Appendix 1 – Revised Section 3.3 Estimating Chinook salmon adult equivalent bycatch

3.3 Estimating Chinook salmon adult equivalent bycatch

To understand impacts on Chinook populations, a method was developed to estimate how the different bycatch numbers would propagate to adult equivalent spawning salmon. Estimating the adult equivalent bycatch is necessary because not all salmon caught as bycatch in the pollock fishery would otherwise have survived to return to their spawning streams. Currently, accurate in-season Chinook salmon abundance levels are unavailable. Therefore, this analysis relies on analyses of historical data. Developing regulations designed to reduce the impact of bycatch requires methods that appropriately assess the impact of bycatch on the various salmon populations. A stochastic "adult equivalence" model was developed, which accounts for sources of uncertainty. The model is an extension of Witherell et al.'s (2002) evaluation, and relaxes a number of that study's assumptions.

Adult-equivalency (AEQ) of the bycatch was estimated to translate how different hard caps may affect Chinook salmon stocks. This is distinguished from the annual bycatch numbers that are recorded by observers each year for management purposes. The AEQ bycatch applies the extensive observer datasets on the length frequencies of Chinook salmon found as bycatch and converts these to the ages of the bycaught salmon, appropriately accounting for the time of year that catch occurred. Coupled with information on the proportion of salmon that return to different river systems at various ages, the bycatch-at-age data is used to pro-rate, for any given year, how bycatch affects future potential spawning runs of salmon.

Evaluating impacts to specific stocks was done by using historical scale-pattern analysis (Myers et al.1984, Myers and Rogers 1988, Myers et al. 2003) and preliminary genetics studies from samples collected in 2005, 2006 and 2007 (Seeb et al. 2008). While sample collection issues exist (as described in section 3.3.2) and different methodologies were employed (scale pattern analyses and genetic analyses), these stock estimates nonetheless provide similar overall proportions of between 54-60% for western Alaska. The consistency of these results from these different methodologies lends credibility to this general estimate. Where possible, historical run sizes were contrasted with AEQ mortality arising from the observed pollock fishery Chinook bycatch to river of origin.

3.3.1 Estimating Chinook salmon catch-at-age

In order to appropriately account for the impact of salmon bycatch in the groundfish fisheries, it is desirable to correct for the age composition of the bycatch. For example, the impact on salmon populations of a bycatch level of 10,000 adult mature salmon is likely greater than the impact of catching 10,000 salmon that have just emerged from rivers and only a portion of which are expected to return for spawning in several years time. Hence, estimation of the age composition of the bycatch (and the measure of uncertainty) is critical. The method follows an expanded version of Kimura (1989) and modified by Dorn (1992). Length at age data are used to construct age-length keys for each stratum and sex. These keys are then applied to randomly sampled catch-at-length frequency data. The stratum-specific age composition estimates are then weighted by the catch within each stratum to arrive at an overall age composition for each year.

The modification from Kimura's (1989) approach was simply to apply a two-stage bootstrap scheme to obtain variance estimates. In the first stage, for a given year, sampled tows were drawn with replacement from all tows from which salmon were measured. In the second stage, given the collection of tows from the first stage, individual fish measurements were resampled with replacement. All stratum-specific information was carried with each record. For the length-age data, a separate but similar two-stage bootstrap process was done. Once samples of lengths and ages were obtained, age-length keys were constructed and applied to the catch-weighted length frequencies to compute age composition estimates. This process was repeated 100 times, and the results stored to obtain a distribution of both length and age composition.

Three years of length-at-age data are available from Myers et al. (2003). These data are based on salmon scale samples collected by the NMFS groundfish observer program from 1997-1999 and processed for age determination (and river of origin) by scientists at the University of Washington (Table 3-1). The bycatch in the A-season is dominated by age 5 fish (51%) with ages 6 and 7 Chinook representing 15% on average while ages 3 and 4 are 35%.

Table 3-1 Summary of Chinook salmon bycatch age data from Myers et al (2003) used to construct age-length keys for this analysis.

Year	A	B	Total
1997	842	756	1,598
1998	873	826	1,699
1999	645	566	1,211
Total	2,360	2,148	4,508

Extensive salmon bycatch length frequency data are available from the NMFS groundfish observer program since 1991 (Table 3-2). The age data were used to construct age length keys for nine spatio-temporal strata (one area for winter, two areas for summer-fall, for each of three fishery sectors). Each stratum was weighted by the NMFS Alaska Region estimates of salmon bycatch (Table 3-3). To the extent possible, sex-specific age-length keys within each stratum were created and where cells were missing, a “global” sex-specific age-length key was used. The global key was simply computed over all strata within the same season. For years other than 1997-1999, a combined-year age-length key was used (based on all of the 1997-1999 data). This method was selected in favor of simple (but less objective) length frequency slicing based on evaluations of using the combined key on the individual years and comparing age-composition estimates with the estimates derived using annual age-length keys. The reason that the differences were minor is partially due to the fact that there are only a few age classes caught as bycatch, and these are fairly well determined by their length at-age distribution (Fig. 3-1).

The bootstrapped distributions of salmon length frequencies are shown in Fig. 3-2 and the resulting application of bootstrapped age-length keys is shown in Fig. 3-3 with mean values given in (Table 3-4). For modeling purposes, it’s necessary to track the estimated numbers of salmon caught by age and season (Table 3-5). The estimates catch-age uncertainty (Table 3-6) were propagated through the analysis and includes covariance structure (e.g., as illustrated in Fig. 3-4).

Table 3-2 The number of Chinook salmon measured for lengths in the pollock fishery by season (A and B), area (NW=east of 170°W; SE=west of 170°W), and sector (S=shorebased catcher vessels, M=mothership operations, CP=catcher-processors). *Source: NMFS Alaska Fisheries Science Center observer data.*

Season Area Sector	**A All S**	**A All M**	**A All CP**	**B NW S**	**B NW M**	**B NW CP**	**B SE S**	**B SE M**	**B SE CP**	**Total**
1991	2,227	302	2,569		25	87	221	10	47	5,488
1992	2,305	733	889	2	4	14	1,314	21	673	5,955
1993	1,929	349	370	1	11	172	298	255	677	4,062
1994	4,756	408	986	3	93	276	781	203	275	7,781
1995	1,209	264	851		8	31	457	247	305	3,372
1996	9,447	976	2,798		17	161	5,658	1,721	493	21,271
1997	3,498	423	910	12	303	839	12,126	370	129	18,610
1998	3,124	451	1,329		38	191	8,277	2,446	1,277	17,133
1999	1,934	120	1,073		1	627	1,467	97	503	5,822
2000	608	17	1,388	4	40	179	564	3	120	2,923
2001	4,360	268	3,583		25	1,816	1,597	291	1,667	13,607
2002	5,587	850	3,011		23	114	5,353	520	494	15,952
2003	9,328	1,000	5,379	258	290	1,290	4,420	348	467	22,780
2004	7,247	594	3,514	1,352	557	1,153	8,884	137	606	24,044
2005	9,237	694	3,998	4,081	244	1,610	10,336	45	79	30,324
2006	17,875	1,574	5,716	685	66	480	12,757	3	82	39,238
2007	16,008	1,802	9,012	881	590	1,986	21,725	2	801	52,807

Table 3-3 Chinook salmon bycatch in the pollock fishery by season (A and B), area (NW=east of 170°W; SE=west of 170°W), and sector (S=shorebased catcher vessels, M=mothership operations, CP=catcher-processors). *Source: NMFS Alaska Region, Juneau.*

Season Area Sector	**A All S**	**A All M**	**A All CP**	**B NW S**	**B NW M**	**B NW CP**	**B SE S**	**B SE M**	**B SE CP**	**Total**
1991	10,192	9,001	17,645	0	48	318	1,667	103	79	39,054
1992	6,725	4,057	12,631	0	26	187	1,604	1,739	6,702	33,672
1993	3,017	3,529	8,869	29	157	7,158	2,585	6,500	4,775	36,619
1994	8,346	1,790	17,149	0	121	771	1,206	452	2,055	31,890
1995	2,040	971	5,971		35	77	781	632	2,896	13,403
1996	15,228	5,481	15,276		113	908	9,944	6,208	2,315	55,472
1997	4,954	1,561	3,832	43	2,143	4,172	22,508	3,559	1,549	44,320
1998	4,334	4,284	6,500		309	511	27,218	6,052	2,037	51,244
1999	3,103	554	2,694	13	12	1,284	2,649	362	1,306	11,978
2000	878	19	2,525	4	230	286	714	23	282	4,961
2001	8,555	1,664	8,264	0	162	5,346	3,779	1,157	4,517	33,444
2002	10,336	1,976	9,481	0	38	211	9,560	1,717	1,175	34,495
2003	16,488	2,892	14,428	764	864	2,962	6,437	1,076	1,081	46,993
2004	12,376	2,092	9,492	2,530	1,573	2,844	21,171	503	1,445	54,028
2005	14,097	2,111	11,421	8,873	744	4,175	26,113	144	168	67,847
2006	36,039	5,408	17,306	936	175	1,373	21,718	25	178	83,159
2007	35,458	5,860	27,943	1,672	3,494	4,923	40,079	50	2,225	121,704

Table 3-4 Calendar year age-specific Chinook salmon bycatch estimates based on the mean of 100 bootstrap samples of available length and age data. Age-length keys for 1997-1999 were based on Myers et al. (2003) data split by year while for all other years, a combined-year age-length key was used.

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Total
1991	5,624	15,901	13,486	3,445	347	38,802
1992	5,136	9,528	14,538	3,972	421	33,596
1993	2,815	16,565	12,992	3,673	401	36,446
1994	849	5,300	20,533	4,744	392	31,817
1995	498	3,895	4,827	3,796	367	13,382
1996	5,091	18,590	26,202	5,062	421	55,366
1997	5,855	23,972	7,233	5,710	397	43,167
1998	19,168	16,169	11,751	2,514	615	50,216
1999	870	5,343	4,424	1,098	21	11,757
2000	662	1,923	1,800	518	34	4,939
2001	6,512	12,365	11,948	1,994	190	33,009
2002	3,843	13,893	10,655	5,469	489	34,349
2003	5,703	16,723	20,124	3,791	298	46,639
2004	6,935	23,740	18,371	4,406	405	53,858
2005	10,466	30,717	21,886	4,339	304	67,711
2006	11,835	31,455	32,452	6,636	490	82,869
2007	16,174	66,024	33,286	5,579	357	121,419

Table 3-5 Age specific Chinook salmon bycatch estimates by season and calendar age based on the mean of 100 bootstrap samples of available length and age data.

Year/season	Age 3	Age 4	Age 5	Age 6	Age 7	Total
1991	**5,624**	**15,901**	**13,486**	**3,445**	**347**	**38,802**
A	5,406	14,764	12,841	3,270	313	36,593
B	218	1,137	646	174	34	2,209
1992	**5,136**	**9,528**	**14,538**	**3,972**	**421**	**33,596**
A	1,017	4,633	13,498	3,798	408	23,355
B	4,119	4,895	1,040	174	13	10,241
1993	**2,815**	**16,565**	**12,992**	**3,673**	**401**	**36,446**
A	1,248	3,654	7,397	2,778	290	15,368
B	1,567	12,910	5,595	895	111	21,078
1994	**849**	**5,300**	**20,533**	**4,744**	**392**	**31,817**
A	436	3,519	18,726	4,211	326	27,218
B	413	1,781	1,807	533	66	4,599
1995	**498**	**3,895**	**4,827**	**3,796**	**367**	**13,382**
A	262	1,009	3,838	3,534	327	8,969
B	236	2,885	989	263	40	4,413
1996	**5,091**	**18,590**	**26,202**	**5,062**	**421**	**55,366**
A	863	7,187	23,118	4,431	349	35,947
B	4,228	11,403	3,085	632	71	19,418
1997	**5,855**	**23,972**	**7,233**	**5,710**	**397**	**43,167**
A	456	2,013	3,595	3,899	271	10,234
B	5,399	21,958	3,638	1,811	126	32,933
1998	**19,168**	**16,169**	**11,751**	**2,514**	**615**	**50,216**
A	1,466	2,254	8,639	2,079	512	14,950
B	17,703	13,915	3,112	435	103	35,266
1999	**870**	**5,343**	**4,424**	**1,098**	**21**	**11,757**
A	511	1,639	3,151	898	18	6,217
B	360	3,704	1,272	200	3	5,540
2000	**662**	**1,923**	**1,800**	**518**	**34**	**4,939**
A	365	1,167	1,406	453	26	3,416
B	298	757	395	66	8	1,522
2001	**6,512**	**12,365**	**11,948**	**1,994**	**190**	**33,009**
A	2,840	3,458	9,831	1,798	171	18,098
B	3,672	8,907	2,117	196	19	14,910
2002	**3,843**	**13,893**	**10,655**	**5,469**	**489**	**34,349**
A	1,580	5,063	9,234	5,328	478	21,683
B	2,263	8,830	1,421	141	11	12,666
2003	**5,703**	**16,723**	**20,124**	**3,791**	**298**	**46,639**
A	2,941	9,408	17,411	3,437	267	33,464
B	2,763	7,315	2,713	354	31	13,175
2004	**6,935**	**23,740**	**18,371**	**4,406**	**405**	**53,858**
A	1,111	5,520	13,090	3,763	354	23,838
B	5,824	18,220	5,282	643	51	30,020
2005	**10,466**	**30,717**	**21,886**	**4,339**	**304**	**67,711**
A	1,407	6,993	15,563	3,361	226	27,550
B	9,059	23,724	6,323	978	78	40,161
2006	**11,835**	**31,455**	**32,452**	**6,636**	**490**	**82,869**
A	3,604	17,574	30,447	6,404	465	58,494
B	8,231	13,881	2,005	232	25	24,374
2007	**16,174**	**66,024**	**33,286**	**5,579**	**357**	**121,419**
A	5,791	29,269	28,648	5,059	317	69,084
B	10,384	36,755	4,638	520	40	52,336

Table 3-6 Estimates of coefficients of variation of Chinook salmon bycatch estimates by season and calendar age based on the mean of 100 bootstrap samples of available length and age data.

A season	Age 3	Age 4	Age 5	Age 6	Age 7
1991	14%	6%	6%	10%	31%
1992	20%	9%	4%	9%	27%
1993	22%	9%	5%	10%	37%
1994	27%	12%	3%	10%	30%
1995	25%	12%	5%	6%	22%
1996	19%	6%	2%	9%	21%
1997	35%	12%	6%	7%	28%
1998	16%	9%	3%	10%	23%
1999	19%	10%	5%	11%	91%
2000	25%	9%	6%	9%	27%
2001	10%	6%	3%	7%	22%
2002	15%	6%	3%	4%	16%
2003	14%	6%	3%	8%	21%
2004	15%	6%	2%	5%	20%
2005	18%	6%	3%	7%	23%
2006	17%	5%	3%	7%	22%
2007	22%	5%	4%	8%	25%
B season	**Age 3**	**Age 4**	**Age 5**	**Age 6**	**Age 7**
1991	23%	8%	12%	27%	67%
1992	9%	9%	25%	69%	87%
1993	19%	4%	9%	20%	65%
1994	17%	6%	6%	14%	27%
1995	21%	5%	12%	23%	48%
1996	6%	3%	7%	11%	29%
1997	12%	3%	10%	12%	39%
1998	5%	6%	9%	23%	36%
1999	16%	3%	8%	22%	149%
2000	9%	5%	8%	25%	49%
2001	7%	3%	8%	20%	52%
2002	6%	2%	8%	17%	43%
2003	8%	3%	5%	15%	32%
2004	6%	2%	5%	12%	30%
2005	5%	2%	5%	10%	23%
2006	4%	3%	8%	15%	33%
2007	6%	2%	7%	13%	28%

3.3.2 Estimating genetic composition of Chinook salmon bycatch

This section provides an overview the best available information used to determine the region or river of origin of the Chinook salmon caught as bycatch in the Bering Sea pollock fishery. The AEQ model uses genetic estimates of Chinook salmon taken as bycatch in the Bering Sea pollock fishery to determine where the AEQ Chinook salmon would have returned. To determine the stock composition mixtures of Chinook salmon in the Bering Sea, the model uses best available genetics analysis from ADF&G scientists (Templin et al. 2008). Genetic stock identification estimated the relative composition of 15 regional groups in the bycatch samples. For this analysis, estimates are provided for the 8 largest contributing groups and the remaining components were combined into the ‘other’ category, resulting in 9 stock groups (Table 3-7).

A scale pattern analysis completed in 2003 estimated age and stock composition of Chinook salmon in the 1997-1999 BSAI groundfish fishery bycatch samples from the NMFS Groundfish Observer Program database (Myers et al. 2003). Results indicated that bycatch samples were dominated by younger (age 1.2) fish in summer and older (age 1.3 and 1.4) fish in winter (Myers et al. 2003). The stock structure was dominated by western Alaskan stocks, with the estimated overall stock composition of 56% western Alaska, 31% Cook Inlet, 8% Southeast Alaska-British Columbia and 5% Russia. Here "western Alaska" included the Yukon River, Kuskokwim River, and Bristol Bay (Nushagak and Togiak) rivers. Within this aggregate grouping, the proportion of the sub-regional stock composition estimates averaged 40% Yukon River, 34% Bristol Bay and 26% Kuskokwim Chinook salmon Table 3-8Myers et al. 2003).

For comparison against previous estimates, results from Myers and Rogers (1988) scale pattern analysis of bycatch samples from 1979-1982 (collected by U.S. foreign fishery observes on foreign or joint venture vessels in the Bering Sea EEZ) indicated that stock structure was dominated by western Alaskan stocks with estimated overall stock composition of 60% western Alaska, 17% South Central, 13% Asia (Russia) and 9% Southeast Alaska-British Columbia. Within the aggregated western Alaskan group, 17% were of Yukon River salmon, with 29% Bristol Bay and 24% Kuskokwim salmon.

As indicated in Myers et al. (2003), the origin of salmon also differs by season. In the winter, age-1.4 western Alaskan Chinook were primarily from the subregions of the Yukon and Kuskokwim. In the fall, results indicated that age-1.2 western Alaskan Chinook were from subregions of the Kuskokwim and Bristol Bay with a large component of Cook Inlet Chinook salmon stocks as well.

The proportions of western Alaskan subregional stocks (Yukon, Kuskokwim and Bristol Bay) appear to vary considerably with factors such as brood year, time and area (Myers et al. 2003). Yukon River Chinook are often the dominant stock in winter while Bristol Bay, Cook Inlet and other Gulf of Alaska stocks are often the dominant stocks in the eastern BSAI in the fall (Myers et al. 2003). Additional studies from high seas tagging results as well as scale pattern analyses from Japanese driftnet fishery in the Bering Sea indicate that in the summer immature western Alaskan Chinook are distributed further west in the Bering Sea than other North American stocks. For the scale-pattern analyses, freshwater-type (age 0.1, 0.2, etc) Chinook were omitted. Although the proportion of these samples were relatively small, the extent that Chinook bycatch could be attributed to southern stocks where this type is more common (e.g., from the Columbia River) may be underestimated in the Myers et al. (2003) analysis.

More recent analyses of bycatch samples are underway (Templin et al. 2008). For purposes of evaluation of impacts of alternatives on individual river systems, the most recent estimates (Seeb et al. 2008) are the main reference for evaluating the impact of bycatch on the 9 sets of river systems. These more recent estimates were chosen since they are most representative of the timeframe analyzed. Earlier work presented in Myers et al. (2003) had a different resolution to stock composition and was from samples covering an earlier period.

