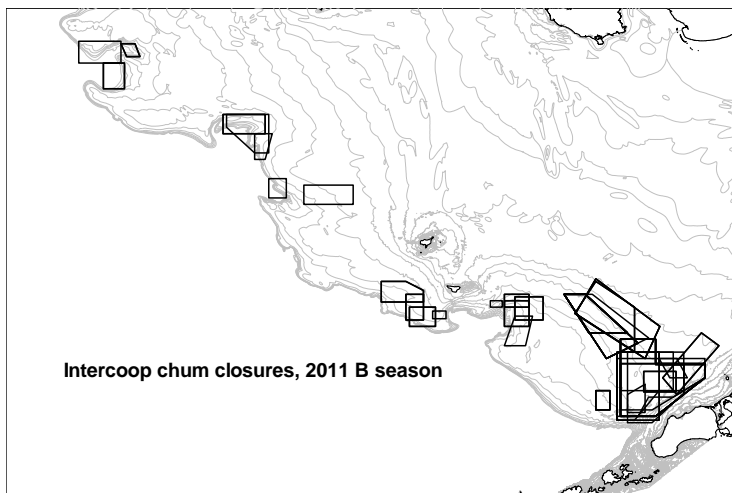


Figure 2c

When encountered in 2013, chum along the western edge of the shelf were very concentrated. The spikes of bycatch that occurred in 2013 were higher than those in 2011 (Figure 3), but were also more effectively mitigated by the closures. This is evident by the presence of fewer and lower peaks throughout 2013, interspersed between very high spikes that triggered the large closures. Pollock were available in more areas throughout the shelf in 2013 compared to 2011 (Figures 5 and 6). This was especially true for catcher vessels that sought to avoid chum issues by fishing further north (Tables 4 and 5). This resulted in generally higher catch rates and much more pollock catch earlier in the season (Figure 4). Vessels were generally able to relocate operations after large closures and were not forced to fish along closure boundaries hoping to catch pollock in lower bycatch areas on the fringe of closures. Also, with higher pollock CPUEs, less time was spent towing, and that also lessens bycatch rates.

