

Report to the North Pacific Fishery Management Council
on the
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 23 areas to fishing in the 2008 A season and 29 areas during the 2008 B season, based on high bycatch rates for chinook or chum salmon, experienced by vessels working in the area. In addition, during the 2008 A season an area (the “Chinook Conservation Area”) of approximately 735 sq. miles was closed permanently during the 2008 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:

The EFP ran for both the entire pollock A and B seasons in 2008. For the sake of comparison we have included catch and bycatch 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 – 2008.

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

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 – 2008 (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.

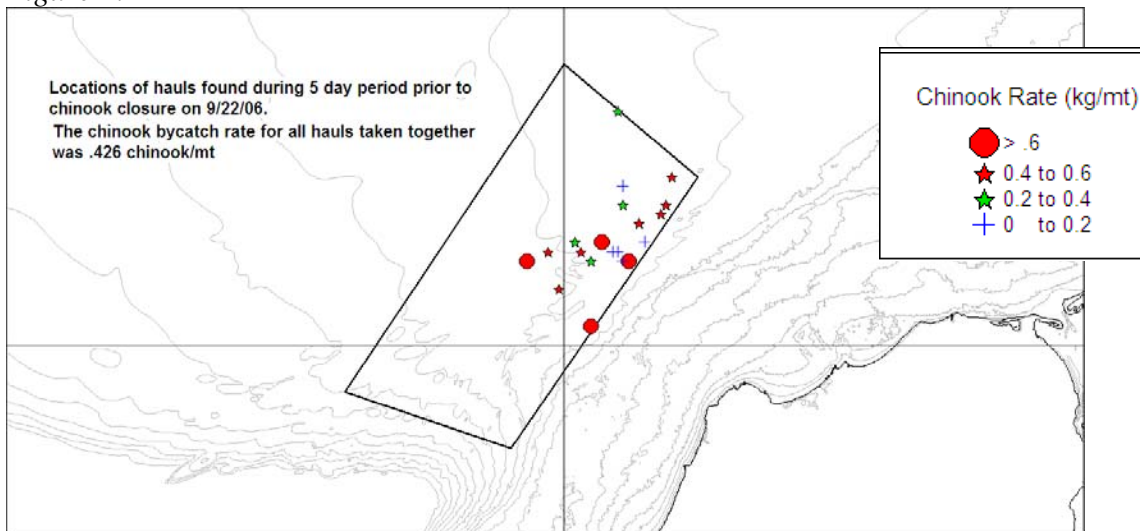
Evaluation of salmon savings.

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, 8th Edition, p 452).

The three maps below illustrate this procedure for the chinook closure of 9/22/06. Figure 1 shows the chinook closure that began on 9/22/06, and includes the locations of observed hauls taken in that area during the 5 day period preceding the closure. After the closure, vessels who had been in that closure area (i.e. those whose hauls are shown in Figure 1) either moved a small distance to the southwest, or made large moves to the northwest (Figures 2 and 3). Lower chinook rates were found in all of the new fishing areas.

Figure 1.



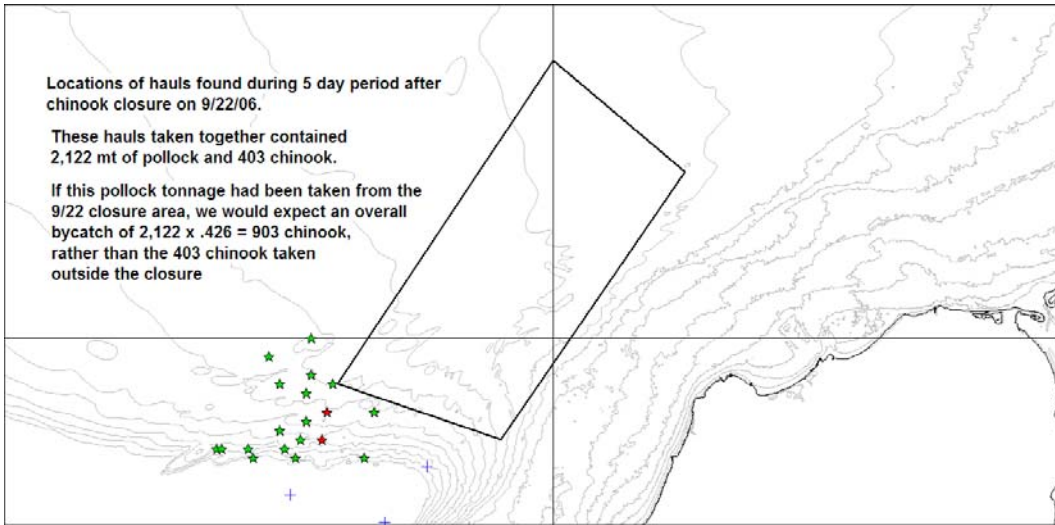


Figure 2. View at the same scale as above of five day fishing activity for vessels in the first map (Fig 2) showing positions that led to a reduction from an expected chinook take of 903 to 403 actual (i.e. counted by observers from the haul positions shown).