To illustrate the influence of bycatch temporal and spatial variability regarding bycatch stock composition, retrospective analyses were performed using the available genetics data collected from 2005-2007. We acknowledge that this assumption (i.e., constant stock composition within season-area strata) may be poor, especially for years beyond this period. For the main impact analysis the time period was selected to be from 2003-2007 which overlaps with the sample collection period and may reduce concerns about mis-matches between the sampling period for genetics work and the application period for impact analysis.

Scientists at ADF&G developed a DNA baseline to resolve the stock composition mixtures of Chinook salmon in the Bering Sea (Templin et al. 2008). This baseline includes 24,100 individuals sampled from over 175 rivers from the Kamchatka Peninsula, Russia, to the central Valley in California (see Table 3-7 for list of rivers).

The Templin et al. (2008) genetic stock identification (GSI) study used classification criteria whereby the accuracy of resolution to region-of-origin must be greater than or equal to 90%. This analysis identified 15 regional groups for reporting results and for purposes of this analysis these were combined into nine stock units. The nine stock units are: Pacific Northwest (PNW, comprised of baseline stocks across BC, OR, WA and CA); Coastal western Alaska (Coast WAK comprised of the lower Yukon, the Kuskokwim River and Bristol Bay (Nushagak) river systems); Cook Inlet; Middle Yukon; Northern Alaska Peninsula (NAK Penin); Russia; Southeast and Transboundary River Systems (TBR); and Upper Yukon, while minor components in the bycatch are combined into the “other” category for clarity. Consistent with previous observations regarding the seasonal and regional differences in stock origin of bycatch samples (Myers et al. 2003), bycatch samples were stratified by year, season and region (Table 3-9).

The Seeb et al. (2008) study analyzed samples taken from the bycatch during the 2005 B season, both A and B seasons during 2006, and a sample from an excluder test fishery during the 2007 A season. Where possible, the genetics samples from the bycatch were segregated by major groundfish bycatch regions. Effectively, this entailed a single region for the entire fishery during winter (which is typically concentrated in space to the region east of 170°W) and two regions during the summer, a NW region (west of 170°W) and a southeast region (east of 170°W). The genetic sampling distribution varies considerably by season and region compared to the level of bycatch (as reported by the NMFS Alaska Region, Table 3-3).

The samples used in the Seeb et al. (2008) analysis were obtained opportunistically for a study to evaluate using scales and other tissues as collected by the NMFS observer program for genetic sampling. Unfortunately, during this study, the collected samples failed to cover the bycatch in groundfish fisheries in a comprehensive manner. For example, in 2005 most sampling was completed prior to the month (October) when most of the bycatch occurred (Fig. 3-5). To account for these sampling issues we computed a weighted average of the samples over years within regions and seasons. The 2005 B-season stock composition results were given one third of the weight since sampling effort was low during October of that year (relative to the bycatch) while the 2006 B-season stock composition data was given two-thirds of the weight in simulating stock apportionments. For the A season, the 2007 data (collected from a limited number of tows) were given one fifth the weight while the 2006 was weighted 4 times that value.

Once these mean stock composition estimates (and associated uncertainties) were obtained, it was necessary to apply the stratum-specific stock composition levels (Table 3-11) to the stratum specific bycatch totals to arrive at an annual stock-specific bycatch level for application in the model (Fig. 3-6). An important feature of this analysis is that the bycatch amounts by location and season were used explicitly for the estimates of the relative contribution of bycatch from different salmon regions (e.g. Fig. 3-8). This is also an important distinction from previous studies (e.g. Myers et al, 2003) which assumed that the stock identification samples were proportional to the season and area specific bycatch over all years.

For the purposes of assigning the bycatch to region of origin, the level of uncertainty is important to characterize. While there are many approaches to implement assignment uncertainty, the method chosen here assumes that the stratified stock composition estimates are unbiased and that the assignment uncertainty based on a classification algorithm (Seeb et al. 2008; Table 3-9) adequately represents the uncertainty (i.e., the estimates and their standard errors are used to propagate this component of uncertainty). Inter-annual variability is introduced two ways: (1) by accounting for inter-annual variability in bycatch among strata; and (2) by using the point estimates (and errors) from the data (Table

3-11) over the different years (2005-2007) while weighting appropriately for the sampling intensity. The procedure for introducing variability in regional stock assignments of bycatch followed a Monte Carlo procedure with the point estimates and their variances used to simulate beta distributed random variables (which have the desirable property of being bounded by 0.0 and 1.0) and applied to the catch weightings (for the summer/fall (B) season) where areas are disaggregated. Areas were combined for the winter fishery since the period of bycatch by the fishery is shorter and from a more restricted area.

Application of GSI to estimate the composition of the bycatch by reporting region suggests that, if the goal is to provide estimates on the stock composition of the bycatch, there is a need to adjust for the magnitude of bycatch occurring within substrata (e.g., east and west of 170°W during the B season, top panels of Fig. 3-6). Applying the stock composition results presented in Table 3-11 over different years and weighted by catch gives stratified proportions that have similar characteristics to the raw genetics data (Table 3-9). Importantly, these stratified stock composition estimates can be applied to bycatch levels in other years which will result in overall annual differences in bycatch proportions by salmon stock region. These simulations can be characterized graphically in a way that shows the covariance structure among regional stock composition estimates. This application extrapolates beyond the current analysis of these genetic data however and additional investigation of the temporal variation in stock composition is recommended.

The preliminary stock composition estimates for this more recent study based on the genetics are shown broken out by regions, year and season for the 9 stock units identified (Table 3-9). Accounting for sampling variability, the mean stock compositions by strata, and mean apportionments of the bycatch to stock (region) of origins by area and season of the pollock fishery are shown in Table 3-11.

While stock units differ from previous studies in levels of aggregation, results for western Alaskan aggregate river systems (e.g., AYK region) are similar to the scale-pattern study presented by Myers and Rogers (1988) and Myers et al. (2003; Table 3-12). The three studies indicate similarities in overall estimates of stock composition by river system even though aggregation levels, years of samples, and methodologies differ (Table 3-12). However, comparisons of stock composition estimates from other areas are more variable. For example the contribution from Cook Inlet stocks ranges from 4%-31% amongst studies while Russian stocks vary from 2%-14% (Table 3-12). There is particular variation amongst the two scale patterns studies (Myers and Rogers 1988 and Myers et al. 2003) for these other stocks. Due to this apparent variability the impact analysis focused mainly on the AYK stocks, in particular the Yukon, Kuskokwim and Bristol Bay river systems. Impacts are characterized in aggregate for these stocks, in aggregate for Coastal western Alaska grouping (which includes the lower Yukon, Kuskokwim and other minor stocks) as well as by individual river system. Impacts are reported in general for stocks such as Cook Inlet, aggregate Pacific Northwest, and Russia but discussions of these are limited due to the uncertainty.

For this impact analysis, it was desirable to provide some estimates of AEQ specific to the following western Alaska river systems individually: Yukon, Kuskokwim, Bristol Bay. The recent genetics study treated these stocks as a group. Thus, for purposes of discussion in this analysis, the AEQ results for the Coastal western Alaska stock grouping were combined with results for the middle and upper Yukon and the resulting aggregate broken out to individual river systems using the proportions estimated by Myers et al. (2003). Doing so provides a way to make rough comparisons of bycatch impacts (AEQ) and river system specific measures of run size, harvest, and escapement. However, impacts presented in this analysis are characterized to the extent possible within the limitations of the data. AEQ estimation was employed to provide some information on the relative impacts by genetic groupings and in conjunction with scale pattern estimates by western Alaskan river systems. As noted previously, these data are limited by their uncertainty thus extensions of these results beyond the scope of the data was carefully avoided.

Use of total run-size estimates for impact analysis by river system or in aggregate is problematic. As described in sections 5.2 assessment of total run size and escapement by river system is highly variable between systems. Some river systems in the WAK region lack total run or escapement estimates. As such, combining available estimates to determine an "aggregate total run" for WAK is inappropriate due to magnification of errors as well as masking the uncertainties and data limitations associated with individual river system estimates. Use of individual run estimates to compare with bycatch AEQ is also complicated by the caveats associated with the stock composition estimates. AEQ estimation to river of origin is used to estimate the relative changes under various cap scenarios. These estimates are also uncertain and that uncertainty increases with further extrapolations historically and to finer resolutions. Therefore, judgements with respect to detailed impacts were avoided, especially in cases where it would require interpretations beyond the extent of the data. Finally, impact rates by river system (i.e., explicit comparison of AEQ with run size for runs) would presume analyses on productivity thresholds about river systems that are beyond the scope of this analysis.

Additional funding and research focus is being directed towards both collection of samples from the EBS trawl fishery for Chinook salmon species as well as the related genetic analyses to estimate stock composition of the bycatch. Additional information on the status of these data collections and analysis programs will be forthcoming.

Table 3-7 Chinook baseline collections used in analysis of bycatch mixtures for genetics studies (from Templin et al. 2008).

No.	Region	Location	Years	N
1	Russia	Bistraya River	1998	94
2		Bolshaya River	1998, 2002	77
3		Kamchatka River (Late)	1997, 1998	119
4		Pakhatcha River	2002	50
5	Coast W AK (Norton Sound)	Pilgrim River	2005, 2006	82
6		Unalakleet River	2005	82
7		Golsovia River	2005, 2006	111
8	Coast W AK (Lower Yukon)	Andreafsky River	2002, 2003	236
9		Anvik River	2002	95
10		Gisasa River	2001	188
11		Tozitna River	2002, 2003	290
12	Middle Yukon	Henshaw Creek	2001	147
13		S. Fork Koyuk	2003	56
14		Kantishna River	2005	187
15		Chena River	2001	193
16		Salcha River	2005	188
17		Beaver Creek	1997	100
18		Chandalar River	2002, 2003, 2004	175
19		Sheenjek River	2002, 2004, 2006	51
20	Upper Yukon	Chandindu River	2000, 2001, 2003	247
21		Klondike River	1995, 2001, 2003	79
22		Stewart River	1997	99
23		Mayo River	1992, 1997, 2003	197
24		Blind River	2003	134
25		Pelly River	1996, 1997	140
26		Little Salmon River	1987, 1997	100
27		Big Salmon River	1987, 1997	117
28		Tatchun Creek	1987, 1996, 1997, 2002, 2003	369
29		Nordenskiold River	2003	55
30		Nisutlin River	19,871,997	56
31		Takhini River	1997, 2002, 2003	162
32		Whitehorse Hatchery	1985, 1987, 1997	242
33	Coast W AK (Kuskokwim)	Goodnews River	1993, 2005, 2006	368
34		Arolik River	2005	147
35		Kanektok River	1992, 1993, 2005	244
36		Eek River	2002, 2005	173
37		Kwethluk River	2001	96
38		Kisaralik River	2001, 2005	191
39		Tuluksak River	1993, 1994, 2005	195
40		Aniak River	2002, 2005, 2006	336
41		George River	2002, 2005	191
42		Kogrukluk River	1992, 1993, 2005	149
43		Stony River	1994	93
44		Cheeneetnuk River	2002, 2006	117
45		Gagaryah River	2006	190
46		Takotna River	1994, 2005	176
47	Upper Kuskokwim	Tatlawiksuk River	2002, 2005	191
48		Salmon River (Pitka Fork)	1995	96
49	Coast W AK (Bristol Bay)	Togiak River	1993, 1994	159
50		Nushagak River	1992, 1993	57
51		Mulchatna River	1994	97
52		Stuyahok River	1993, 1994	87
53		Naknek River	1995, 2004	110
54		Big Creek	2004	66
55		King Salmon River	2006	131
56	N. AK Peninsula	Meshik River	2006	42
57		Milky River	2006	67
58		Nelson River	2006	95
59		Black Hills Creek	2006	51
60		Steelhead Creek	2006	93
61	S. AK Peninsula	Chignik River	1995, 2006	75
62		Ayakulik River	1993, 2006	136
63		Karluk River	1993, 2006	140

Table 3-7 (continued) Chinook baseline collections used in analysis of bycatch mixtures for genetics studies (from Templin et al. 2008).

No.	Region	Location	Years	N
64	Cook Inlet	Deshka River	1995, 2005	251
65		Deception Creek	1991	67
66		Willow Creek	2005	73
67		Prairie Creek	1995	52
68		Talachulitna River	1995	58
69		Crescent Creek	2006	164
70		Juneau Creek	2005, 2006	119
71		Killey Creek	2005, 2006	266
72		Benjamin Creek	2005, 2006	205
73		Funny River	2005, 2006	220
74		Slikok Creek	2005	95
75		Kenai River (mainstem)	2003, 2004, 2006	302
76		Crooked Creek	1992, 2005	306
77		Kasilof River	2005	321
78		Anchor River	2006	200
79		Ninilchik River	2006	162
80	Upper Copper River	Indian River	2004, 2005	50
81		Bone Creek	2004, 2005	78
82		E. Fork Chistochina River	2004	145
83		Otter Creek	2005	128
84		Sinona Creek	2004, 2005	157
85	Lower Copper River	Gulkana River	2004	211
86		Mendeltna Creek	2004	144
87		Kiana Creek	2004	75
88		Manker Creek	2004, 2005	62
89		Tonsina River	2004, 2005	75
90		Tebay River	2004, 2005, 2006	68
91	Northern SE AK	Situk River	1988, 1990, 1991, 1992	143
92		Big Boulder Creek	1992, 1993, 1995, 2004	178
93		Tahini River	1992, 2004	169
94		Tahini River (LMH) Pullen Creek Hatchery	2005	83
95		Kelsall River	2004	96
96		King Salmon River	1989, 1990, 1993	144
97	Coast SE AK	King Creek	2003	143
98		Chickamin River	1990, 2003	56
99		Chickamin River - Little Port Walter	1993, 2005	126
100		Chickamin River - Whitman Lake Hatchery	1992, 1998, 2005	331
101		Humpy Creek	2003	94
102		Butler Creek	2004	95
103		Clear Creek	1989, 2003, 2004	166
104		Cripple Creek	1988, 2003	143
105		Genes Creek	1989, 2003, 2004	95
106		Kerr Creek	2003, 2004	151
107		Unuk River - Little Port Walter	2005	150
108		Unuk River - Deer Mountain Hatchery	1992, 1994	147
109		Keta River	1989, 2003	144
110		Blossom River	2004	95
111	Andrew Cr	Andrews Creek	1989, 2004	152
112		Crystal Lake Hatchery	1992, 1994, 2005	397
113		Medvejie Hatchery	1998, 2005	273
114		Hidden Falls Hatchery	1994, 1998	155
115		Macaulay Hatchery	2005	94
116	TBR Taku	Klukshu River	1989, 1990	174
117		Kowatua River	1989, 1990	144
118		Little Tatsemeanie River	1989, 1990, 2005	144
119		Upper Nahlin River	1989, 1990	130
120		Nakina River	1989, 1990	141
121		Dudidontu River	2005	86
122		Tahltan River	1989	95

Table 3-7 (continued) Chinook baseline collections used in analysis of bycatch mixtures for genetics studies (from Templin et al. 2008).

No.	Region	Location	Years	N
123	BC/WA/OR	Kateen River	2005	96
124		Damdochax Creek	1996	65
125		Kincolith Creek	1996	115
126		Kwinageese Creek	1996	73
127		Oweegee Creek	1996	81
128		Babine Creek	1996	167
129		Bulkley River	1999	91
130		Sustut	2001	130
131		Ecstall River	2001, 2002	86
132		Lower Kalum	2001	142
133		Lower Atnarko	1996	144
134		Kitimat	1997	141
135		Wannock	1996	144
136		Klinaklini	1997	83
137		Nanaimo	2002	95
138		Porteau Cove	2003	154
139		Conuma River	1997, 1998	110
140		Marble Creek	1996, 1999, 2000	144
141		Nitinat River	1996	104
142		Robertson Creek	1996, 2003	106
143		Sarita	1997, 2001	160
144		Big Qualicum River	1996	144
145		Quinsam River	1996	127
146		Morkill River	2001	154
147		Salmon River	1997	94
148		Swift	1996	163
149		Torpy River	2001	105
150		Chilko	1995, 1996, 1999, 2002	246
151		Nechako River	1996	121
152		Quesnel River	1996	144
153		Stuart	1997	161
154		Clearwater River	1997	153
155		Louis Creek	2001	179
156		Lower Adams	1996	46
157		Lower Thompson River	2001	100
158		Middle Shuswap	1986, 1997	144
159		Birkenhead Creek	1997, 1999, 2002, 2003	93
160		Harrison	2002	96
161		Makah National Fish Hatchery	2001, 2003	94
162		Forks	2005	150
163		Upper Skagit River	2006	93
164		Soos Creek Hatchery	2004	119
165		Lyons Ferry Hatchery	2002, 2003	191
166		Hanford Reach	2000, 2004, 2006	191
167		Lower Deschutes River	2002	96
168		Lower Kalama	2001	95
169		Carson Stock - Mid and Upper Columbia spring	2001	96
170		McKenzie - Willamette River	2004	95
171		Alsea	2004	93
172		Siuslaw	2001	95
173		Klamath	1990, 2006	52
174		Butte Creek	2003	96
175		Eel River	2000, 2001	88
176		Sacramento River - winter run	2005	95

Table 3-8 Maximum likelihood estimates (MLE) of the western Alaska subregional (Yukon, Kuskokwim, and Bristol Bay) stock composition of Chinook salmon in incidental catches by U.S. commercial groundfish fisheries in the eastern Bering Sea portion of the U.S. exclusive economic zone in 1997-1999 (from Myers et al. 2003). The estimates are summarized by (a) brood year (BY) 1991-1995 and (b) for the fishery area east of 170°W by fishery season, year, and age group. Fishery season: fall = July-December, winter = January-June. Numbers in parentheses are 95% confidence intervals (CI) derived from 1000 bootstrap runs (random sampling with replacement). An estimate of zero without a confidence interval indicates that the stock was not present and the data were re-analyzed without those baseline groups. Percentages represented by 0.0 are small numbers, less than 0.05 but greater than zero. Dashes indicate that no baseline data were available for that regional stock group.