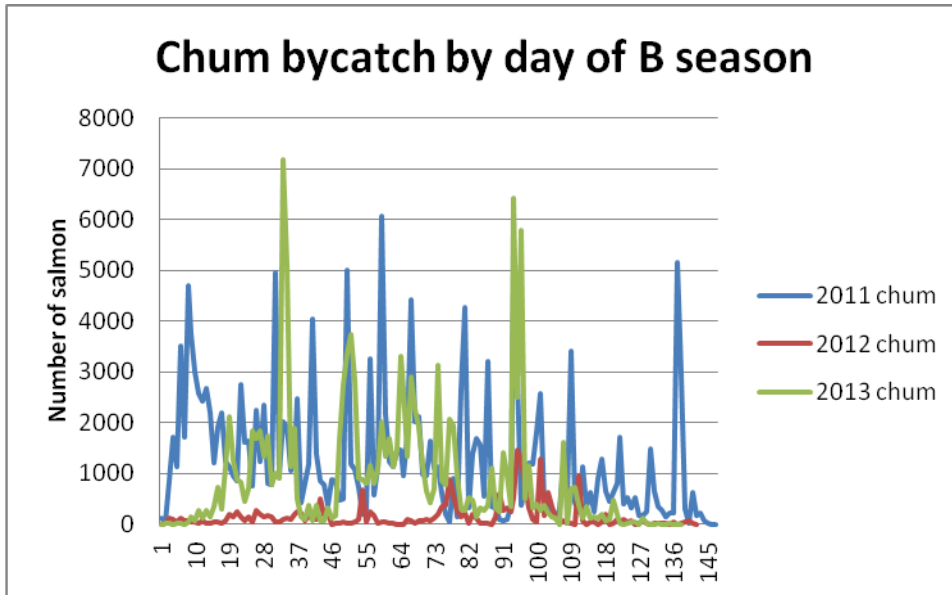


Figure 3. Chum bycatch by day of season, 2011 - 2013

Table 4. Catch from catcher vessels delivering shoreside, by latitude

Latitude	Percent of pollock landed			Cumulative percent of pollock landed		
	2011	2012	2013	2011	2012	2013
53-54	0%	0%	0%	0%	0%	0%
54-55	24%	20%	10%	25%	20%	10%
55-56	39%	17%	39%	63%	38%	49%
56-57	25%	16%	26%	88%	54%	75%
57-58	7%	11%	10%	96%	66%	84%
58-59	4%	15%	8%	100%	81%	92%
59-60	0%	7%	6%	100%	88%	98%
60-62	0%	11%	2%	100%	99%	100%
61-62	0%	1%	0%	100%	100%	100%

Table 5. CPUE of catcher vessels delivering shoreside, by latitude

Latitude	2011	2012	2013
53-54	5.9	5.4	6.9
54-55	8.2	6.8	11.5
55-56	9.3	6.8	10.2
56-57	17.0	18.9	34.8
57-58	17.7	19.4	21.6
58-59	5.6	20.4	27.0
59-60		18.4	26.5
60-62		17.2	