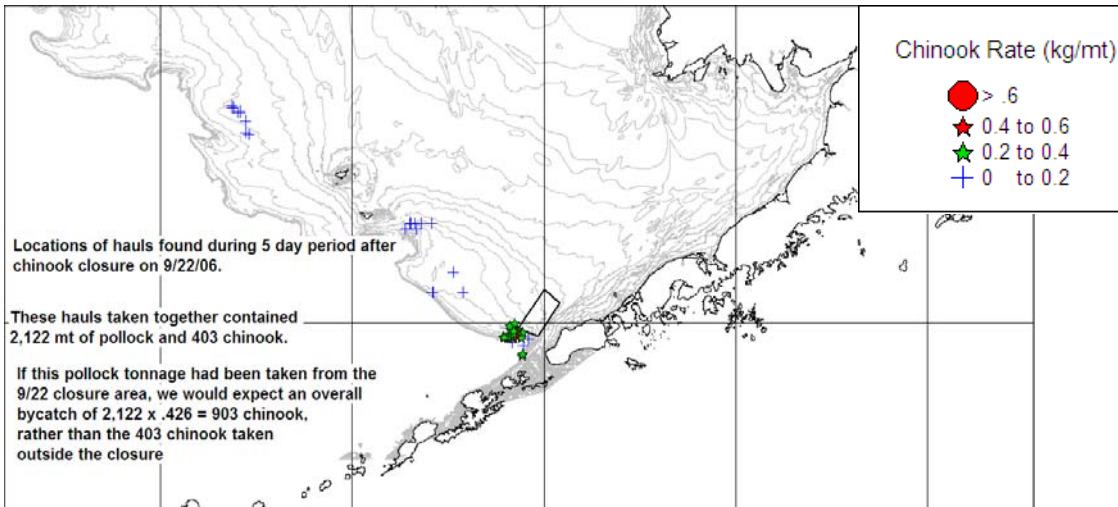


Figure 3. Full view of all hauls from boats in map 1-A for the 5 day period after the start of the 9/22 closure

Avoidance results from the 2008 Intercoop Agreement

The results from these calculations for the 2008 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 23 closures in addition to the full-season Chinook Conservation Area closure. Of these there were 17 closures for which observer data could be found from vessels fishing inside the areas before they closed. (Note that 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). Of these 17, all had post-closure observer information for vessels that fished inside prior to the closure (that is, we had observer information for boats both before and after the closure). Again, 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 45,000 mt of observed groundfish associated with boats that fished inside areas before they were closed, and that also had observers after closures, 4,953 chinook were avoided. This represents a reduction of 77% 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. Twenty-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 7,419 mt of pollock catch that could be tracked. Chinook savings of -533 salmon compared to an expected bycatch of 535 (had boats continued to fish in the closed areas) indicated that closures may have been ineffective at reducing chinook bycatch during the B season. Chum savings of 965 fish from an expected chum take of 1,400 (that would have been taken had vessels continued to fish in the closed areas) indicate a reduction of 69% in expected chum bycatch.

Table 2a. Summary of 2008A Chinook closure effectiveness

A season results	Chinook closures
Pollock catch (after closure)	44,782
Actual chinook bycatch (in moved tows)	1,461
Expected chinook bycatch	6,414
Chinook savings	4,953
% reduction	77%
Actual chum bycatch	65
Expected chum bycatch	194
Chum savings	129
% reduction	66%

Table 2b. Summary of 2008B chinook and chum closure effectiveness

B season results	B Chinook closures	B Chum closures	ombined B closures
Pollock catch (after closure)	3,971	3,448	7,419
Actual chinook bycatch (in moved tows)	1,056	12	1,068
Expected chinook bycatch	470	65	535
Chinook savings	-586	53	-533
% reduction	-125%	82%	-100%
Actual chum bycatch	153	282	435
Expected chum bycatch	350	1,050	1,400
Chum savings	197	768	965
% reduction	56%	73%	69%

Table 2c. Full year chinook and chum closure effectiveness

Full year results (A + B)	A and B closures
Pollock catch (after closure)	52,201
Actual chinook bycatch (in moved tows)	2,529
Expected chinook bycatch	6,949
Chinook savings	4,420
% reduction	64%
Actual chum bycatch	500
Expected chum bycatch	1,594
Chum savings	1,094
% reduction	69%

Compliance/ Enforcement

No violations of the Intercoop closed areas were found during the 2008 season.

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; however, due to difficulties involved auditing new types of data associated with new VMS units introduced in the fishery in 2008, the audit has not been completed. It is anticipated to be available in March 2009 and results can then be obtained from the NPFMC.