Sample			Kamchatka		Yukon		Kuskokwim		Bristol Bay		Cook Inlet		SE Alaska		British Columbia	
Description	**Age(s)**	**N**	**MLE**	**(95% CI)**	**MLE**	**(95% CI)**	**MLE**	**(95% CI)**	**MLE**	**(95% CI)**	**MLE**	**(95% CI)**	**MLE**	**(95% CI)**	**MLE**	**(95% CI)**
(a) Summary by brood year:																
BY91	1.4-1.5	373	4.1	(0.0-10.0)	37.2	(17.2-56.1)	27.0	(4.4-47.4)	4.2	(0.0-12.1)	27.5	(18.3-37.5)	-	-	0	
BY92	1.3-1.5	530	6.0	(2.5-9.6)	29.7	(16.6-39.9)	5.5	(0.0-22.1)	21.0	(12.4-29.2)	33.4	(24.6-41.3)	-	-	4.4	(1.5-8.2)
BY93	1.2-1.4	1111	5.9	(3.0-9.5)	12.7	(4.0-23.2)	24.5	(11.4-37.3)	17.9	(11.1-25.3)	28.5	(21.8-34.1)	8.5	(5.7-11.2)	2.0	(0.0-4.1)
BY94	1.1-1.3	762	0		20.2	(12.3-30.4)	0		41.7	(33.9-49.7)	30.0	(20.5-37.5)	8.1	(5.1-11.8)	-	-
BY95	1.1-1.2	481	4.4	(0.1-10.2)	12.2	(4.2-20.7)	15.8	(6.7-24.1)	10.6	(0.0-28.1)	41.9	(28.4-52.4)	15.1	(9.2-22.0)	-	-
(b) Summary for the fishery area east of 170°W by fishery season, year, and age group:																
Fall 1998	1.1	134	0		6.1	(0-15.0)	3.9	(0-9.4)	0		57.7	(37.1-74.8)	32.3	(16.5-47.9)	-	-
Fall 1997	1.2	286	3.8	(0.0-8.7)	0.0	(0-13)	16.1	(1.7-25.4)	17.6	(9.5-28.5)	49.2	(37.1-58.5)	8.5	(3.7-14.5)	4.8	(0.2-10.5)
Fall 1998	1.2	249	0		10.2	(2.5-21.4)	0		41.4	(29.8-51.6)	38.7	(25.5-50.2)	9.7	(4.7-16.2)	-	-
Fall 1999	1.2	222	5.8	(0.0-12.9)	13.0	(2.0-25.3)	18.3	(5.6-33.3)	27.2	(4.5-50.2)	31.3	(16.3-44.7)	4.4	(0.0-9.8)	-	-
Winter 1997	1.3	240	5.7	(1.5-10.4)	24.6	(10.2-38.3)	5.9	(0.0-27.6)	28.0	(14.5-39.5)	30.0	(18.2-40.8)	-	-	5.8	(1.3-11.3)
Winter 1998	1.3	428	4.6	(0.8-9.7)	23.1	(11.2-36.9)	22.8	(6.7-38.8)	17.3	(8.8-27.3)	18.2	(9.9-26.4)	11.9	(7.5-16.3)	2.1	(0-6.3)
Winter 1999	1.3	279	0		34.7	(23.0-47.4)	0		37.6	(27.4-47.8)	18.5	(8.9-28.3)	9.2	(5.3-13.5)	-	-
Winter 1997	1.4	327	3.9	(0.0-9.7)	34.6	(14.8-53.7)	28.4	(6.8-48.9)	4.7	(0.0-13.4)	28.4	20.3-34.6)	-	-	0	
Winter 1998	1.4	178	10.9	(3.8-18.6)	35.0	(17.4-49.9)	12.8	(0.0-34.9)	10.1	(0.0-21.0)	31.2	(19.3-41.9)	-	-	0	
Winter 1999	1.4	122	22.0	(9.1-36.4)	9.9	(0.0-31.2)	32.2	(8.6-50)	2.9	(0-13.5)	28.2	(11.2-44.4)	4.8	(0-10.4)	0	

Table 3-9 ADF&G preliminary estimates of stock composition based on genetic samples stratified by year, season, and region (SE=east of 170°W, NW=west of 170°W). Standard errors of the estimates are shown in parentheses and were used to evaluate uncertainty of stock composition. Source: Seeb et al. 2008.

Year / Season / Area	PNW	Coast W AK	Cook Inlet	Middle Yukon	N AK Penin	Russia	TBR	Upper Yukon	Other
2005 B SE	45.3%	34.2%	5.3%	0.2%	8.8%	0.6%	3.3%	0.0%	2.4%
N = 313	(0.032)	(0.032)	(0.019)	(0.003)	(0.021)	(0.005)	(0.016)	(0.001)	(0.015)
2005 B NW	6.5%	70.9%	2.2%	4.7%	6.7%	2.0%	3.5%	2.8%	0.7%
N = 543	(0.012)	(0.047)	(0.011)	(0.013)	(0.042)	(0.007)	(0.012)	(0.009)	(0.008)
2006 B SE	38.4%	37.2%	7.5%	0.2%	7.0%	0.6%	4.3%	0.1%	4.7%
N = 309	(0.029)	(0.032)	(0.020)	(0.004)	(0.019)	(0.005)	(0.017)	(0.002)	(0.020)
2006 B NW	6.4%	67.3%	3.0%	8.0%	2.1%	3.3%	0.5%	8.0%	1.4%
N = 296	(0.016)	(0.035)	(0.020)	(0.020)	(0.016)	(0.013)	(0.007)	(0.019)	(0.014)
2006 A All	22.9%	38.2%	0.2%	1.1%	31.2%	1.1%	1.1%	2.3%	1.9%
N = 902	(0.015)	(0.038)	(0.004)	(0.005)	(0.039)	(0.004)	(0.007)	(0.006)	(0.011)
2007 A All	9.4%	75.2%	0.1%	0.5%	12.0%	0.2%	0.1%	0.1%	2.4%
N = 380	(0.016)	(0.031)	(0.004)	(0.005)	(0.025)	(0.003)	(0.002)	(0.003)	(0.014)

Table 3-10 NMFS regional office estimates of Chinook salmon bycatch in the pollock fishery compared to genetics sampling levels by season and region, 2005-2007 (SE=east of 170°W, NW=west of 170°W).

			Area			Area	
		Season	SE	NW	Total	SE	NW
Bycatch	2005	B	26,425	13,793	40,217	66%	34%
	2006	B	21,922	2,484	24,405	90%	10%
	2006	A			58,753		
	2007	A			69,261		
Genetic Samples	2005	B	489	282	771	63%	37%
	2006	B	286	304	590	48%	52%
	2006	A			801		
	2007	A			360		

Table 3-11 Mean values of catch-weighted stratified proportions of stock composition based on genetic sampling by season, and region (SE=east of 170°W, NW=west of 170°W). Standard errors of the estimates (in parentheses) were derived from 200 simulations based on the estimates from Table 3-9 and weighting annual results as explained in the text.

Season / Area	PNW	Coast W AK	Cook Inlet	Middle Yukon	N AK Penin	Russia	TBR	Upper Yukon	Other
B SE	45.0%	34.7%	5.1%	0.1%	8.6%	0.6%	3.4%	0.0%	2.4%
	(0.025)	(0.024)	(0.017)	(0.002)	(0.016)	(0.004)	(0.014)	(0.001)	(0.014)
B NW	6.4%	68.9%	2.6%	6.6%	4.4%	2.7%	1.8%	5.6%	1.0%
	(0.010)	(0.023)	(0.012)	(0.011)	(0.019)	(0.007)	(0.006)	(0.012)	(0.008)
A All	12.1%	67.7%	0.1%	0.6%	16.0%	0.4%	0.2%	0.6%	2.3%
	(0.012)	(0.021)	(0.003)	(0.004)	(0.019)	(0.002)	(0.002)	(0.003)	(0.010)

Table 3-12 Comparison of stock composition estimates for three different studies on Chinook bycatch samples taken from trawl fisheries in the eastern Bering Sea.

Study		Myers and Rogers (1988)			Myers et al (2003)			Seeb et al. 2008		
Years sampled		1979-1982			1997-1999			2005-2007[1]		
Stocks and estimated aggregate % composition in bycatch	Western AK	60%			56%					
		Yukon	Bristol Bay	Kusko-kwim	Yukon	Bristol Bay	Kusko-kwim			
		17%	29%	24%	40%	34%	26%			
Smaller scale breakouts (where available) listed to the right (with associated % contrib. of aggregate below)	Coastal WAK (also includes Norton Sound)							48%		
								Lower Yukon	Kusko-kwim	Bristol Bay
								Na	Na	Na
	Middle Yukon							3%		
	Upper Yukon							3%		
	NAK Penin							13%		
	Cook Inlet	17%			31%			4%		
	SEAK/Can	9%			8%					
	TBR							2%		
	PNW[2]							23%		
	Russia	14%			5%			2%		
	Other[3]							3%		

[1]note for purposes of comparison, only 2006 stock composition estimates *averaged annually and across regions* are shown here.

[2]PNW is an aggregate of over 150 stocks from British Columbia, Washington, Oregon and California. For a full list of stocks included see Table 3-7

[3]'other' is comprised of minor components after aggregation to major river systems as described in Table 3-7.

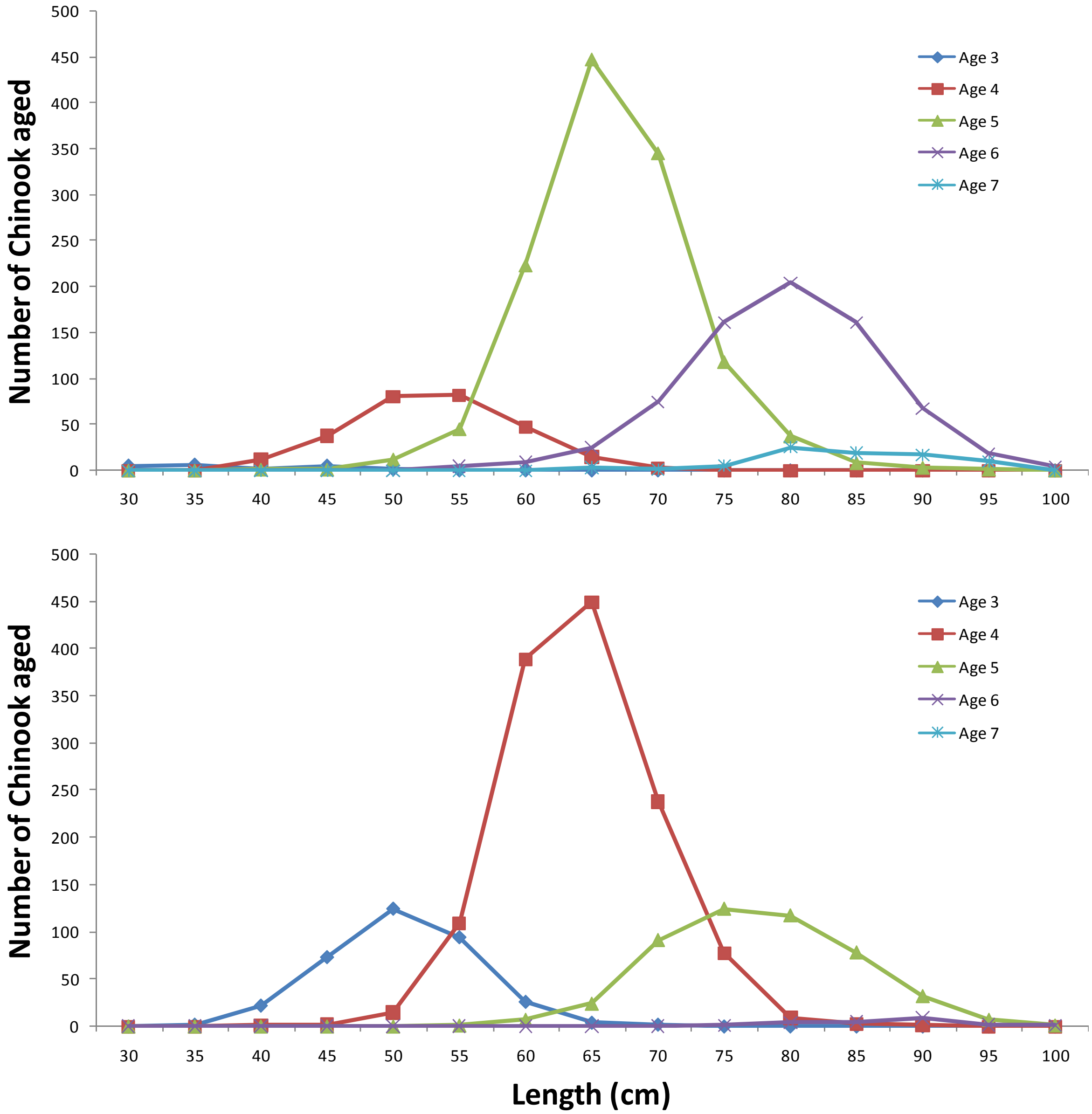


Fig. 3-1 Summary distribution of age samples by length collected by the NMFS groundfish observer program during 1997-1999 and analyzed by University of Washington scientists (Myers et al. (2003) for the A-season (top panel) and B season (bottom panel).

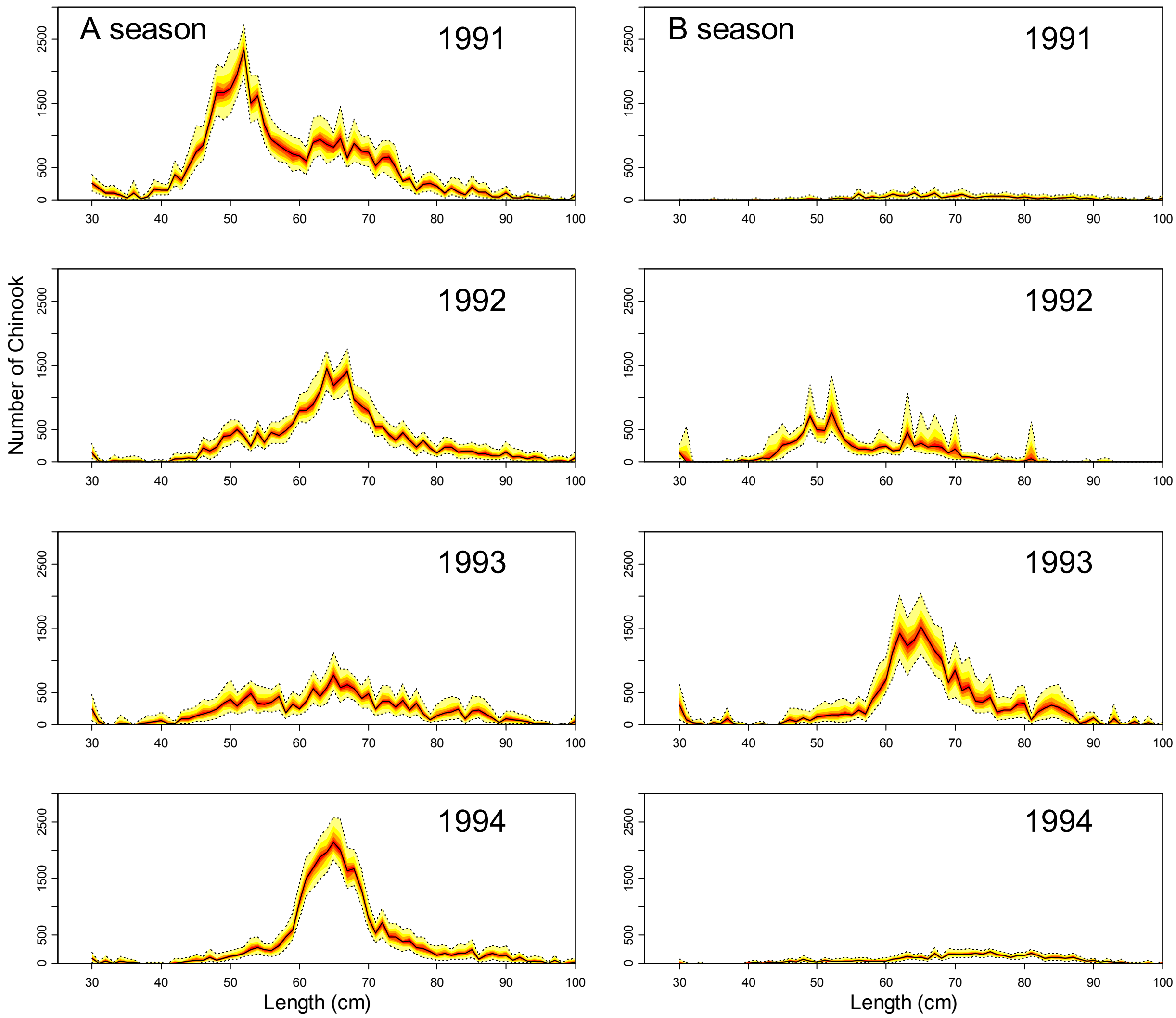


Fig. 3-2 Length frequency by season and year of Chinook salmon occurring as bycatch in the pollock fishery. Error distributions based on two-stage bootstrap re-sampling procedure.

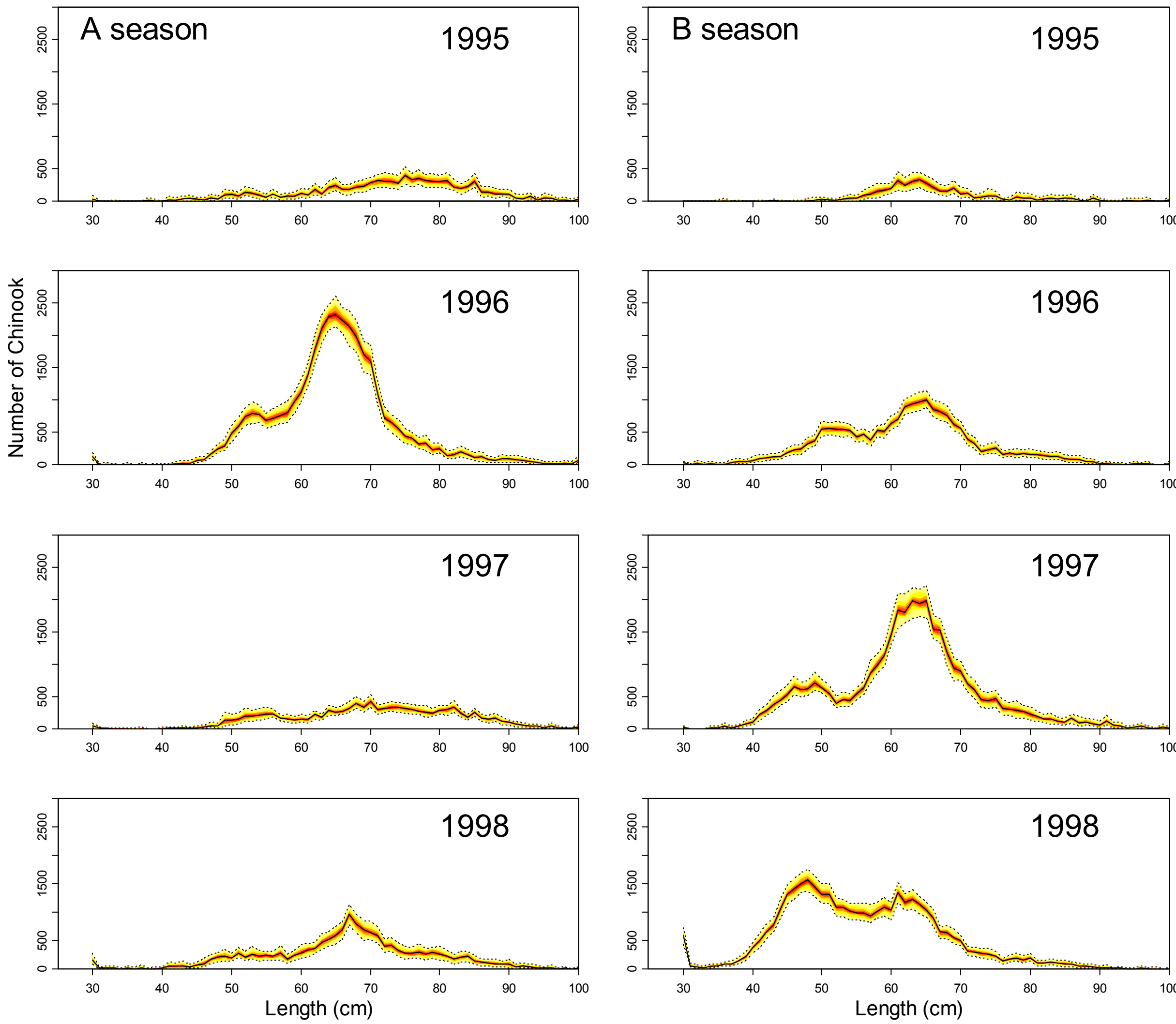


Fig. 3-2 (continued) Length frequency by season and year of Chinook salmon occurring as bycatch in the pollock fishery. Error distributions based on two-stage bootstrap re-sampling procedure.