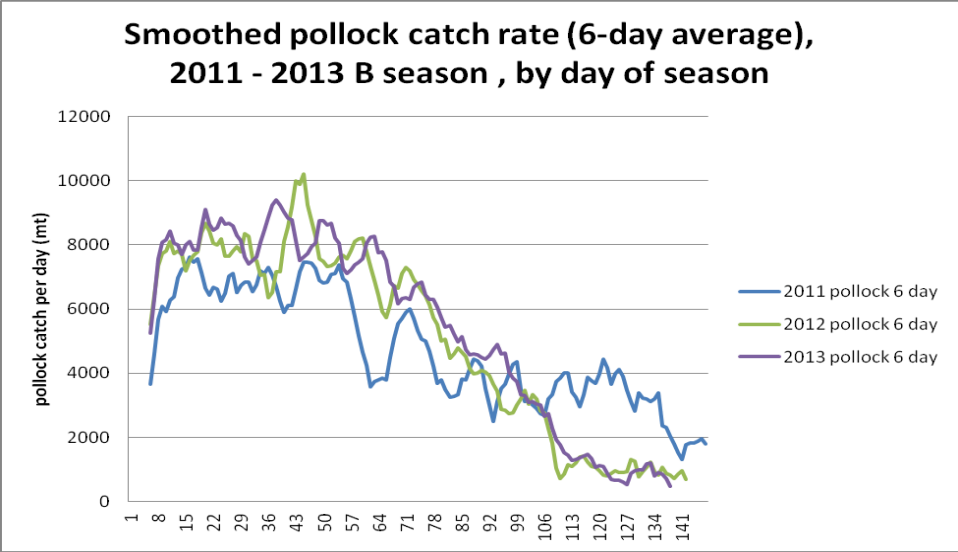


Figure 4. Pollock catch by day of season, 2011 - 2013

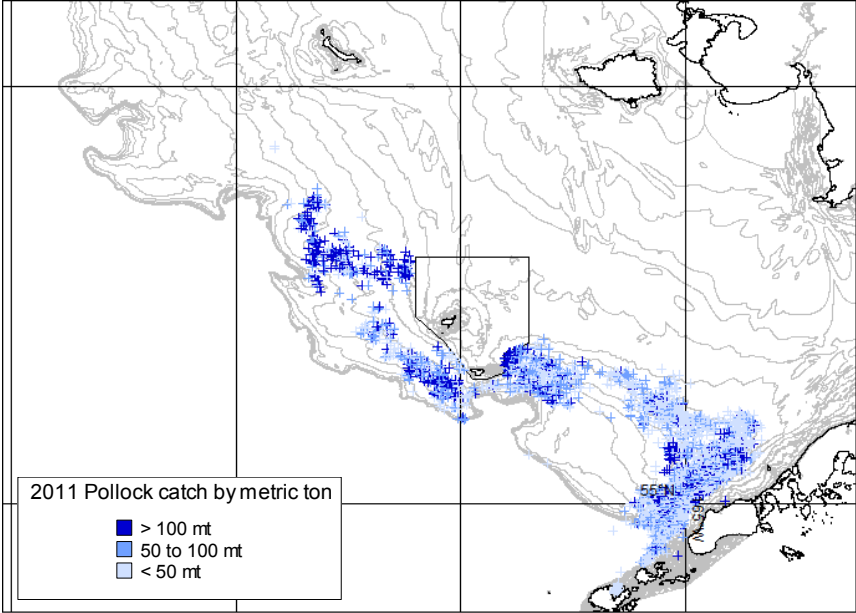


Figure 5. CV pollock catch locations in 2011

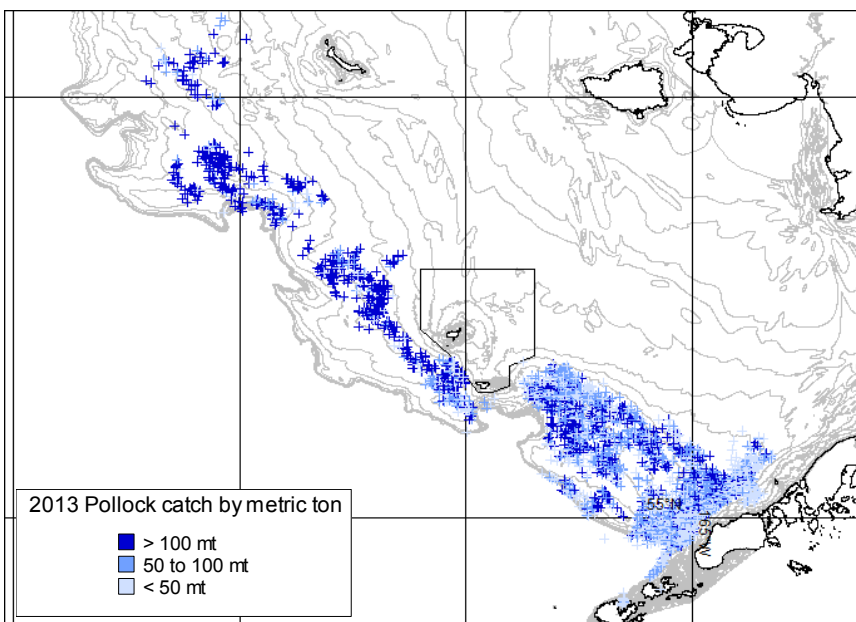


Figure 6. CV pollock catch locations in 2013

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

Table A1. Chum savings by closure

Closure Type	Closure date	Pollock catch (mt) in closures, prior to closure	Chum rate in closure (N/mt)	Chum rate after closure	Displaced pollock (mt)	Actual chum bycatch (N)	Est chum bycatch at closure rate	Chum reduction (estimate - actual)	N Before Hauls	N after Hauls
Chum	0628_2013	88	0.06	0.00	369	0	21	21	1	1
Chum	0702_2013	834	0.47	0.63	1,538	964	723	-241	9	11
Chum	0702_2013	557	0.99	0.00	1,229	6	1,222	1,216	7	1
Chum	0705_2013	1,429	0.51	0.42	3,092	1,286	1,588	302	15	15
Chum	0705_2013	298	0.46	0.53	776	412	360	-52	4	3
Chum	0709_2013	89	0.98	1.43	280	401	275	-126	2	2
Chum	0712_2013	3,840	1.31	0.30	5,794	1,720	7,564	5,844	27	30
Chum	0716_2013	3,916	1.79	0.02	4,386	72	7,864	7,792	25	20
Chum	0719_2013	244	0.95	0.04	1,472	54	1,393	1,339	5	5
Chum	0802_2013	305	1.30	0.35	2,223	785	2,882	2,097	7	9
Chum	0802_2013	4,940	0.44	0.31	7,437	2,311	3,250	939	34	27
Chum	0806_2013	583	0.34	0.26	951	247	320	73	6	5
Chum	0809_2013	1,339	0.50	0.66	3,236	2,129	1,610	-519	17	16
Chum	0816_2013	4,864	1.39	0.12	5,888	736	8,210	7,474	37	35
Chum	0820_2013	434	2.48	0.52	622	325	1,541	1,216	4	3
Chum	0823_2013	77	26.25	0.01	199	2	5,226	5,224	2	1
Chum	0827_2013	1,280	1.24	0.14	1,138	163	1,408	1,245	11	5
Chum	0830_2013	79	0.93	0.82	109	90	102	12	2	2
Chum	0830_2013	145	3.00	0.01	195	2	585	583	1	1
Chum	0910_2013	1,758	0.44	1.85	2,699	4,980	1,196	-3,784	16	11
Chum	0913_2013	48	1.34	0.00	273	0	367	367	1	1
Chum	0913_2013	536	0.36	0.23	1,571	361	565	204	8	7
Chum	0913_2013	2,145	1.71	0.30	2,021	610	3,453	2,843	8	7
Chum	0917_2013	425	0.69	0.20	466	93	323	230	5	4
Chum	0920_2013	15	0.07	1.84	252	464	17	-447	1	2