Comments on the 2007 A and B seasons and changes to the IC closure system for 2008

The total chinook bycatch for 2009 stands at 17,678, which is the lowest seen since 2000 and the 3rd lowest number since 1991 (Table 1). Avoidance results for the 5 seasons for which rolling hot spots have substituted for time/area closures are shown in Table 3 below. The table below suggests that less pollock harvest was displaced by closures during the 2008A season. While strictly true according to the methods used, this result

does not accurately capture the effect on the fleet because the bycatch program operated in a significantly different manner in 2008. The changes were:

1. Incorporation of the Chinook Conservation Area
2. Fewer changes to closure area by extending a large ‘A’ season closure for three weeks.
3. Increase in potential closure area for the B season.

Table 3. Hot spot closure effectiveness, 2006 - 2008.

Summary item	2006B	2007A	2007 B	2008A	2008B
Pollock harvest moved from closures	41,691	102,592	182,111	44,782	7,419
% of pollock harvest affected	8%	19%	23%	12%	1%
Chinook savings	1,537	35,550	14,576	4,953	-533
% reduction	20%	70%	54%	66%	-100%
Chum savings	15,419		86,410		965
% reduction	67%		70%		73%

In accordance with the agreement, the first closure was put in place on 1/30/08. A map of this closure is shown below in Figure 4. This closure was kept in place through 2/22/08, although additional smaller closures west of 168 W were added to this area on 2/12 and 2/18). Because this large closure (at 825 sq. mi. it was considered the main closure east of 168 W) was kept in place for three weeks, there was very little chance to contrast before and after fishing in the area after the first 5 days the closure was in effect. After 5 days, the original hauls that were observed inside the closure area were not longer available for testing closure effectiveness. After this point, the only hauls that could be recorded inside the area came from Tier 1 or Tier 2 vessels test fishing inside the closure and this resulted in the relatively little bycatch that could be tracked to assess the effectiveness of the closure. However, this repeated test fishing in the closure and associated large percentage of bycatch reduction in the boats that then moved out indicate that leaving this closure in place was justified and effective in reducing bycatch. Although the net result appears to be that little pollock catch was displaced, in fact one of the major ‘A’ season fishing grounds, which repeatedly showed high bycatch rates when tested by vessels from coops in tiers 1 and 2, remained completely closed for 3 weeks. This undoubtedly resulted in significant salmon savings that cannot be captured by the methods used in this analysis.

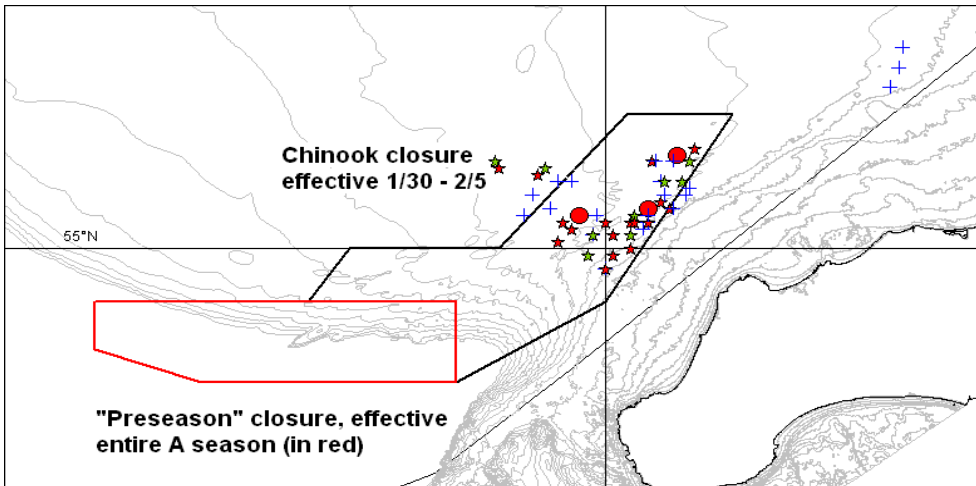
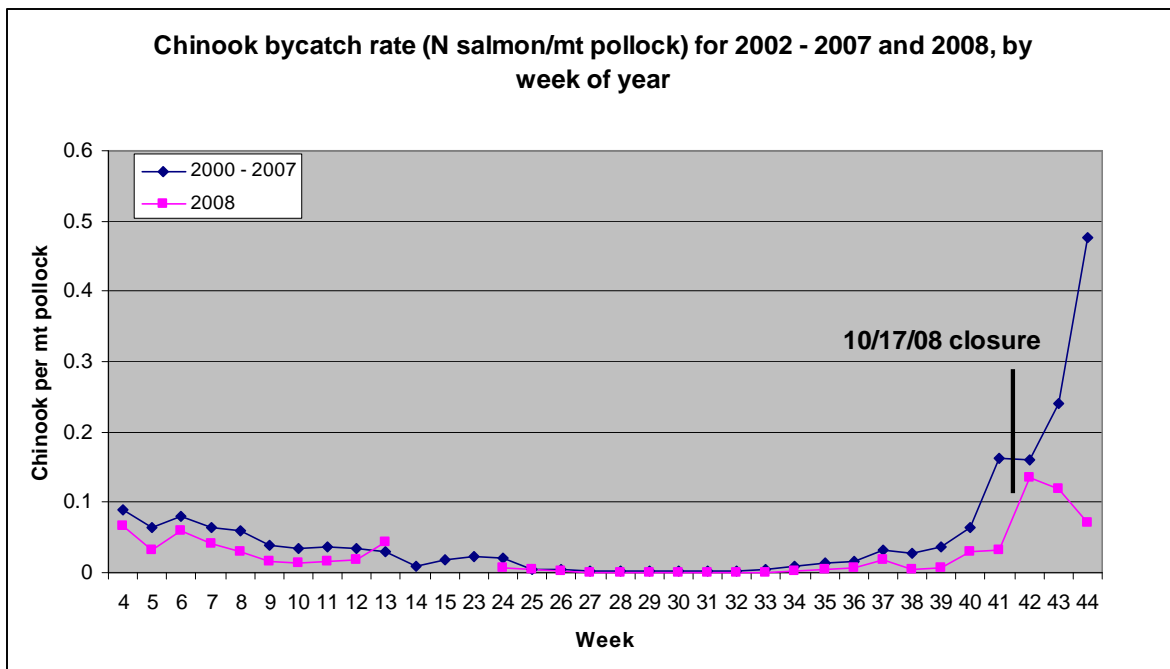