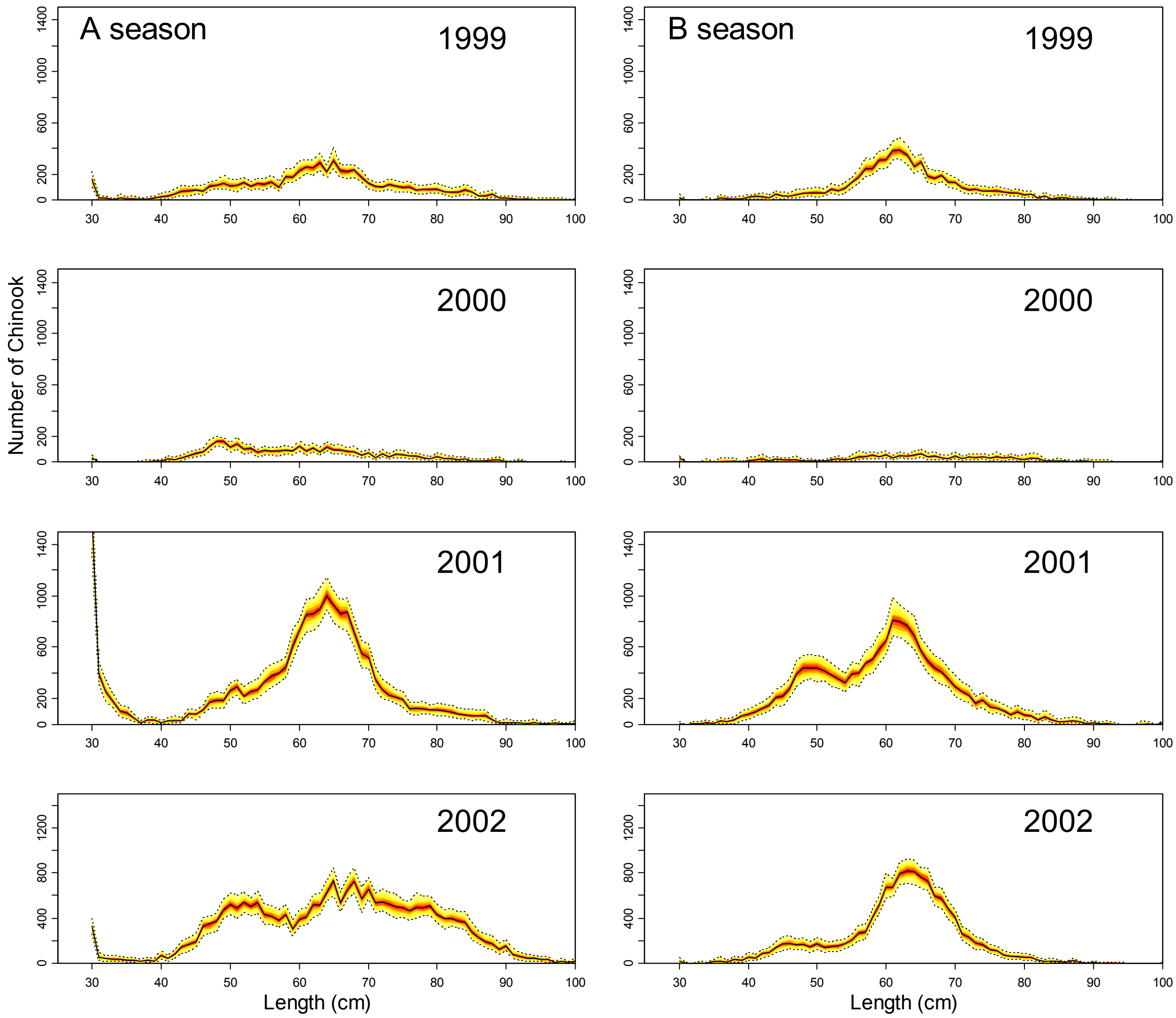


Fig. 3-2 (continued) Length frequency by season and year of Chinook salmon occurring as bycatch in the pollock fishery. Error distributions based on two-stage bootstrap re-sampling procedure.

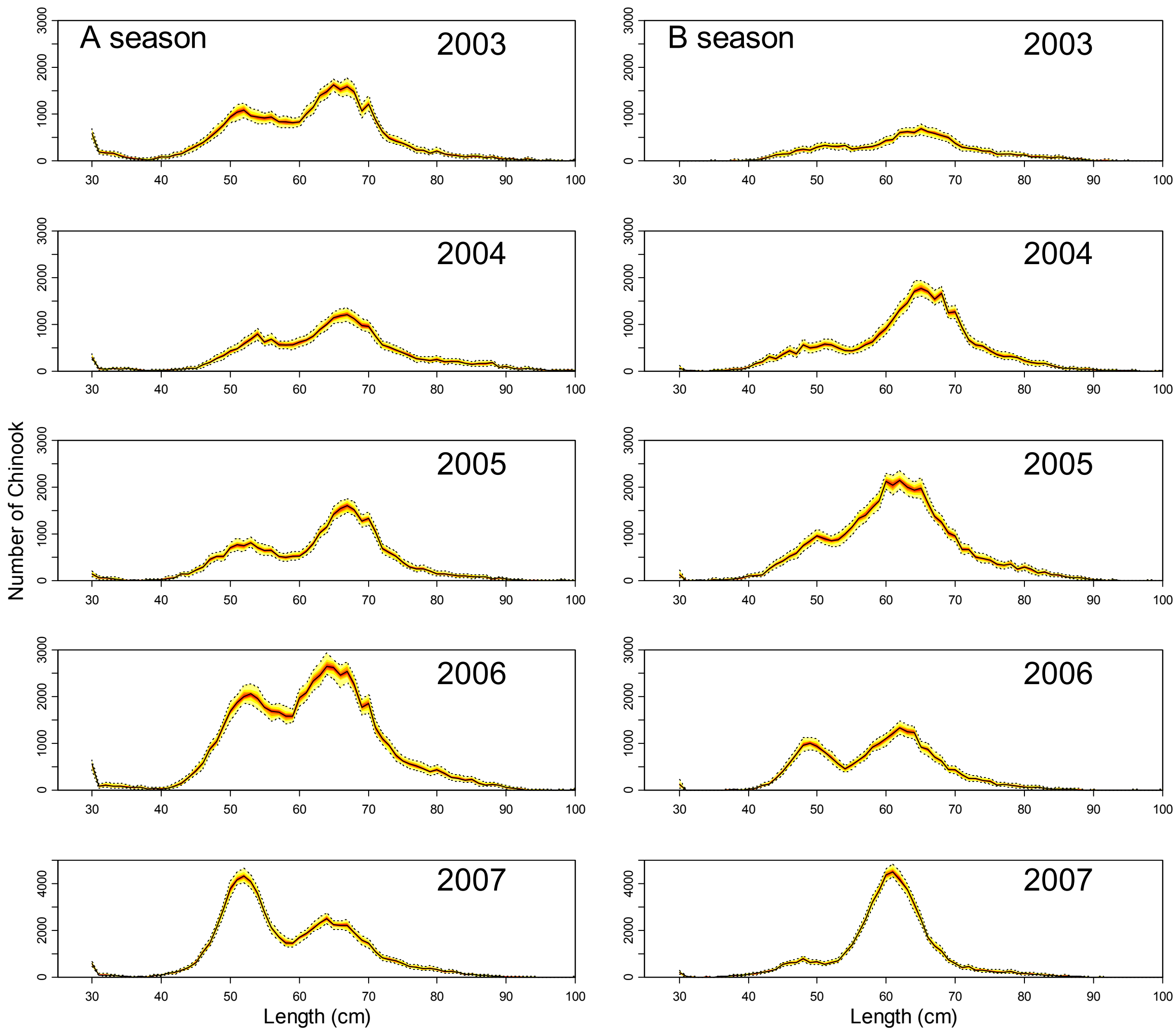


Fig. 3-2 (continued) Length frequency by season and year of Chinook salmon occurring as bycatch in the pollock fishery. Error distributions based on two-stage bootstrap re-sampling procedure.

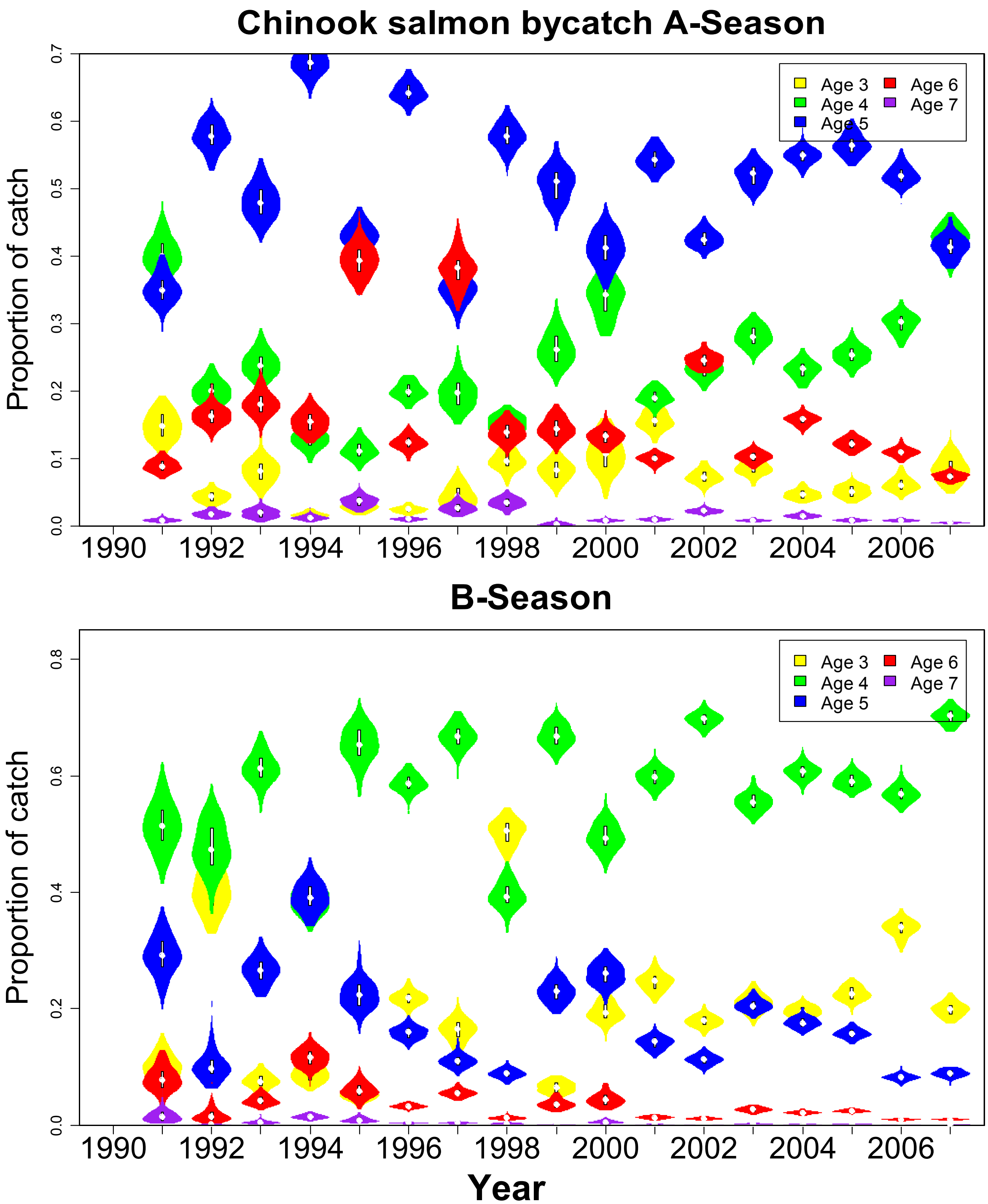


Fig. 3-3 Chinook salmon bycatch age composition by year and A-season (top) and B-season (bottom). Vertical spread of blobs represent uncertainty as estimated from the two-stage bootstrap re-sampling procedure.

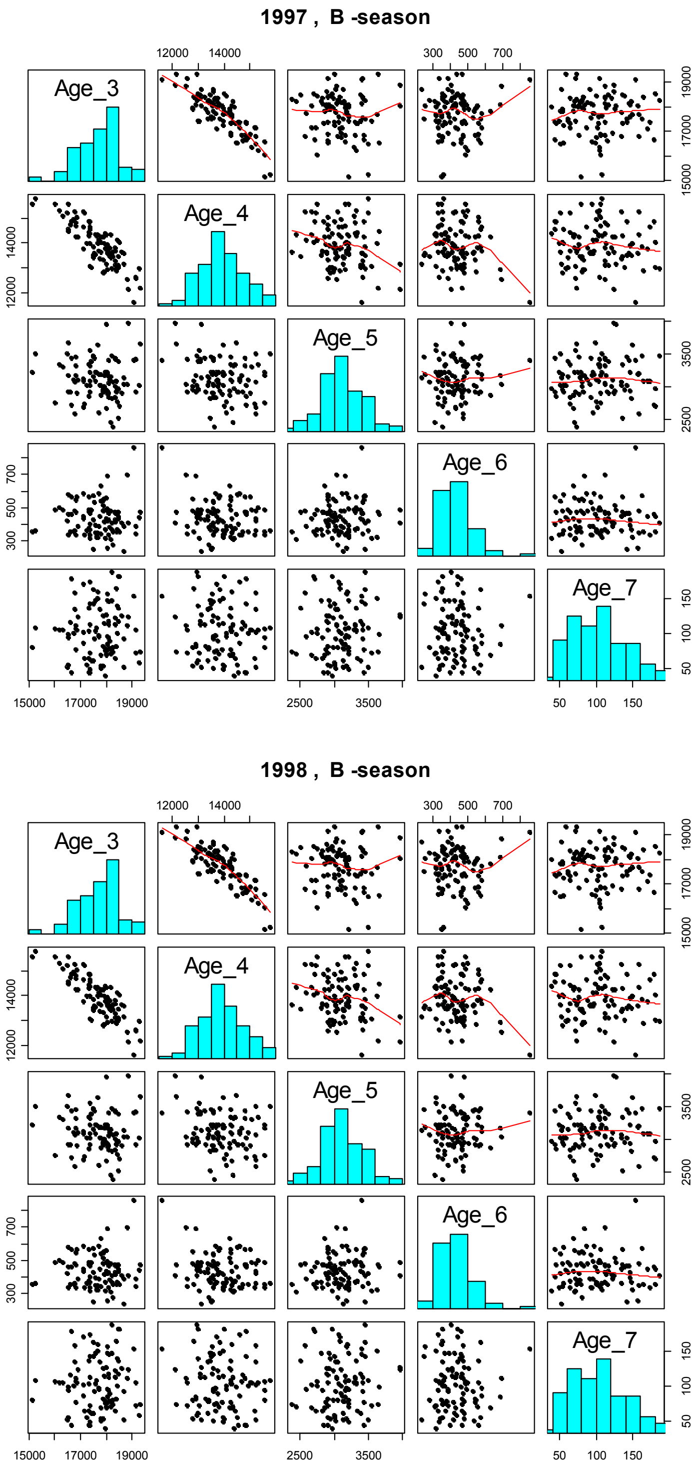
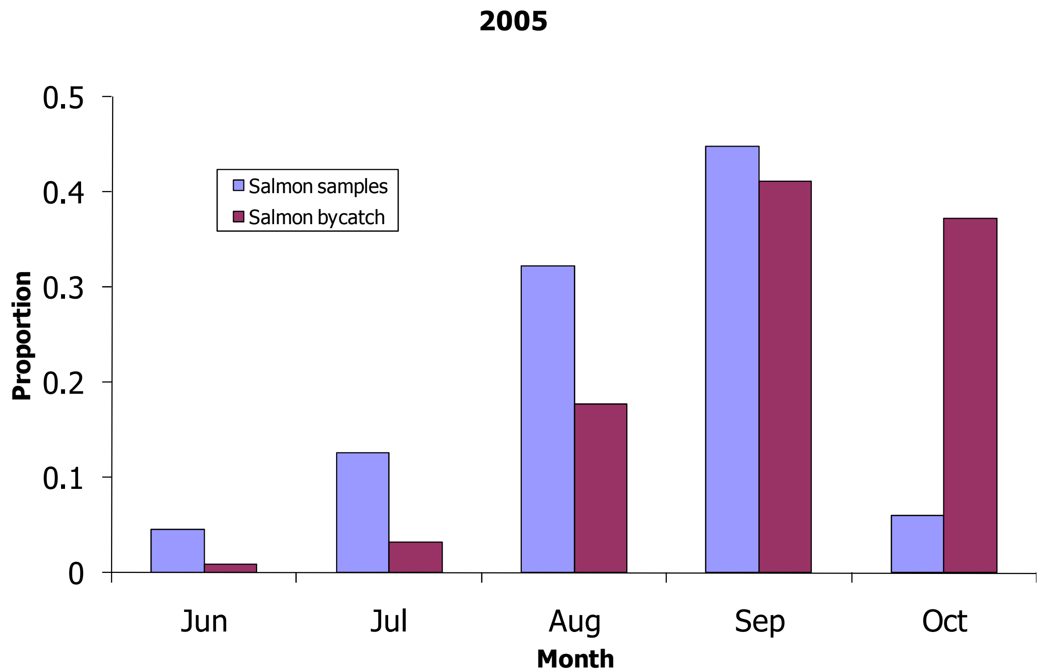


Fig. 3-4 Bootstrap estimates of Chinook salmon bycatch example showing correlation of bycatch at different ages for the B-season in 1997 (top) and 1998 (bottom).