Chum	1001_2013	69	0.22	0.27	171	46	37	-9	2	2
Chum	1004_2013	72	0.33	0.41	330	135	110	-25	2	1
Chum	1011_2013	460	0.39	0.01	1,101	16	431	415	5	5
Totals		30,869			49,818	18,410	52,641	34,231		

Table A2. Chinook savings by closure

Closure Type	Closure date	Pollock catch (mt) in closures, prior to closure	Chinook rate in closure (N/mt)	Chinook rate after closure	Displaced pollock (mt)	Actual chinook bycatch (N)	Est chinook bycatch at closure rate	Chinook reduction (estimate - actual)	N Before Hauls	N after Hauls	midpoint
Chum	0628_2013	88.02	0.01	0.00	369	0	4	4	1	1	3
Chum	0702_2013	834.09	0.00	0.00	1,538	3	0	-3	9	11	3
Chum	0702_2013	557.16	0.00	0.00	1,229	1	0	-1	7	1	3
Chum	0705_2013	1,429.13	0.00	0.00	3,092	1	6	5	15	15	3
Chum	0705_2013	297.66	0.01	0.00	776	1	5	4	4	3	3
Chum	0709_2013	88.63	0.02	0.01	280	3	6	3	2	2	3
Chum	0712_2013	3,839.50	0.00	0.00	5,794	2	5	3	27	30	3
Chum	0716_2013	3,915.86	0.00	0.00	4,386	4	20	16	25	20	3
Chum	0719_2013	244.03	0.00	0.00	1,472	2	0	-2	5	5	3
Chum	0802_2013	304.76	0.00	0.00	2,223	3	0	-3	7	9	3
Chum	0802_2013	4,939.99	0.01	0.00	7,437	29	41	12	34	27	3
Chum	0806_2013	583.09	0.00	0.01	951	6	3	-3	6	5	3
Chum	0809_2013	1,339.13	0.00	0.00	3,236	16	7	-9	17	16	3
Chum	0816_2013	4,864.21	0.01	0.00	5,888	1	75	74	37	35	3
Chum	0820_2013	434.34	0.01	0.00	622	0	7	7	4	3	3
Chum	0823_2013	77.33	0.00	0.01	199	1	0	-1	2	1	3
Chum	0827_2013	1,279.89	0.00	0.00	1,138	0	4	4	11	5	3
Chum	0830_2013	79.23	0.00	0.01	109	1	0	-1	2	2	3
Chum	0830_2013	145.00	0.01	0.00	195	0	1	1	1	1	3
Chum	0910_2013	1,757.67	0.08	0.01	2,699	17	220	203	16	11	3
Chum	0913_2013	48.48	0.02	0.00	273	0	6	6	1	1	3
Chum	0913_2013	536.42	0.05	0.01	1,571	9	73	64	8	7	3
Chum	0913_2013	2,144.85	0.00	0.00	2,021	4	7	3	8	7	3
Chum	0917_2013	424.55	0.01	0.02	466	9	3	-6	5	4	3
Chum	0920_2013	15.00	0.00	0.40	252	102	0	-102	1	2	3
Chum	1001_2013	68.98	0.35	0.30	171	52	60	8	2	2	3
Chum	1004_2013	71.73	0.22	0.29	330	95	74	-21	2	1	3
Chum	1011_2013	460.12	0.73	0.01	1,101	14	799	785	5	5	3
Totals		30,869			49,818	376	1,427	1,051			