Figure 4. First I/C closure on 1/30. The “preseason” closure is also called the Chinook Conservation Area in the ICA (from IC announcement on 1/31).

Also notable in the results is an apparent loss of salmon as seen in the negative chinook savings in the 2008 ‘B’ season. During the time when chinook historically build in numbers on the grounds, relatively few vessels were fishing, yielding relatively few samples to test our closures, and none of those left fishing were in tier 1 or 2 coops. The IC managers also chose again to extend large closures for most of the duration of the ‘B’ season after chinook started to appear in mid-October.

Figure 5. Historical chinook bycatch rates in October and chinook bycatch rates from 2008.



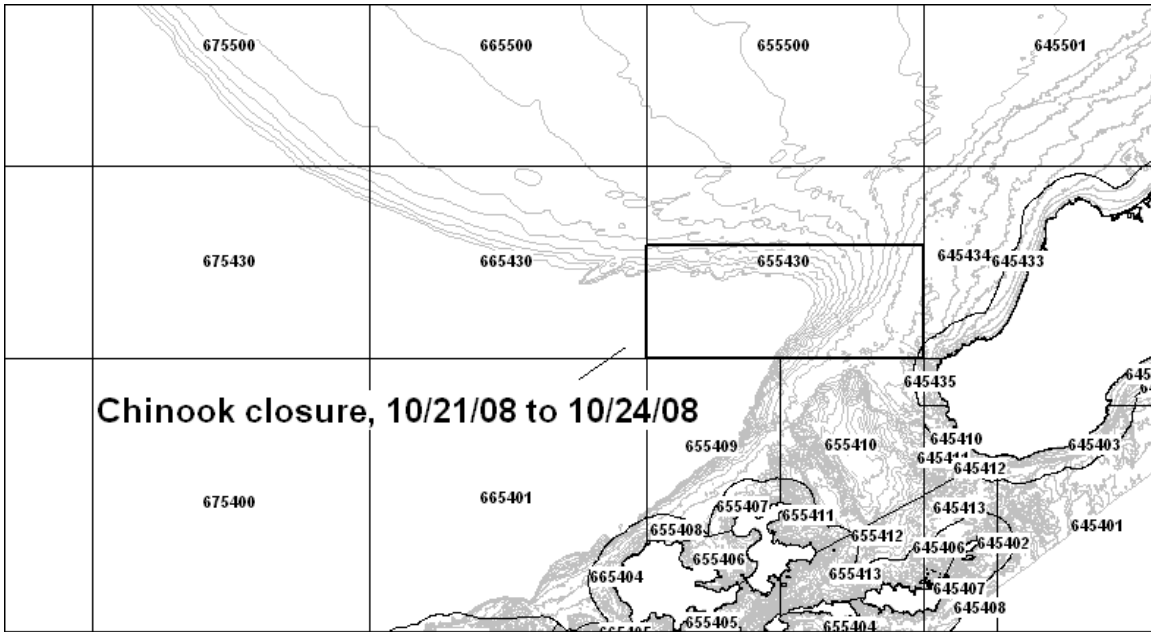


Figure 7. IC closure on 10/21/08

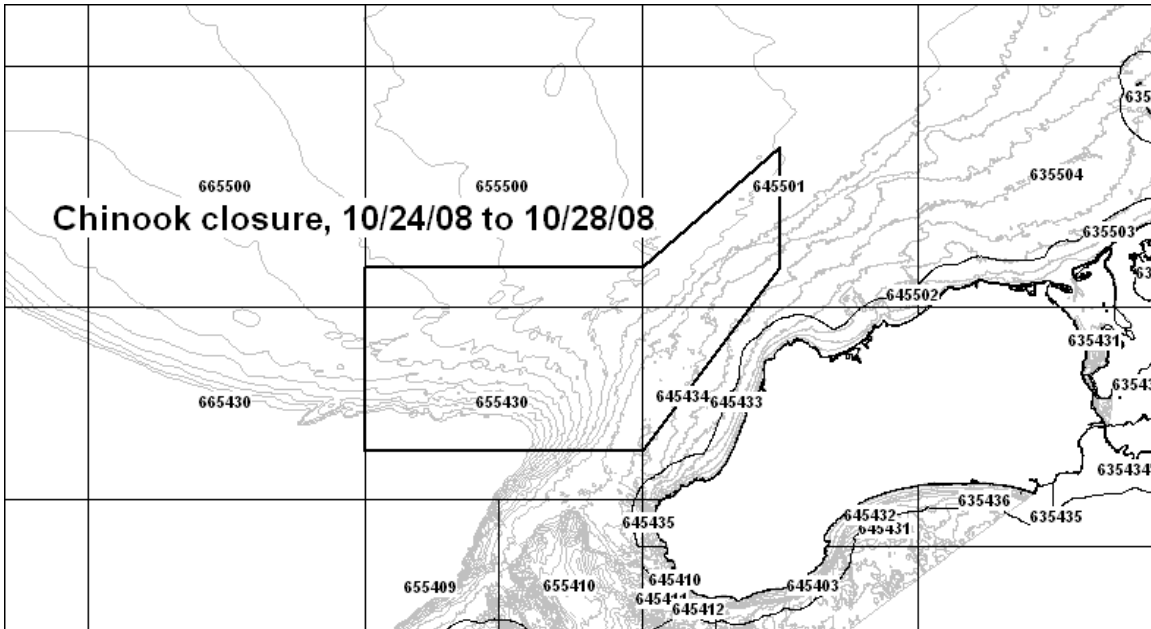
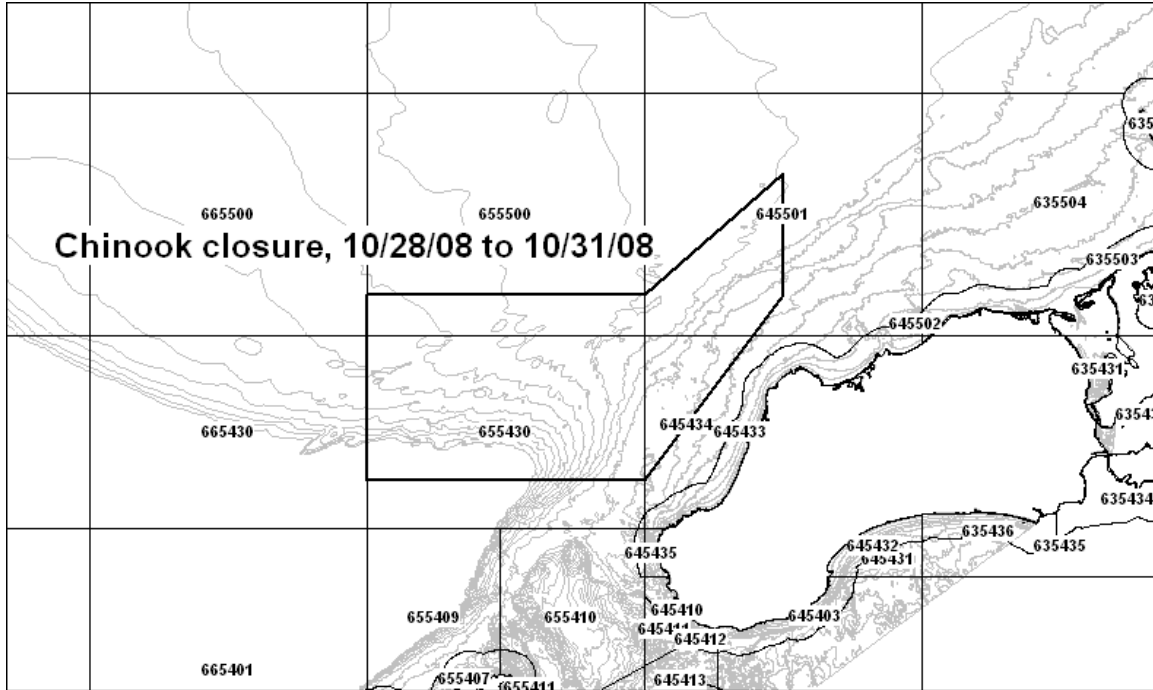