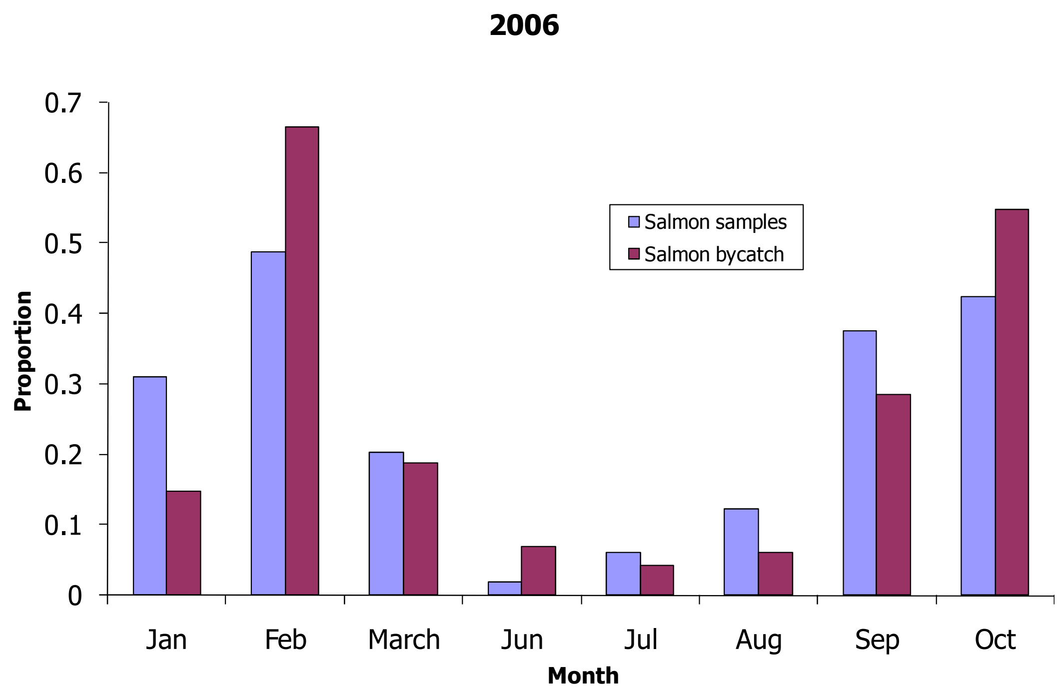


Fig. 3-5 Proportion of Chinook salmon samples collected for genetics compared to the proportion of bycatch by month for 2005 B-season only (top panel) and 2006 A and B season combined (bottom panel).

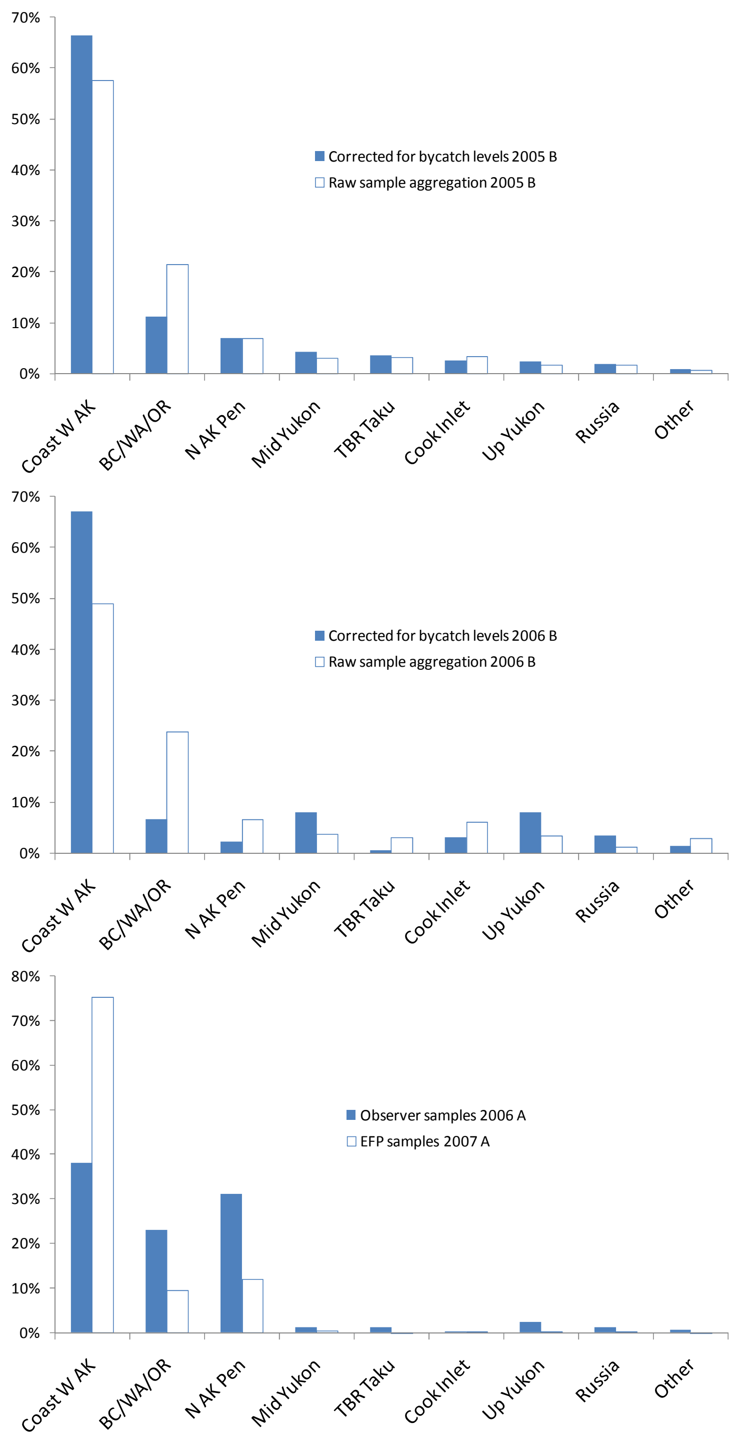


Fig. 3-6 Chinook salmon bycatch results by reporting region for 2005 B season (top), 2006 B season (middle), and the 2006 and (partial sample) of 2007 A seasons (bottom). The top two panels include uncorrected results where bycatch differences between regions (east and west of 170°W) are ignored (empty columns).

3.3.3 Estimating adult equivalence

The impact of bycatch on salmon runs is the primary output statistic. This measure relates the historical bycatch levels relative to the subsequent returning salmon run *k* in year *t* as:

$$u_{t,k} = \frac{AEQ_{t,k}}{AEQ_{t,k} + S_{t,k}} \qquad (1)$$

where $AEQ_{t,k}$ and $S_{t,k}$ are the adult-equivalent bycatch and stock size (run return) estimates of the salmon species in question, respectively. The calculation of $AEQ_{t,k}$ includes the bycatch of salmon returning to spawn in year *t* and the bycatch from previous years for the same brood year (i.e., at younger, immature ages). This latter component needs to be decremented by ocean survival rates and maturity schedules. The impact of current year and previous years bycatch on salmon returning (as adult equivalents in year *t*) can be expressed in expanded form (without stock specificity) as:

$$\begin{aligned}
AEQ_t = &\sum_{a=3}^{7} c_{t,a}\gamma_a + \\
&\gamma_4(1-\gamma_3)s_3c_{t-1,3} + \\
&\gamma_5(1-\gamma_4)(1-\gamma_3)s_3s_4c_{t-2,3} + \\
&\gamma_6(1-\gamma_5)(1-\gamma_4)(1-\gamma_3)s_3s_4s_5c_{t-3,3} + \\
&\gamma_7(1-\gamma_6)(1-\gamma_5)(1-\gamma_4)(1-\gamma_3)s_3s_4s_5s_6c_{t-4,3} + \\
\\
&\gamma_5(1-\gamma_4)s_4c_{t-1,4} + \\
&\gamma_6(1-\gamma_5)(1-\gamma_4)s_4s_5c_{t-2,4} + \\
&\gamma_7(1-\gamma_6)(1-\gamma_5)(1-\gamma_4)s_4s_5s_6c_{t-3,4} + \\
\\
&\gamma_6(1-\gamma_5)s_5c_{t-1,5} + \\
&\gamma_7(1-\gamma_6)(1-\gamma_5)s_5s_6c_{t-2,5} + \\
\\
&\gamma_7(1-\gamma_6)s_6c_{t-1,6}
\end{aligned} \qquad (2)$$

where $c_{t,a}$ is the bycatch of age *a* salmon in year *t*, s_a is the proportion of salmon surviving from age *a* to *a+1,* and γ_a is the proportion of salmon at sea that will return to spawn at age *a.* Since this model is central to the calculation of *AEQ* values, an explanatory schematic is given in Fig. 3-7). Maturation rates vary over time and among stocks detailed information on this is available from a wide variety of sources. For the purpose of this study, an average over putative stocks was developed based on a variety of studies (Table 3-13). Note that there is a distinction between the distribution of mature age salmon found in rivers (Table 3-13) and the expected age-specific maturation rate of oceanic salmon ($\gamma_{a,k}$) used in this model. However, given ocean survival rates the values for $\gamma_{a,k}$ can be solved which satisfy the age-specific maturation averaged over different stocks (bottom row of Table 3-13).

To carry out the computations in a straightforward manner, the numbers of salmon that remain in the ocean (i.e., they put off spawning for at least another year) are tracked through time until age 7 where for this model, all Chinook in the ocean at that age are considered mature and will spawn in that year.

Stochastic versions of the adult equivalence calculations acknowledge both run-size inter-annual variability and run size estimation error, as well as uncertainty in maturation rates, the natural mortality rates (oceanic), river-of-origin estimates, and age assignments. The variability in run size can be written as (with $\dot{S}_{t,k}$ representing the stochastic version of $S_{t,k}$):

$$\dot{S}_{t,k} = \bar{S}_k e^{\varepsilon_t + \delta_t} \quad \varepsilon_t \sim N\left(0,\sigma_1^2\right), \quad \delta_t \sim N\left(0,\sigma_2^2\right) \qquad (3)$$

where σ_1^2, σ_2^2 are specified levels of variability in inter-annual run sizes and run-size estimation variances, respectively. Note that for the purposes of this EIS, estimates of run sizes were unavailable for some stocks hence this method is described here for conceptual purposes only.

The stochastic survival rates were simulated as:

$$\dot{s}_a = 1 - \exp\left(-M_a + \delta\right), \qquad \delta \sim N\left(0, 0.1^2\right) \qquad (4)$$

whereas the maturity in a given year and age was drawn from beta-distributions:

$$\dot{\gamma}_a \sim B\left(\alpha_a, \beta_a\right) \qquad (5)$$

with parameters α_a, β_a specified to satisfy the expected value of age at maturation (Table 3-13) and a pre-specified coefficient of variation term (provided as model input).

Similarly, the parameter responsible for assigning bycatch to river-system of origin was modeled using a combination of years and "parametric bootstrap" approach, also with the beta distribution:

$$\dot{p}_k \sim B\left(\alpha_k, \beta_k\right) \qquad (6)$$

again with α_k, β_k specified to satisfy the expected value the estimates and variances shown in Table 3-1. For the purposes of this study, the estimation uncertainty is considered as part of the inter-annual variability in this parameter. The steps (implemented in a spreadsheet) for the AEQ analysis can be outlined as follows:

1. Select a bootstrap sample of salmon bycatch-at-age ($c_{t,a}$) for each year from the catch-age procedure described above;
2. Sum the bycatch-at-age for each year and proceed to account for year-of-return factors (e.g., stochastic maturation rates and ocean survival (Eqs. 2-5);
3. Partition the bycatch estimates to stock proportions (by year and area) drawn randomly from each parametric bootstrap;
4. Store stratum-specific AEQ values for each year;
5. Repeat 1-4 200 times;
6. Based on updated genetics results, assign to river of origin components ($\dot{p}_k$, Eq. 6).
7. Compile results over all years and compute frequencies from which relative probabilities can be estimated;

Sensitivity analyses on maturation rates by brood year were conducted and contrasted with alternative assumptions about natural mortality (M_a) schedules during their oceanic phase as follows:

Model	3	4	5	6	7
1 - None	0.0	0.0	0.0	0.0	0.0
2 - Variable	0.3	0.2	0.1	0.05	0.0
3 - Constant	0.2	0.2	0.2	0.2	0.0

The pattern of bycatch relative to AEQ is variable and relatively insensitive to mortality assumptions (Fig. 3-10). For simplicity in presenting the analysis, subsequent values are based on the intermediate age-specific natural mortality (Model 2). The corresponding age-specific probabilities that a salmon would return to spawn (given the in-river mature population proportions shown in Table 3-13) are:

Age	3	4	5	6	7
Maturation probability (γ_a)	0.059	0.273	0.488	0.908	1.000

Notice that in some years, the bycatch records may be below the actual AEQ due to the lagged impact of previous years catches (e.g., in 1999 and 2000). A similar result would be predicted for AEQ model results in 2008 regardless of actual bycatch levels in this year due to the cumulative effect of bycatch prior to 2008, and particularly the impact of bycatch levels in 2007 as that will continue to impact the AEQ (and thus subsequent returns to river systems) for several years.

Overall, the estimate of AEQ Chinook mortality from 1994-2007 ranged from about 15,000 fish to over 78,000 with the largest contribution of the mortality comprised of stocks in the coastal west-Alaska (Table 3-14). Note that the intent here is to show that annual stock composition estimates of the bycatch is affected by the seasons and areas when and where bycatch occurs. Note that these results are based on the assumption that the genetics findings from the 2005-2007 data represent the historical pattern of bycatch stock composition (by strata).

Evaluations of alternative Chinook salmon caps were done based on re-casting historical catch levels as if a cap proposal had been implemented. Since the alternatives all have specific values by season and sector, the effective limit on Chinook bycatch levels can vary for each alternative and over different years. This is caused by the distribution of the fleet relative to the resource and the variability of bycatch rates by season and years. To capture the effect of an alternative policy, the 2003-2007 mean "effective" cap for each alternative was computed, and used as the seasonal limit for evaluation purposes (Table 3-15). These values were then used in the AEQ simulation model as season-specific caps. This means that the minimum of the historical season-specific bycatch and the effective cap level given in Table 3-15 was applied for estimating the AEQ for each policy.

The sum over ages of catch in year *t* that would have returned in that year

$$AEQ_t = \underbrace{\sum_{a=3}^{7} c_{t,a}\gamma_a}\ + \text{ Fish caught in earlier years that would have survived:}$$

The catch of age 3 salmon in previous years that survived and had not returned in earlier years

$$\left\{\begin{array}{l}
\gamma_4\left(1-\gamma_3\right)s_3c_{t-1,3} + \\
\gamma_5\left(1-\gamma_4\right)\left(1-\gamma_3\right)s_3s_4c_{t-2,3} + \\
\gamma_6\left(1-\gamma_5\right)\left(1-\gamma_4\right)\left(1-\gamma_3\right)s_3s_4s_5c_{t-3,3} + \\
\gamma_7\left(1-\gamma_6\right)\left(1-\gamma_5\right)\left(1-\gamma_4\right)\left(1-\gamma_3\right)s_3s_4s_5s_6c_{t-4,3} +
\end{array}\right.$$

The catch of age 4 salmon in previous years that survived and had not returned in earlier years

$$\left\{\begin{array}{l}
\gamma_5\left(1-\gamma_4\right)s_4c_{t-1,4} + \\
\gamma_6\left(1-\gamma_5\right)\left(1-\gamma_4\right)s_4s_5c_{t-2,4} + \\
\gamma_7\left(1-\gamma_6\right)\left(1-\gamma_5\right)\left(1-\gamma_4\right)s_4s_5s_6c_{t-3,4} +
\end{array}\right.$$

The catch of age 5 salmon…

$$\left\{\begin{array}{l}
\gamma_6\left(1-\gamma_5\right)s_5c_{t-1,5} + \\
\gamma_7\left(1-\gamma_6\right)\left(1-\gamma_5\right)s_5s_6c_{t-2,5} +
\end{array}\right.$$

$$\gamma_7\left(1-\gamma_6\right)s_6c_{t-1,6}$$

Fig. 3-7 Explanatory schematic of main AEQ equation. Symbols are defined in text.

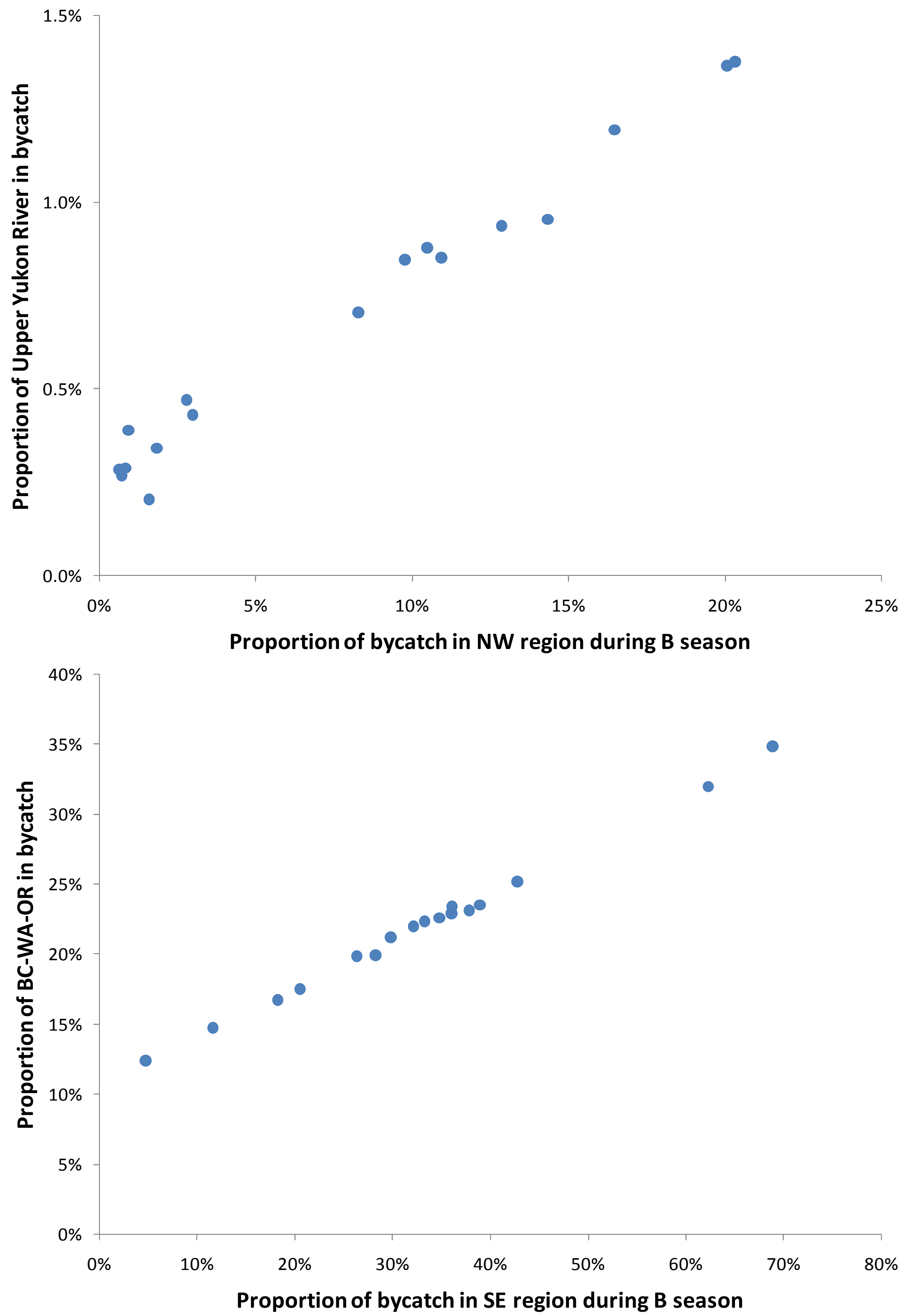


Fig. 3-8 Figure showing how the overall proportion of Upper Yukon River relates to the bycatch proportion that occurs in the NW region (west of 170°W; top panel) and how the proportion of the BC-WA-OR (PNW) relates to the SE region (east of 170°W; bottom panel) during the summer-fall pollock fishery, 1991-2007.