Appendix 2: Dirty 20 list appearances

Number of times each vessel was on a 2013 chum weekly dirty 20 list

Vessel	Number of times on Dirty 20	Vessel	Number of times on Dirty 20	Vessel	Number of times on Dirty 20
ALDEBARAN	5	MARGARET LYN	1	SEATTLE ENTERPRISE	5
ARCTIC EXPLORER	9	MARK I	0	STARBOUND	0
ARCTURUS	5	MISTY DAWN	0	AMERICAN BEAUTY	0
BLUE FOX	0	NORDIC FURY	1	ELIZABETH F	1
BRISTOL EXPLORER	3	OCEAN LEADER	1	PACIFIC CHALLENGER	0
CAPE KIWANDA	4	OCEANIC	0	WALTER N	2
COLUMBIA	5	PACIFIC CHALLENGER	3	ALASKA ROSE	2
DOMINATOR	6	PACIFIC FURY	0	BERING ROSE	2
EXCALIBUR II	3	TRAVELER	1	DESTINATION	1
GLADIATOR	6	VANGUARD	0	GREAT PACIFIC	2
GOLDEN DAWN	7	WESTERAALEN	0	LESLIE LEE	5
GOLDEN PISCES	4	WESTERN DAWN	0	PROGRESS	3
HAZEL LORRAINE	3	AMERICAN EAGLE	7	SEA WOLF	2
LISA MELINDA	0	ANITA J	7	VANGUARD	0
MAJESTY	5	COLLIER BROTHERS	3	WESTERN DAWN	1
MARCY J	2	COMMODORE	5	ALSEA	0
MARGARET LYN	3	GOLD RUSH	5	ARGOSY	0
NORTHERN PATRIOT	7	HICKORY WIND	2	AURIGA	1
NORTHWEST EXPLORER	0	MISS BERDIE	0	AURORA	1
OCEAN EXPLORER	11	NORDIC FURY	1	DEFENDER	2
PACIFIC EXPLORER	9	OCEAN HOPE 3	5	FIERCE ALLEGIANCE	3
PACIFIC RAM	0	POSEIDON	1	GUN-MAR	1
PACIFIC VIKING	6	ROYAL ATLANTIC	8	MORNING STAR	1
PEGASUS	0	STORM PETREL	3	NORDIC STAR	5
PEGGY JO	1	ALASKA OCEAN	0	SEADAWN	5
PERSEVERANCE	0	AMERICAN DYNASTY	1	STARFISH	4
PREDATOR	1	AMERICAN TRIUMPH	0	STARLITE	3
RAVEN	0	ARCTIC FJORD	1	STARWARD	3
ROYAL AMERICAN	8	ISLAND ENTERPRISE	0	ARCTIC WIND	0
SEEKER	0	KODIAK ENTERPRISE	0	BERING DEFENDER	1
SOVEREIGNTY	6	NORTHERN EAGLE	1	CAITLIN ANN	7
TRAVELER	2	NORTHERN HAWK	1	CHELSEA K	3
VIKING EXPLORER	5	NORTHERN JAEGER	0	PACIFIC PRINCE	2
ALEUTIAN CHALLENGER	0	OCEAN ROVER	0	VIKING	5
AMERICAN BEAUTY	0	PACIFIC GLACIER	0	WESTWARD I	3