Figure 8. IC closure on 10/24/08

Figure 9. IC closure on 10/28/08



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

Table A1a. Chinook and chum salmon closure effectiveness, 2008 A season

ClosureType	Date	"After" closure pollock catch	"After" closure chinook	Estimated closed-area chinook catch	Chinook reduction (estimate - actual)	Std Err chinook	"After" closure chums	Estimated closed-area chum catch	Chum reduction (estimate - actual)	Std Err chum	Number of samples prior to closure	Number of samples after closure
Chinook	01/30/08	8,480	199	1,310	1,111	298	1	3	2	2	78	104
Chinook	02/01/08	3,284	210	709	499	655	2	2	0	4	15	44
Chinook	02/05/08	1,989	238	255	17	112	0	0	0	0	12	31
Chinook	02/08/08	4,308	171	775	604	390	1	0	-1	0	15	54
Chinook	02/12/08	242	0	0	0	0	0	0	0	0	1	4
Chinook	02/12/08	5,500	169	1,419	1,250	198	31	25	-6	14	58	87
Chinook	02/15/08	2,827	80	340	260	140	23	88	65	65	6	41
Chinook	02/15/08	1,639	101	94	-7	35	0	0	0	0	16	23
Chinook	02/19/08	5,208	28	432	403	118	0	72	72	47	11	55
Chinook	02/19/08	649	21	13	-8	4	0	0	0	0	8	11
Chinook	02/22/08	4,435	109	542	433	78	4	0	-4	0	14	49
Chinook	02/22/08	1,622	8	239	231	27	0	0	0	0	17	15
Chinook	02/26/08	103	5	0	-5	0	0	0	0	0	1	2
Chinook	02/26/08	911	2	77	75	52	0	0	0	0	6	13
Chinook	02/29/08	1,513	18	166	148	37	0	0	0	0	5	15
Chinook	02/29/08	228	5	10	5	1	0	0	0	0	2	3
Chinook	03/11/08	1,844	97	35	-62	18	3	4	1	5	17	29
Totals		44,782	1,461	6,414	4,953	2,163	65	194	129	138	282	580

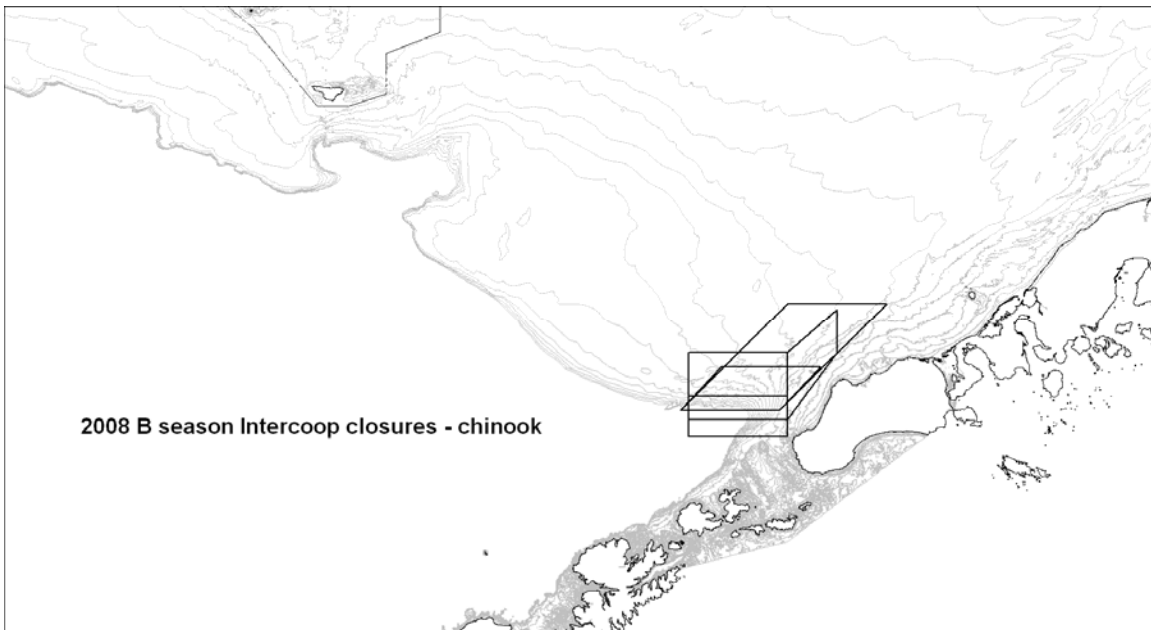
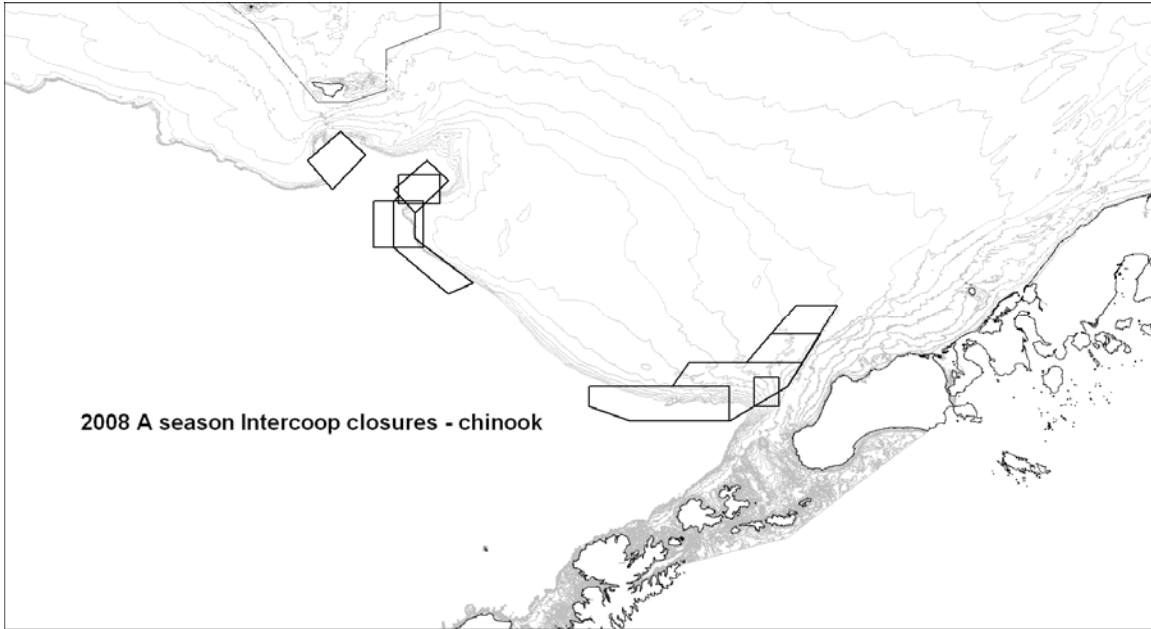
Table A1b. Chinook and chum salmon closure effectiveness, 2008 B season, by chinook closure.