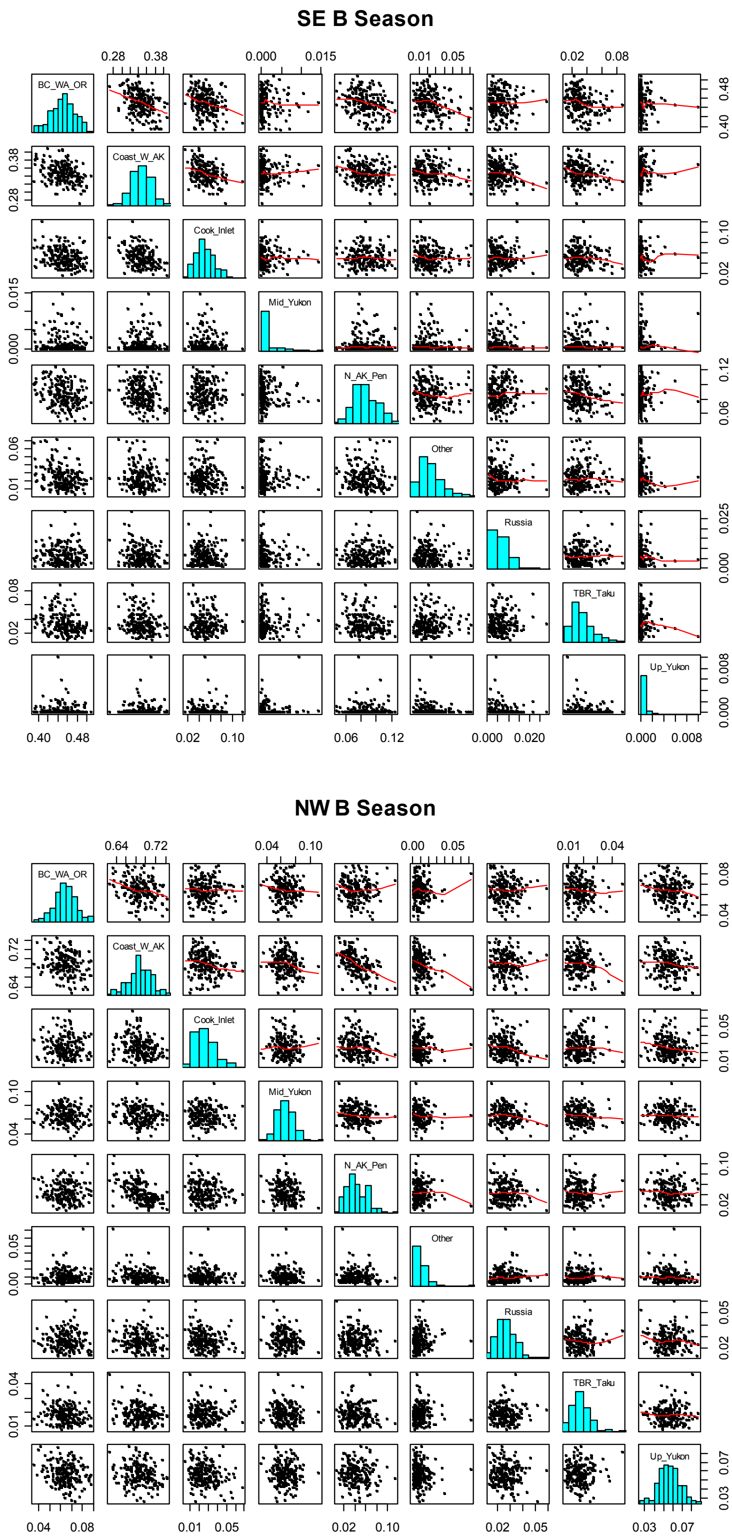


Fig. 3-9 Simulated Chinook salmon stock proportion by region for the B season based on reported standard error values from ADF&G analyses and assuming that the 2006 data has better coverage and is hence weighted 2:1 compared to the 2005 B-season data.

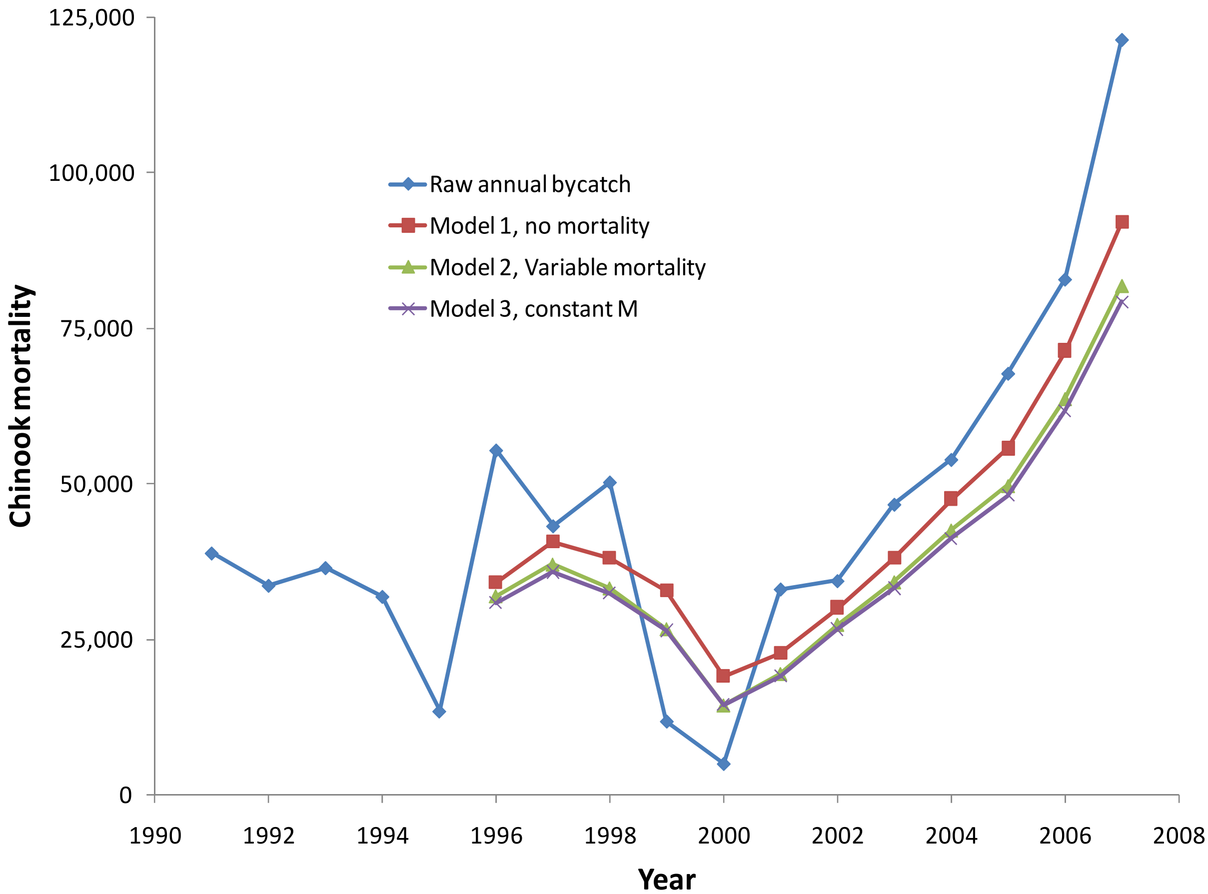


Fig. 3-10 Time series of Chinook adult equivalent bycatch from the pollock fishery, 1991-2007 compared to the annual totals under different assumptions about ocean mortality rates.

Table 3-13 Range of estimated mean age-specific maturation by brood year used to compute adult equivalents. The weighted mean value is based on the relative Chinook run sizes between the Nushagak and Yukon Rivers since 1997. *Sources: Healey 1991, Dani Evenson (ADF&G pers. comm.), Rishi Sharma (CRITFC, pers. comm.).*

	Weight	Age 3	Age 4	Age 5	Age 6	Age 7
Yukon	2.216	1%	13%	32%	49%	5%
Nushagak since 82	1.781	1%	21%	38%	39%	2%
Nushagak since 66	0	0%	17%	36%	43%	3%
Goodnews	0	0%	20%	31%	45%	4%
SE Alaska (TBR)	0.3	0%	18%	40%	37%	5%
BC, WA, OR, & CA	0.7	3%	28%	53%	14%	1%
Weighted mean		1%	18%	37%	40%	3%

Table 3-14 Median values of stochastic simulation results of AEQ Chinook mortality attributed to the pollock fishery by region, 1994-2007. These simulations include stochasticity in natural mortality (Model 2, CV=0.1), bycatch age composition (via bootstrap samples), maturation rate (CV=0.1), and stock composition (as detailed above). NOTE: these results are based on the assumption that the genetics findings from the 2005-2007 data represent the historical pattern of bycatch stock composition (by strata).

	BC, WA, OR, and CA	Coastal W. AK	Cook Inlet	Middle Yukon	N. Alaska Peninsula	Other	Russia	Upper Yukon	TBR (SE)	Total
1994	5,198	21,518	242	201	4,898	714	147	194	198	33,310
1995	5,635	14,084	415	104	3,302	532	112	96	279	24,559
1996	6,974	17,025	520	154	3,939	632	142	137	364	29,886
1997	11,376	16,895	1,276	413	3,364	715	277	343	783	35,442
1998	10,967	14,218	1,110	103	3,382	696	165	87	711	31,439
1999	6,429	15,099	573	297	3,193	561	188	245	387	26,973
2000	2,815	9,383	219	167	2,106	330	99	147	152	15,418
2001	3,694	10,473	349	260	2,141	375	149	221	238	17,899
2002	6,236	14,516	509	106	3,467	609	117	96	341	25,997
2003	5,743	20,065	398	356	4,424	679	207	311	292	32,475
2004	10,164	21,904	1,018	466	4,592	859	305	393	685	40,386
2005	11,169	25,462	1,203	767	5,107	923	439	645	772	46,487
2006	12,719	36,337	892	363	8,355	1,348	290	339	633	61,275
2007	18,079	44,380	1,597	694	9,743	1,688	485	608	1,069	78,344

Table 3-15 Chinook salmon effective bycatch "caps" in the pollock fishery by season (A and B) based on average values of the caps (if they occurred) had they been applied from 2003-2007.

Cap, A/B, sector	A season	B season	Total
PPA Scenario 1 w/ transfer	46,561	20,372	66,933
PPA Scenario 1 w/o transfer	44,974	20,372	65,346
PPA Scenario 2 w/ transfer	33,010	13,500	46,510
PPA Scenario 2 w/o transfer	31,809	13,500	45,309
87,500 50/50 opt2a	31,950	32,844	64,793
87,500 50/50 opt2d	36,899	28,791	65,690
87,500 58/42 opt1	44,118	20,321	64,439
87,500 58/42 opt2a	41,653	30,463	72,116
87,500 58/42 opt2d	42,234	24,258	66,492
87,500 70/30 opt1	49,368	16,277	65,644
87,500 70/30 opt2a	44,665	18,427	63,092
87,500 70/30 opt2d	55,376	17,815	73,191
68,100 50/50 opt1	27,784	18,272	46,056
68,100 50/50 opt2a	26,459	28,264	54,723
68,100 50/50 opt2d	25,196	24,258	49,455
68,100 58/42 opt1	29,569	17,581	47,150
68,100 58/42 opt2a	28,587	21,247	49,834
68,100 58/42 opt2d	32,676	19,997	52,674
68,100 70/30 opt1	41,021	13,253	54,274
68,100 70/30 opt2a	35,980	15,495	51,475
68,100 70/30 opt2d	42,234	14,640	56,874
48,700 50/50 opt1	19,292	16,196	35,488
48,700 50/50 opt2a	18,053	17,439	35,493
48,700 50/50 opt2d	21,242	16,725	37,966
48,700 58/42 opt1	21,142	13,253	34,394
48,700 58/42 opt2a	19,592	15,495	35,087
48,700 58/42 opt2d	23,610	14,640	38,250
48,700 70/30 opt1	27,784	10,225	38,009
48,700 70/30 opt2a	26,459	12,262	38,721
48,700 70/30 opt2d	25,196	11,612	36,809
29,300 50/50 opt1	9,761	10,225	19,985
29,300 50/50 opt2a	10,637	12,262	22,900
29,300 50/50 opt2d	10,070	11,612	21,682
29,300 58/42 opt1	12,725	8,740	21,465
29,300 58/42 opt2a	12,177	10,520	22,697
29,300 58/42 opt2d	12,031	10,634	22,665
29,300 70/30 opt1	15,120	6,885	22,005
29,300 70/30 opt2a	17,010	7,065	24,074
29,300 70/30 opt2d	14,859	6,775	21,634

Additional References

Dorn, M.W. 1992. Detecting environmental covariates of Pacific whiting *Merluccius productus* growth using a growth-increment regression model. Fish. Bull. 90:260-275.

Kimura, D.K. 1989. Variability in estimating catch-in-numbers-at-age and its impact on cohort analysis. *In* R.J. Beamish and G.A. McFarlane (eds.), Effects on ocean variability on recruitment and an evaluation of parameters used in stock assessment models. Can. Spec. Publ. Fish. Aq. Sci. 108:57-66.

Appendix 2 – Revised Section 3.4 Consideration of future actions

3.4 Consideration of Future Actions

An 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 nonfederal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7*)."

In this EIS, relevant past and present actions are identified and integrated into the impacts analysis for each resource component in Chapters 4 through 8. Each chapter also includes a section on consideration of future actions to provide the reader with an understanding of the changes in the impacts of the alternatives on each resource component when we take into account the reasonable foreseeable future actions. The discussions relevant to each resource component have been included in each chapter (1) to help each chapter stand alone as a self-contained analysis, for the convenience of the reader, and (2) as a methodological tool to ensure that the threads of each discussion for each resource component remain distinct, and do not become confused.

This section provides a summary description of the reasonably foreseeable future actions that may affect resource components and that also may be affected by the alternatives in this analysis. These include future actions that may affect the Bering Sea pollock fishery, the salmon caught as bycatch in that fishery, and the impacts of salmon bycatch on the resources components analyzed in this EIS. The actions in the list have been grouped in the following four categories:

- Ecosystem-sensitive management
- Traditional management tools
- Actions by other Federal, State, and international agencies
- Private actions

The "action area" for salmon bycatch management includes the Federal waters of the Bering Sea. Impacts of the action may occur outside the action area in salmon freshwater habitats and along salmon migration routes.

Table 3-16 summarizes the reasonably foreseeable "actions" identified in this analysis that are likely to have an impact on a resource component within the action area and timeframe. Actions are understood to be human actions (e.g., a proposed rule to designate northern right whale critical habitat in the Pacific Ocean), as distinguished from natural events (e.g., an ecological regime shift). Identification of actions likely to impact a resource component, or change the impacts of any of the alternatives, within this action's area and time frame will allow the public and Council to make a reasoned choice among alternatives.

CEQ regulations require a consideration of actions, whether taken by a government or by private persons, which are reasonably foreseeable. This is interpreted as indicating actions that are more than merely possible or speculative. Actions have been considered reasonably foreseeable if some concrete step has been taken toward implementation, such as a Council recommendation or the publication of a proposed rule. Actions simply "under consideration" have not generally been included because they may change substantially or may not be adopted, and so cannot be reasonably described, predicted, or foreseen.

Table 3-16 Reasonably foreseeable future actions

Ecosystem-sensitive management	• Ongoing Research to understand the interactions between ecosystem components • Increasing protection of ESA-listed and other non-target species • Increasing integration of ecosystems considerations into fisheries management
Traditional management tools	• Authorization of pollock fishery in future years • Increasing enforcement responsibilities • Technical and program changes that will improve enforcement and management • Development of a Salmon Excluder Device
Other Federal, State, and international agencies	• State management of salmon fisheries • Hatchery release of salmon • Future exploration and development of offshore mineral resources • Expansion and construction of boat harbors • Other State actions
Private actions	• Commercial pollock and salmon fishing • CDQ investments in western Alaska • Subsistence harvest of Chinook salmon • Sport harvest of Chinook salmon • Increasing levels of economic activity in Alaska's waters and coastal zone

3.4.1 Ecosystem-sensitive management[1]

3.4.1.1 Ongoing research to understand the interactions between ecosystem components

Researchers are learning more about the components of the ecosystem, the ways these interact, and the impacts of fishing activity on them. Research topics include cumulative impacts of climate change on the ecosystem, the energy flow within an ecosystem, and the impacts of fishing on the ecosystem components. Ongoing research will improve the interface between science and policy-making and facilitate the use of ecological information in making policy. Many institutions and organizations are conducting relevant research.

Recent fluctuations in the abundance, survival, and growth of salmon in the Bering Sea have added significant uncertainty and complexity to the management of Bering Sea salmon resources. Similar fluctuations in the physical and biological oceanographic conditions have also been observed; however, the limited information on Bering Sea salmon ecology was not sufficient to adequately identify

[1] The term "ecosystem-sensitive management" is used in this EIS in preference to the terms "ecosystem-based management" and "ecosystem approaches to management." The term was chosen to indicate a wide range of measures designed to improve our understanding of the interactions between groundfish fishing and the broader ecosystems, to reduce or mitigate the impacts of fishing on the ecosystems, and to modify fisheries governance to integrate ecosystems considerations into management. The term was used because it is not a term of art or commonly used term which might have very specific meanings. When the term "ecosystem-based management" is used, it is meant to reflect usage by other parties in public discussions.

mechanisms linking recent changes in ocean conditions to salmon resources. North Pacific Anadromous Fish Commission (NPAFC) scientists responded by developing BASIS (Bering-Aleutian Salmon International Survey), a comprehensive survey of the Bering Sea pelagic ecosystem. BASIS was designed to improve our understanding of salmon ecology in the Bering Sea and to clarify mechanisms linking recent changes in ocean conditions with salmon resources in the Bering Sea. The Alaska Fisheries Science Center's Ocean Carrying Capacity (OCC) Program is responsible for BASIS research in U.S. waters.

Researchers with the OCC Program have conducted shelf-wide surveys during fall 2002 through 2006 on the eastern Bering Sea shelf as part of the multiyear BASIS research program. The focus of BASIS research was on salmon; however, the broad spatial coverage of oceanographic and biological data collected during late summer and early fall provided insight into how the pelagic ecosystem on the eastern Bering Sea shelf responded to changes in spring productivity. Salmon and other forage fish (e.g., age-0 walleye pollock, Pacific cod, and Pacific herring) were captured with a surface net trawl, zooplankton were collected with oblique bongo tows, and oceanographic data were obtained from conductivity-temperature-depth (CTD) vertical profiles. More information on BASIS is provided in Chapter 5 and is available at the AFSC website at: http://www.afsc.noaa.gov/ABL/occ/ablocc_basis.htm.

In 2008, North Pacific Research Board (NPRB) and National Science Foundation (NSF) began a project for understanding ecosystem processes in the Bering Sea called the Bering Sea Integrated Ecosystem Research Program (BSIERP). Approximately 90 federal, state and university scientists will provide coverage of the entire Bering Sea ecosystem. Scientists will conduct three years of field research on the eastern Bering Sea Shelf, from St. Lawrence Island to the Aleutians, followed by two more years for analysis and reporting. They will study a range of issues, including atmospheric forcing, physical oceanography, and the economic and social impacts on humans and communities of a changing ecosystem. More information on this research project is available on the NPRB web site at: http://bsierp.nprb.org/index.htm.