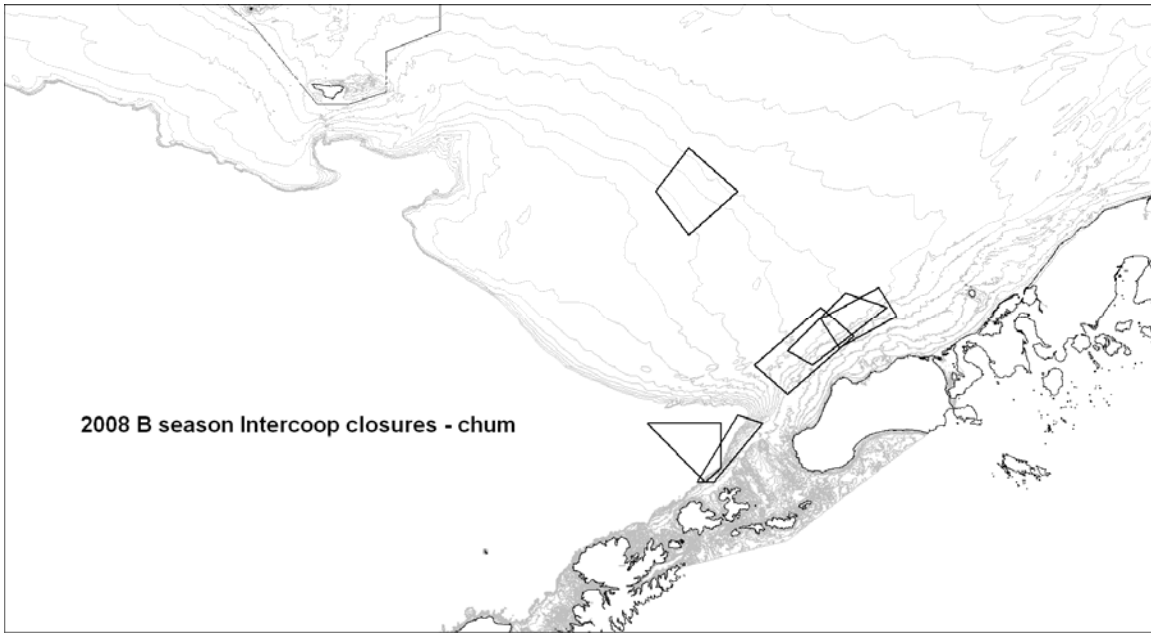
ClosureType	Date	"After" closure pollock catch	"After" closure chinook	Estimated closed-area chinook catch	Chinook reduction (estimate - actual)	Std Err chinook	"After" closure chums	Estimated closed-area chum catch	Chum reduction (estimate - actual)	Std Err chum	Number of samples prior to closure	Number of samples after closure
Chinook	09/16/08	1,523	22	102	80	27	112	257	145	63	23	32
Chinook	09/19/08	121	0	9	9	2	0	26	26	4	7	2
Chinook	10/10/08	589	98	46	-52	42	10	37	27	49	4	11
Chinook	10/14/08	71	12	0	-12	0	0	0	0	0	1	2
Chinook	10/17/08	1,466	522	219	-303	65	26	25	-1	12	20	26
Chinook	10/21/08	65	36	15	-21	5	1	1	0	0	8	1
Chinook	10/24/08	136	366	79	-287	67	4	3	-1	4	4	6
Totals		3,971	1,056	470	-586	207	153	350	197	132	67	80

Table A1c. Chinook and chum salmon closure effectiveness, 2008 B season, by chum closure.

ClosureType	Date	"After" closure pollock catch	"After" closure chinook	Estimated closed-area chinook catch	Chinook reduction (estimate - actual)	Std Err chinook	"After" closure chums	Estimated closed-area chum catch	Chum reduction (estimate - actual)	Std Err chum	Number of samples prior to closure	Number of samples after closure
Chum	07/08/08	112	0	0	0	0	14	0	-14	0	1	4
Chum	07/11/08	200	1	0	-1	0	31	0	-31	0	1	5
Chum	07/15/08	1,424	2	8	6	9	216	182	-34	112	14	31
Chum	07/22/08	291	0	0	0	0	1	41	40	6	2	6
Chum	08/15/08	163	0	0	0	0	0	4	4	0	2	5
Chum	08/29/08	215	3	1	-2	1	8	210	202	108	3	7
Chum	09/09/08	140	6	0	-6	0	12	515	503	0	1	5
Chum	09/12/08	6	0	0	0	0	0	21	21	0	1	1
Chum	10/03/08	899	0	55	55	8	0	77	77	8	12	15
Totals		3,448	12	65	53	18	282	1,050	768	234	37	79

Appendix 2: Charts showing closures





Appendix 3: Dirty 20 list appearances

Number of times each vessel was on a 2008 Chinook weekly dirty 20 list

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

Number of times each vessel was on a 2008 chum weekly dirty 20 list

ALASKA OCEAN	0	GOLD RUSH	3	PACIFIC EXPLORER	7
ALASKA ROSE	3	GOLDEN DAWN	5	PACIFIC FURY	1
ALASKAN COMMAND	2	GOLDEN PISCES	7	PACIFIC GLACIER	0
ALDEBARAN	6	GREAT PACIFIC	2	PACIFIC PRINCE	1
ALEUTIAN CHALLE	0	GUN-MAR	1	PACIFIC RAM	0
ALSEA	2	HALF MOON BAY	3	PACIFIC VIKING	10
ALYESKA	0	HAZEL LORRAINE	1	PEGASUS	0
AMERICAN BEAUTY	6	HICKORY WIND	4	PEGGY JO	0
AMERICAN DYNASTY	0	HIGHLAND LIGHT	0	PERSEVERANCE	0
AMERICAN EAGLE	7	INTREPID EXPLORER	0	POSEIDON	8
AMERICAN TRIUMPH	0	ISLAND ENTERPRISE	2	PREDATOR	0
ANITA J	5	KODIAK ENTERPRISE	1	PROGRESS	3
ARCTIC EXPLORER	7	LESLIE LEE	5	RAVEN	0
ARCTIC FJORD	0	LISA MELINDA	0	ROYAL AMERICAN	7
ARCTIC STORM	0	MAJESTY	12	ROYAL ATLANTIC	2
ARCTIC WIND	1	MAR-GUN	0	SEA WOLF	4
ARCTURUS	9	MARCY J	3	SEADAWN	4
ARGOSY	2	MARGARET LYN	2	SEATTLE ENTERPRISE	1
AURIGA	3	MARK I	0	SEEKER	6
AURORA	2	MISTY DAWN	2	SOVEREIGNTY	6
BERING ROSE	1	MORNING STAR	1	STARBOUND	0
BRISTOL EXPLORER	6	NORDIC FURY	3	STARFISH	1
CAITLIN ANN	1	NORDIC STAR	4	STARLITE	1
CALIF HORIZON	0	NORTHERN EAGLE	2	STARWARD	0
CAPE KIWANDA	4	NORTHERN GLACIER	2	STORM PETREL	6
CHELSEA K	2	NORTHERN HAWK	1	SUNSET BAY	0
COLUMBIA	9	NORTHERN JAEGER	0	TRAVELER	0
COMMODORE	8	NORTHERN PATRIOT	8	VANGUARD	3
DEFENDER	3	NORTHWEST EXPLOR	3	VESTERAALEN	0
DESTINATION	2	OCEAN EXPLORER	4	VIKING	0
DOMINATOR	6	OCEAN HOPE 3	3	VIKING EXPLORER	12
ELIZABETH F	1	OCEAN LEADER	0	WALTER N	1
EXCALIBUR II	4	OCEAN ROVER	1	WESTERN DAWN	3
FIERCE ALLEGIANCE	0	OCEANIC	1	WESTWARD I	0
GLADIATOR	5	PACIFIC CHALLENGER	0		