Additionally, ecosystem protection is supported by an extensive program of research into ecosystem components and the integrated functioning of ecosystems, carried out at the AFSC. The AFSC's Fishery Interaction Team (FIT), formed in 2000 to investigate the ecological impacts of commercial fishing, is focusing on the impacts of Pacific cod, pollock, and Atka mackerel fisheries on Steller sea lion populations (Connors and Logerwell 2005). The AFSC's Fisheries and the Environment (FATE) program is investigating potential ecological indicators for use in stock assessment (Boldt 2005). The AFSC's Auke Bay Lab and RACE Division map the benthic habitat on important fishing grounds, study the impact of fishing gear on different types of habitats, and model the relationship between benthic habitat features and fishing activity (Heifetz et al. 2003). Other AFSC ecosystem programs include the North Pacific Climate Regimes and Ecosystem Productivity Program, the Habitat and Ecological Processes program, and the Loss of Sea Ice program (J. Boldt, pers. comm., September 26, 2005). More information on these research programs is available at the AFSC website at: http://www.afsc.noaa.gov.

3.4.1.2 Increasing protection of ESA-listed and other non-target species

Pollock fishing may impact a wide range of other resources, such as seabirds, marine mammals, and non-target species, such as salmon and halibut. Recent Council and NMFS actions suggest that the Council and NMFS may consider measures for protection for ESA-listed and other non-target species.

Changes in the status of species listed under the ESA, the addition of new listed species, designation of critical habitat, and results of future Section 7 consultations may require modifications to pollock fishing practices to reduce the impacts of this fishery on listed species and critical habitat.

The discussion of ESA-listed salmon is in Chapter 5. We are not aware of any changes to the ESA-listed salmon status or designated critical habitat that may affect the future pollock fishery. The impacts of the pollock fishery on ESA-listed salmon are currently limited to the Upper Willamette and Lower Columbia River stocks. The tracking of coded-wire tagged surrogate salmon for ESA-listed stocks may result in additional ESA-listed salmon stocks being identified as potentially impacted by the pollock fisheries. The possible take of any additional ESA-listed salmon stocks would trigger ESA consultation and may result in additional management measures for the pollock fishery depending on the result of the consultation.

Washington State's Sea Grant program is currently working with catcher-processors in the Bering Sea pollock fishery to study the sources of seabird strikes in their operations and to look for ways fishermen can reduce the rate of strikes (Melvin et al. 2004). Other studies are investigating the potential for use of video monitoring of seabird interactions with trawl and longline gear (McElderry et al. 2004; Ames et al. 2005). This research is especially important because action area has very high seabird densities and potential aggregations of ESA-listed short tailed albatross (NMFS 2007b).

The Council is in the process of considering revisions to the Steller sea lion protection measures applicable to the pollock fishery. Since the Steller sea lion protection measures were implemented, extensive scientific research has been conducted to understand the impacts of fisheries on Steller sea lions and life history and foraging activities of these animals. These studies have changed our understanding of Steller sea lion and groundfish fisheries interactions. On October 18, 2005, the Council requested that NMFS reinitiate consultation on the November 2000 Biological Opinion and evaluate all new information that has developed since the previous consultations, including the 2001 Biological Opinion on the Steller sea lion protection measures for the Alaska groundfish fisheries (NMFS 2006). The March 2008 Steller sea lion recovery plan provides a thorough review of the threats to the recovery to the species, the status of the species, and criteria that must be met to down-list and delist the species (NMFS 2008a). NMFS is preparing a new FMP-level Biological Opinion to thoroughly review and synthesize information regarding potential impacts on Steller sea lions and their prey by the groundfish fisheries identified since the previous FMP-level Biological Opinion, the 2001 Biological Opinion, the 2003 supplement, and the recovery plan. From this new information, revisions to the Steller sea lion protection measures may be proposed so that the best scientific information available is used to ensure the fisheries are not likely to result in jeopardy of extinction and destruction or adverse modification of designated critical habitat and to alleviate any unnecessary restrictions for the fleet to improve efficiency and ensure economic viability for the industry. NMFS and the Council would develop an EIS to analyze the impacts of proposed changes to the Steller sea lion protection measures.

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 Marine Mammal Protection Act (MMPA). The Pribilof Islands population was designated depleted because it had declined to less than 50% of levels observed in the late 1950s, and no compelling evidence suggested that carrying capacity has changed substantially since the late 1950s (NMFS 2007a). 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 2005). 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 2007a). As more information becomes available regarding the interaction between the groundfish fisheries and northern fur seals, fishing restrictions may be necessary to mitigate potential adverse effects.

NMFS has begun a status review to determine if ribbon seals should be listed as threatened or endangered under the ESA (73 FR 16617, March 28, 2008). NMFS received a petition for listing ribbon seals from the Center for Biological Diversity (2007) and found that the petition presents substantial scientific or commercial information indicating that the petition action may be warranted. Ribbon seals are potentially affected by the diminishing sea ice in the Bering Sea and Arctic regions as they are dependent on sea ice for important activities such as resting and reproduction. Listing of this species would require ESA consultation on federal actions that may adversely affect ribbon seals or any designated critical habitat. One ribbon seal has been observed taken in the pollock trawl fishery between 2000 and 2004 (Angliss and Outlaw 2007), and therefore, any listing of this species may require an ESA consultation for the groundfish fisheries and potential protection measures. Although NMFS has prioritized its review of ribbon seals, it has also announced its intention to initiate status reviews for all ice seals, including bearded, ringed, and spotted seals (73 FR 16617, March 28, 2008). On May 28, 2008, the Center for Biological Diversity petitioned NMFS to list bearded, spotted, and ringed seals under the ESA (CBD 2008). The agency's decision on whether to list these species or not is due May 28, 2009.

3.4.1.3 Increasing integration of ecosystems considerations into fisheries management

Ecosystem assessments evaluate the state of the environment, including monitoring climate–ocean indices and species that indicate ecosystem changes. Ecosystem-based fisheries management reflects the incorporation of ecosystem assessments into single species assessments when making management decisions, and explicitly accounts for ecosystem processes when formulating management actions. Ecosystem-based fisheries management may still encompass traditional management tools, such as TACs, but these tools will likely yield different quantitative results.

To integrate such factors into fisheries management, NMFS and the Council will need to develop policies that explicitly specify decision rules and actions to be taken in response to preliminary indications that a regime shift has occurred. These decision rules need to be included in long-range policies and plans. Management actions should consider the life history of the species of interest and can encompass varying response times, depending on the species' lifespan and rate of production. Stock assessment advice needs to explicitly indicate the likely consequences of alternate harvest strategies to stock viability under various recruitment assumptions.

Management strategy evaluations (MSEs) can help in this process. MSEs use simulation models of a fishery to test the success of different management strategies under different sets of fishery conditions, such as shifts in ecosystem regimes. The AFSC is actively involved in conducting MSEs for several groundfish fisheries, including for several flatfish species in the BS, and for pollock in the GOA.

Both the Pew Commission report and the Oceans Commission report point to the need for changes in the organization of fisheries and oceans management to institutionalize ecosystem considerations in policy making (Pew 2003; U.S. Commission on Ocean Policy 2004). The Oceans Commission, for example, points to the need to develop new management boundaries corresponding to large marine ecosystems, and to align decision-making with these boundaries (U.S. Commission on Ocean Policy 2004).

Since the publication of the Oceans Commission report, the President has established a cabinet-level Committee on Ocean Policy by executive order. The Committee is to explore ways to structure government to implement ecosystem-based ocean management (Evans and Wilson 2005). Congress reauthorized the Magnuson-Stevens Act in December 2006 to addresses ecosystem-based management.

NMFS and the Council are continuing to develop their ecosystem management measures for the fisheries in the EEZ off Alaska. NMFS is currently developing national Fishery Ecosystem Plan guidelines. It is unclear at this time whether these will be issued as guidelines, or as formal provisions for inclusion in the Magnuson-Stevens Act.

The Council has created a committee to research ecosystem developments and to assist in formulating positions with respect to ecosystem-based management. The Council completed a fishery ecosystem plan for the Aleutian Islands ecosystem (NPFMC 2007). An interagency Alaska Marine Ecosystem Forum (AMEF) is improving inter-agency communication on marine ecosystem issues. The Council has signed a Memorandum of Understanding with 10 Federal agencies and 4 State agencies, to create the AMEF. The AMEF seeks to improve communication between the agencies on issues of shared responsibilities related to the marine ecosystems off Alaska's coast. The initial focus of the AMEF will be on the Aleutian Islands marine ecosystem. The SSC has begun to hold annual ecosystem scientific meetings at the February Council meetings.

In addition to these efforts to explore how to develop its ecosystem management efforts, the Council and NMFS continue to initiate efforts to take account of ecosystem impacts of fishing activity. The Council has recommended habitat protection measures for the eastern Bering Sea (73 FR 12357, March 7, 2008). These measures include the Northern Bering Sea Research Area to address potential impacts of shifts in fishing activity to the north.

The Council's Ecosystem Committee discusses ecosystem initiatives and advise the Council on the following issues: (1) defining ecosystem-based management; (2) identifying the structure and Council role in potential regional ecosystem councils; (3) assessing the implications of NOAA strategic planning; (4) drafting guidelines for ecosystem-based approaches to management; (5) drafting Magnuson-Stevens Act requirements relative to ecosystem-based management; and (6) coordinating with NOAA and other initiatives regarding ecosystem-based management. More details are available in the Council's website at http://www.fakr.noaa.gov/npfmc/current_issues/ecosystem/Ecosystem.htm.

The Council is developing Federal fisheries management in the Arctic Management Area. No significant fisheries exist in the Arctic Management Area, either historically or currently. However, the warming of the Arctic and seasonal shrinkage of the sea ice may be associated with increased opportunities for fishing in this region. The Council proposes to develop an Arctic Fishery Management Plan that would (1) close the Arctic to commercial fishing until information improves so that fishing can be conducted sustainably and with due concern to other ecosystem components, (2) determine the fishery management authorities in the Arctic and provide the Council with a vehicle for addressing future management issues, and (3) implement an ecosystem based management policy that recognizes the unique issues in the Alaskan Arctic. The action is necessary to prevent commercial fisheries from developing in the Arctic without the required management framework and scientific information on the fish stocks, their characteristics, and the implications of fishing for the stocks and related components of the ecosystem.

At this writing, while it seems likely that changes in oceans management and associated changes in fisheries management will occur as a result of these discussions and debates, it is not clear what form these new changes will take.

3.4.1.4 Fishery management responses to the effects of climate change

While climate warming trends are being studied and increasingly understood at a global scale (IPCC 2007), the ability for fishery managers to forecast biological responses to changing climate continues to be difficult. The Bering Sea is subject to periodic climatic and ecological "regime shifts." These shifts change the values of key parameters of ecosystem relationships, and can lead to changes in the relative success of different species. The impacts of climate change in the Bering sea, and the related phenomenon of ocean acidification, is addressed in Section 8.4.

The Council and NMFS have taken actions that indicate a willingness to adapt fishery management to be proactive in the face of changing climate conditions. The Council currently receives an annual update on the status and trends of indicators of climate change in the Bering Sea through the presentation of the Ecosystem Assessment and Ecosystem Considerations Report (Boldt 2007). Much of the impetus for Council and NMFS actions in the northern Bering Sea, where bottom trawling is prohibited in the Northern Bering Sea Research Area, and in the Alaskan Arctic, where the Council and NMFS have prohibited all fishing until further scientific study of the impacts of fishing can be conducted, derives from the understanding that changing climate conditions may impact the spatial distribution of fish, and consequently, of fisheries. In order to be proactive, the Council has chosen to close any potential loopholes to unregulated fishing in areas that have not previously been fished.

Consequently, it is likely that as other impacts of climate change become apparent, fishery management will also adapt in response. Because of the large uncertainties as to what these impacts might be, however, and our current inability to predict such change, it is not possible to estimate what form these adaptations may take.

3.4.2 Traditional management tools

3.4.2.1 Authorization of pollock fishery in future years

The annual harvest specifications process for the pollock (and the associated pollock fishery) creates an important class of reasonably foreseeable actions that will take place in every one of the years considered in the cumulative impacts horizon (out to, and including, 2015). Annual TAC specifications limit each year's harvest within sustainable bounds. The overall OY limits on harvests in the BSAI constrain overall harvest of all species. Each year, OFLs, ABCs, and TACs are specified for two years at a time, as described in the Alaska Groundfish Harvest Specifications EIS (NMFS 2007b).

The harvest specifications are adopted in accordance with the mandates of the Magnuson-Stevens Act, following guidelines prepared by NMFS, and in accordance with the process for determining overfishing criteria that is outlined in Section 3.2 of each of the groundfish FMPs. Specifications are developed using the most recent fishery survey data (often collected the summer before the fishery opens) and reviewed by the Council and its SSC, AP, and Plan Teams. The process provides many opportunities for public comment. The management process, of which the specifications are a part, is analyzed in an EIS (NMFS 2007b). Each year's specifications and the status of the environment are reviewed to determine the appropriate level of NEPA analysis.

Annual pollock harvests, conducted in accordance with the annual specifications, will impact pollock stocks. Annual harvest activity may change total mortality for the pollock stock, may affect stock characteristics through time by selective harvesting, may affect reproductive activity, may increase the annual harvestable surplus through compensatory mechanisms, may affect the prey for the target species, and may alter EFH.

The annual pollock harvests also impact the environmental components described in this EIS: salmon, non-target fish species, seabirds, marine mammals, and a more general set of ecological relationships. In general, the environmental components are renewable resources, subject to environmental fluctuations. Ongoing harvests of pollock may be consistent with the sustainability of other resource components if the fisheries are associated with mortality rates that are less than or equal to the rates at which the resources can grow or reproduce themselves.

The on-going pollock fishery employs hundreds of fishermen and fish processors, and contributes to the maintenance of human communities, principally in Alaska, Washington, and Oregon.

The number of TAC categories with low values for ABC/OFL is increasing which tends to increase the likelihood that NMFS will close directed fisheries to prevent overfishing. Currently, the NPFMC is considering separating components of the ‘other species’ category (sharks, skates, octopus, sculpin). Should that occur, incidental catch of sharks for example could impact management of the pollock fishery. As part of the 2006 ‘other species’ incidental catch of 1,973 mt in the pollock fishery, 504 mt were shark. The tier 6 ABC for shark as part of the ‘other species’ category in 2006 was 463 mt and OFL 617 mt. If sharks were managed as a separate species group under their current tier, the pollock fishery would likely have been constrained in 2006. 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. 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.

3.4.2.2 Increasing enforcement responsibilities

The U.S. Coast Guard (USCG) conducts fisheries enforcement activities in the EEZ off Alaska in cooperation with NOAA Office for Law Enforcement (OLE). New programs to protect resource components from pollock fishery impacts will create additional responsibilities for enforcement agencies. Despite this likely increase in enforcement responsibilities, it is not clear that resources for enforcement will increase proportionately.

The USCG is expected to bear a heavy responsibility for homeland security and is not expected to receive proportionate increases in its budget to accommodate increased fisheries enforcement. Increased responsibilities for homeland security and for detection of increasing drug-smuggling activities in waters off Alaska have limited the resources available for the USCG to conduct enforcement activities at the same level as in the recent past. Any deterrent created by Coast Guard presence in enforcing fisheries regulations and restrictions would likely be reduced, as would the opportunities for detection of fisheries violations at-sea.

Likewise, the NOAA OLE has not recently received increased resources consistent with its increasing enforcement obligations (J. Passer, pers. comm., March 2008). However, new enforcement assistance has become available in recent years through direct Congressional line item appropriations for Joint Enforcement Agreements (JEAs) with all coastal states. The State of Alaska has received approximately $10 million of this funding since 2001, and has used JEA money to purchase capital assets such as patrol vessels and patrol vehicles. The State has also hired new personnel to increase levels of at-sea and dockside enforcement and used JEA money to pay for support and operational expenses pertaining to this increased effort (J. Passer, pers. comm., March 2008).

Uncertainties about Congressional authorization of increased enforcement funding preclude any prediction of trends in the availability of resources to meet increased enforcement responsibilities. Thus, while an increase in responsibilities is reasonably foreseeable, a proportionate increase in funding is not.

3.4.2.3 Technical and program changes that will improve enforcement and management

Managers are increasingly using technology for fisheries management and enforcement. Managers are likely to increase use of vessel monitoring systems (VMS) in coming years. Vessels fishing for pollock in the Bering Sea are required to operate VMS units (50 CFR 679.7(a)(18)). Managers and enforcement personnel are making extensive use of the information from existing VMS units, and are likely to make more use of it in the future, as they continue to learn how to use it more effectively.

A joint project by NMFS, the State of Alaska, and the IPHC led to electronic landings reporting for groundfish during 2006. When fish are delivered on shore, fishermen and buyers fill out a web-based form with the information on landings. The program generates a paper form for industry and will forward the data to a central repository, where they will be available for use by authorized parties. Electronic reporting allows enforcement staff to look at large masses of data for violations and trends. The web-based input form contains numerous automatic quality control checks to minimize data input errors. The program gets data to enforcement agents more quickly, increases the efficiency of record audits, and makes enforcement activity less intrusive, as agents will have less need to board vessels to review documents onboard, or enter plants to review documents on the premises.

Although rationalization programs increase the monitoring obligations for enforcement, they also improve enforcement and management capabilities by shifting enforcement efforts from the water to dockside for monitoring landings and other records. Moreover, by stabilizing or reducing the number of operations and by creating fishing and processing cooperatives, rationalization reduces the costs of private and joint action by industry to address certain management issues, particularly the monitoring and control of bycatch. For example, in the salmon bycatch monitoring program in the AFA pollock fisheries, fishermen contract together for in-season catch monitoring by a private firm, and agree to restrict fishing activity when bycatch rates rise to defined levels.

Monitoring the catch of pollock and salmon bycatch in the pollock fisheries relies heavily on data collected by NMFS-certified observers. Observer coverage requirements for the pollock fisheries and the use of observer data are described in more detail in the Chapter 10. Observers currently are provided through a system known as “pay-as-you-go” under which vessels operators required to carry a NMFS-certified observer contract directly for observer services with observer providers (businesses who hire and provide observers). The Council and NMFS have been analyzing alternatives for restructuring the North Pacific Groundfish Observer Program to provide a new system for procuring and deploying observers supported by broad-based user fees and/or direct Federal subsidies, in which NMFS would contract directly for observer coverage and be responsible for determining when and where observers should be deployed. This system would address problems associated with the lack of flexibility in the current system to deploy observers when and where needed to collect needed data and the disproportionately high cost of observers for smaller vessels.

The observer restructuring analysis has been on hold since June 2006 as a result of unanswered questions about the potential costs of the restructured program and because revisions to NMFS’s legal authority to collect fees to support a restructured program in the Magnuson-Stevens Act were expected. The Magnuson-Stevens Act was amended in late 2006 to provide the needed revisions to NMFS’s fee collection authority. However, questions still exist about the potential costs of the restructured program.

At its April 2008 meeting, the Council tasked staff to develop a discussion paper about the status of the restructuring analysis and as yet unresolved questions so that the Council could provide further direction on observer program restructuring at its December 2008 meeting. Future revisions to the observer program service delivery model could affect the pollock fisheries. However, this fishery has very high observer coverage levels now to monitor sector, cooperative, and CDQ group level allocations of pollock and further increases in observer coverage requirements are recommended by NMFS to better monitor salmon bycatch under some alternatives in this EIS. While some alternatives under consideration in the observer restructuring analysis could result in increased observer coverage costs for vessels that participate in the AFA fisheries, it is unlikely that any future changes in the observer program would lead to a decrease in observer coverage in the Bering Sea pollock fisheries or any reduction in the quality and quantity of observer data that would be collected to support this fishery or any of the salmon bycatch alternatives in this EIS.

NMFS is investigating the use of shipboard video monitoring to ensure compliance with full retention requirements in other regions. In the Alaska Region, NMFS has implemented video monitoring to monitor catch sorting actions of crew members inside fish holding bins and investigating the use of video to monitor regulatory discards. An EFP for continued development of the capability to do video monitoring of rockfish catch in the GOA is currently under consideration by NMFS and Council (73 FR 14226, March 14, 2008). NMFS is hopeful that these investigations could lead to regulations that allow use of video monitoring to supplement observer coverage in some fisheries. Electronic monitoring technology is evolving rapidly, and it is probable that video and other technologies will be introduced to supplement current observer coverage and enhance data collection in some fisheries. Video monitoring has not been sufficiently tested to ensure compliance with a no discard requirement at this time, but NMFS would support and encourage research to explore the feasibility of video for this use.

In addition to the technical aspects of video monitoring, several other issues related to video must be resolved. These include the amount of staff time and resources that would be required to review video footage, curation and storage questions, and the costs to NMFS and the fishing industry. Until these issues are resolved, NMFS will continue to implement existing proven monitoring and catch estimation protocols. Electronic monitoring is discussed in more detail in section 10.5.7.4.

3.4.2.4 Development of the salmon excluder device

Gear modifications are one way to reduce salmon bycatch in the pollock fisheries. NMFS has issued exempted fishing permits for the purpose of testing a salmon excluder device in the pollock trawl fishery of the Bering Sea from 2004 to 2006 and for fall 2008 through spring 2010. The experiment would be conducted from Fall 2008 through Spring 2010. The successful development of a salmon excluder device for pollock trawl gear may result in reductions of salmon bycatch, potentially reducing costs associated with the harvest of pollock and reducing the potential impact on the salmon stocks.

3.4.3 Actions by Other Federal, State, and International Agencies

3.4.3.1 State salmon fishery management

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 Alaska Board of Fisheries (BOF) adopts regulations through a public process to conserve fisheries resources and to allocate fisheries resources to the various users. Yukon River salmon fisheries management includes obligations under an international treaty with Canada. Subsistence fisheries management includes coordination with U.S. Federal government agencies where federal rules apply under 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 (Section 5.2.1).

3.4.3.2 Hatchery releases of salmon

Hatcheries produce salmon fry and release these small salmon into the ocean to grow and mature before returning as adults to the hatchery or local rivers and streams for harvest or breading. Hatchery production increases the numbers of salmon in the ocean beyond what is produced by the natural system. A number of hatcheries produce salmon in Korea, Japan, Russia, the US, and Canada. 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 North Pacific Anadromous Fish Commission summarizes information on hatchery releases, by country and by area, where available. Chapter 5, Chinook Salmon, and Chapter 6, Chum Salmon, provide more information on current and past hatchery releases. It is reasonably foreseeable the hatchery production will continue at a similar level into the future.

3.4.3.3 Future exploration and development of offshore mineral resources

The Minerals Management Service (MMS) expects that reasonably foreseeable future activities include numerous discoveries that oil companies may begin to develop in 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. In an EIS prepared for sales in the OCS Leasing Program, the MMS has assessed the cumulative impacts of such activities on fisheries and finds only small incremental increases in impacts for oil and gas development, which are unlikely to significantly impact fisheries and essential fish habitat (MMS 2003).

On April 8, 2008, MMS published a notice of intent to prepare an Environmental Impact Statement for oil and gas lease Sale 214 which is tentatively scheduled for 2011 in the “program area” of North Aleutian Basin, offshore the State of Alaska. The proposed action is to offer for lease all of the blocks in the program area. The EIS analysis will focus on the potential environmental effects of oil and gas exploration, development, and production on the fish, wildlife, socioeconomic, and subsistence resources in the North Aleutian Basin ‘‘program area’’ and neighboring communities.

The North Aleutian Basin underlies the northern coastal plain of the Alaska Peninsula and the waters of Bristol Bay and is believed to be gas-prone. The “program area” consists of approximately 2.3 million hectares (5.6 million acres) and extends offshore from about 10 statute miles to approximately 120 statute miles, in water depths from approximately 40 feet (12 meters) to 120 feet (37 meters). In October 1989, the North Aleutian Basin Planning Area was placed under a congressional moratorium which banned Department of Interior expenditures in support of any petroleum leasing or development activities in the planning area. In 1998, an Executive Order extended the moratorium as a Presidential withdrawal until 2012. In 2004, the congressional moratorium on petroleum-related activities in the North Aleutian Basin was discontinued and in 2007 the Presidential withdrawal was modified to exclude the North Aleutian Basin.

As part of the EIS process, MMS is collaborating with NMFS on a study of the North Pacific right whale in the North Aleutian Basin. The MMS also contracted to modify an ice-ocean circulation model for Alaska’s Bristol Bay. Proposed studies for fiscal year 2008 include research on subsistence food harvest and sharing activities, studies of juvenile and maturing salmon, and nearshore mapping of juvenile salmon and settling crab. Additional studies are proposed for fiscal year 2009. Information on the Environmental Studies Program, completed studies, and a status report for continuing studies in the NAB area may be found at the Web site: http://www.mms.gov/alaska.

3.4.3.4 Expansion and construction of boat harbors by U. S. Army Corps of Engineers, Alaska District, Civil Works Division (COE-CW)

COE-CW funds harbor developments, constructs new harbors, and upgrades existing harbors to meet the demands of fishing communities. Several upgraded harbors have been completed to accommodate the growing needs of fishing communities and the off-season storage of vessels. Local storage reduces transit times of participating vessels from other major ports, such as Seattle, Washington. Upgraded harbors include, King Cove, Dutch Harbor, Sand Point, Seward, Port Lions, Dillingham, and Kodiak. Additionally, new harbors are planned for Akutan, False Pass, Tatitlek, and Valdez.

3.4.3.5 Other State of Alaska actions

Several State actions in development may impact habitat and those animals that depend on the habitat. These potential actions will be tracked, but cannot be considered reasonably foreseeable future actions because the State has not proposed regulations. These actions include the following:

- Changes to the residue criteria under the Alaska Water Quality Standards. The State proposes to significantly generalize the language of the residues criterion and increase discretion in determining what constitutes an overage. The Alaska Department of Environmental Conservation's proposed residues criterion eliminates the prohibition on residues that cause leaching of toxic or deleterious substances. Under the new system, any and all residue discharges would be allowed without a permit, unless some type of harm (objectionable characteristics or presence of nuisance species) is discovered. The Environmental Protection Agency (EPA) has provided comments to the State regarding this proposed change and determined that major changes were needed for EPA approval. This proposed regulation change became effective for state purposes on July 30, 2006. The State expects EPA's approval of the State regulations by the end of 2008 (Nancy Sonafrank, Alaska Department of Environmental Quality, pers. comm., March 18, 2008).

- The State has passed legislation to implement State primacy for the National Pollution Discharge Elimination System Program under the Clean Water Act and has submitted a primacy package to EPA. The program is required to be as stringent as the current federal program but the effectiveness of implementation will be the key to whether impacts on habitat may be seen. The State expects to receive control of the program from EPA by the end of 2008 (Hartig 2008).

NMFS will track the progress of these potential actions and will include these in effects analyses in future NEPA documents when proposed rules are issued.

3.4.4 Private actions

3.4.4.1 Commercial pollock and salmon fishing

Fishermen will continue to fish for pollock, as authorized by NMFS, and salmon, as authorized by the State. Fishing constitutes the most important class of reasonably foreseeable future private actions and will take place indefinitely into the future. Chapter 4 Walleye Pollock and Chapter 10 Regulatory Impact Review, provide more information on the Bering Sea pollock fishery.

Commercial salmon fisheries exist throughout Alaska, in marine waters, bays, and rivers. Chapter 5 Chinook Salmon, Chapter 6 Chum Salmon, and Chapter 10 Regulatory Impact Review provide more information on the commercial salmon fisheries.

The Marine Stewardship Council (MSC) is a non-profit organization that seeks to promote the sustainability of fishery resources through a program of certifying fisheries that are well managed with respect to environmental impacts (http://eng.msc.org/). Certification conveys an advantage to industry in the marketplace, by making products more attractive to consumers who are sensitive to environmental concerns. A fishery must undergo a rigorous review of its environmental impact to achieve certification. Fisheries are evaluated with respect to the potential for overfishing or recovery of target stocks, the potential for the impacts on the "structure, productivity, function and diversity of the ecosystem," and the extent to which fishery management respects laws and standards, and mandates “responsible and sustainable” use of the resource (SCS 2004). Once certified, fisheries are subject to ongoing monitoring, and other requirements for recertification.

The MSC has certified the BSAI and GOA pollock, BSAI Pacific cod freezer longline, halibut, and sablefish fisheries. The MSC has also certified the State of Alaska’s management of all five salmon species. Because the program requires ongoing monitoring and re-evaluation for certification every five years (SCS 2004), and because the program may convey a marketing advantage, MSC certification may change the pollock industry incentive structure to increase sensitivity to environmental impacts.

3.4.4.2 CDQ Investments in western Alaska

The CDQ Program was designed to improve the social and economic conditions in western Alaska communities by facilitating their economic participation in the BSAI fisheries. The large-scale commercial fisheries of the BSAI developed in the eastern BS without significant participation from rural western Alaska communities. These fisheries are capital-intensive and require large investments in vessels, infrastructure, processing capacity, and specialized gear. The CDQ Program was developed to redistribute some of the BSAI fisheries’ economic benefits to adjacent communities by allocating a portion of commercially important BSAI species to such communities as fixed shares, or quota, of groundfish, halibut, and crab. The percentage of each annual BSAI catch limit allocated to the CDQ Program varies by both species and management area. These allocations, in turn, provide an opportunity for residents of these communities to both participate in and benefit from the BSAI fisheries.

Sixty-five communities participate in the CDQ Program. These communities have formed six non-profit corporations (CDQ groups) to manage and administer the CDQ allocations, investments, and economic development projects. Annual CDQ allocations provide a revenue stream for CDQ groups through various channels, including the direct catch and sale of some species, leasing quota to various harvesting partners, and income from a variety of investments. The six CDQ groups had total revenues in 2005 of approximately $134 million, primarily from pollock royalties.

One of the most tangible direct benefits of the CDQ Program has been employment opportunities for western Alaska village residents. CDQ groups have had some successes in securing career track employment for many residents of qualifying communities, and have opened opportunities for non-CDQ Alaskan residents, as well. Jobs generated by the CDQ program included work aboard a wide range of fishing vessels, internships with the business partners or government agencies, employment at processing plants, and administrative positions.

Many of the jobs generated by the CDQ program are associated with shoreside fisheries development projects in CDQ communities. This includes a wide range of projects, including those directly related to commercial fishing. Examples of such projects include building or improving seafood processing facilities, purchasing ice machines, purchasing and building fishing vessel, gear improvements, and construction of docks or other fish handling infrastructure. CDQ groups also have invested in peripheral projects that directly or indirectly support commercial fishing for halibut, salmon, and other nearshore species. This includes seafood branding and marketing, quality control training, safety and survival training, construction and staffing of maintenance and repair facilities that are used by both fishermen and other community residents, and assistance with bulk fuel procurement and distribution. Several CDQ groups are actively involved in salmon assessment or enhancement projects, either independently or in collaboration with ADF&G. Salmon fishing is a key component of western Alaska fishing activities, both commercially and at a subsistence level. The CDQ Program provides a means to support and sustain both such activities.

3.4.4.3 Subsistence harvest of Chinook salmon

Communities in western and Interior Alaska depend on Chinook salmon from the Bering Sea for subsistence and the associated cultural and spiritual needs. Chinook salmon consumption can be an important part of regional diets, and Chinook salmon and Chinook salmon products are distributed as gifts or through barter and small cash exchanges to persons who do not directly participate in the subsistence fishery. Subsistence harvests will continue indefinitely into the future. Chapters 9 and 10 provide more information on subsistence harvests.

3.4.4.4 Sport fishing for Chinook salmon

Regional residents may harvest Chinook salmon for sport, using a State sport fishing license, and then use these salmon for essentially subsistence purposes. Regional sport fisheries, including Chinook salmon fisheries may also attract anglers from other places. Anglers who come to the action area from elsewhere to sport fish generate economic opportunities for local residents. Sport fishing for Chinook salmon will continue indefinitely into the future. Chapters 9 and 10 provide more information on sport harvests.

3.4.4.5 Increasing levels of economic activity in Alaska's waters and coastal zone

Alaska's population has grown by over 100,000 persons since 1990 (U.S. Census Bureau website accessed at http://www.census.gov/ on July 14, 2005). As of June 2005, Alaska's estimated population is about 662,000. The Alaska State Demographer's projection for the end of the forecast period of this analysis (2015) is about 734,000, an 11% increase (Williams 2005).

Alaska's population in its coastal regions is expected to continue to grow (Crossett et al. 2004). Population growth in these regions may have larger impacts on salmon stocks than growth in inland areas. So far, Alaska's total population growth in coastal areas remains low compared to that in other states. Alaska had the second largest percentage change in growth over the period from 1980 to 2002, but this% was calculated from a relatively low base. Its coastal population grew by about 63%. Alaska has the smallest coastal population density of all the states, with an average of 1.4 persons per square mile in 2003. By comparison, coastal densities were 641 persons per square mile in the northeastern states, 224 on the Atlantic southeastern states, 164 along the Gulf of Mexico, 299 along the West Coast exclusive of Alaska, and 238 in the Great Lakes states (including New York's Great Lakes counties). Maine and Georgia, the states with the next lowest coastal population density, had 60 persons per square mile (Crossett et al. 2004). Crossett et al. project continued population growth in Alaska's coastal regions; however growth in these areas will never approach the levels seen in Hawaii and the lower 48 states.

In Alaska, the success of the CDQ program and the expansion of such community based allocation programs in the future (as discussed under the earlier section on reasonably foreseeable rationalization programs) may lead to increased population in affected communities. A growing population will create a larger environmental "footprint," and increase the demand for marine environmental services. A larger population will be associated with more economic activity from increased cargo traffic from other states, more recreational traffic, potential development of lands along the margin of the marine waters, increased waste disposal requirements, and increased demand for sport fishing opportunities.

Shipping routes from Pacific Northwest ports to Asia run across the GOA and through the BSAI, and pass near or through important fishing areas. The key transportation route between West Coast ports in Washington, Oregon, and British Columbia to East Asia passes from the GOA into the EBS at Unimak Pass, and then returns to the Pacific Ocean in the area of Buldir Island. An estimated 3,100 large vessels used this route in the year ending September 30, 2006. An estimated 853 of these were bulk carriers, and an estimated 916 were container ships (Nuka Research 2006, page 12). The direct routes from California ports to East Asia pass just south of the Aleutian Islands. Continued globalization, growth of the Chinese economy, and associated growth in other parts of the Far East may lead to increasing volumes of commercial cargo vessel traffic through Alaska waters. U.S. agricultural exports to China, for example, doubled between 2002, and 2004; 41% of the increase, by value, was in soybeans and 13% was in wheat (USDA 2005). In future years, this may be an important route for Canadian oil exports to China (Zweig and Jianhai 2005).

The significance of this traffic for the regional environment and for fisheries is highlighted by recent shipping accidents, including the December 2004 grounding of the *M/V Selendang Ayu* and the July 2006 incapacitation of the *M/V Cougar Ace*. The *M/V Selendang Ayu* dumped the vessel's cargo of soybeans and as much as 320,000 gallons of bunker oil, on the shores of Unalaska Island (USCG, Selendang Ayu grounding Unified Command press release, April 23, 2005). On July 23, 2006, the *M/V Cougar Ace*, a 654-foot car carrier homeported in Singapore, contacted the US Coast Guard and reported that their vessel was listing at 80 degrees and taking on water. The *M/V Cougar Ace* was towed to Dutch Harbor where the listing problem was corrected. The vessel was then towed to Portland, Oregon (Alaska Department of Conservation Final situation report, September 1, 2006, available at: http://www.dec.state.ak.us/spar/perp/response/sum_fy07/060728201/sitreps/060728201_sr_10.pdf).

Mining activities in Alaska are expected to increase in the coming years. The Red Dog mine in Northwest Alaska will continue operations and a new deposit in the Bristol Bay region is being explored for possible large-scale strip mining. The continued development and/or expansion of mines, though expected, will be dependent on stable metals prices in the coming years. At present it appears such prices will be stable.

In southwest Alaska copper, gold, and molybdenum may be mined at the prospective Pebble mine (www.pebblepartnership.com). The Pebble mine would be situated in the Bristol Bay region near the northeast end of Iliamna Lake, which feeds directly into Bristol Bay. The Pebble mine is at the pre-feasibility and pre-permitting stage of development, and faces a lengthy and rigorous timeline to production. The Pebble Partnership's proposed mine development plan will be subject to a regulatory review involving 11 state and federal agencies. The Pebble Partnership must provide the required information for an Environmental Impact Statement and be issued more than 60 State and Federal permits. The combined review and permitting process could take three years or more to complete.

Also in southwestern Alaska, near the Kuskokwim River, is the Donlin Creek gold mining project, which is currently completing its feasibility study, and is in preparation for beginning the permitting process. The land is owned by the Kuskokwim Corporation, and the subsurface rights are owned by the Calista Corporation, both Native corporations formed under the Alaska Native Claims Settlement Act. Donlin Creek is one of the largest undeveloped gold deposits in the world.

Oil and gas development can also be expected to increase due to the currently high oil and gasoline prices. Plans are underway for development of a gas pipeline that may include a shipping segment through the GOA. Exploration and eventual extraction development of the Arctic National Wildlife Preserve is also anticipated. It is also possible that fuel prices may create incentive for oil and gas lease sales on the continental shelf off western Alaska, which is the prime fishing ground of the EBS.

It is possible that hydrokinetic power will be generated on WAK rivers within the next ten years. The Federal Energy Regulatory Commission has issued 12 preliminary permits for in-river turbines on Alaskan mainstem rivers. One very small project operated for 60 days on the Yukon River at Ruby last year, and one larger project is likely to be installed at Eagle this year. NMFS statutory authorities require alternative energy permitting and licensing agencies to consult with NMFS regarding the impacts of proposed ocean energy projects on ocean and anadromous resources. FPA also grants NMFS the authority to prescribe fishways and to propose conservation measures to address any adverse effects to fish and wildlife resources at projects licensed by FERC. These consultations offer the opportunity to provide recommendations to both the permitting agencies and energy companies on how to avoid, minimize, or mitigate the impacts of their energy projects on living marine resources and essential habitat. Therefore, NMFS will be aware and review any future studies on the impacts of the hydrokinetic turbines. Additionally, NMFS is reviewing a proposal for ocean kinetic energy generation near Teller-Brevig Mission. The NMFS Alaska Region web page provides more information at [http://www.nmfs.noaa.gov/habitat/habitatprotection/oceanrenewableenergy/index2.html] (Sue Walker, Hydropower Coordinator, NMFS Alaska Region, personal communication)

Additional references

Holt, C., M. Rutherford, R. Peterman. 2008. International cooperation among nation-states of the North Pacific Ocean on the problem of competition among salmon for a common pool of prey resources. Marine Policy 32. pp. 607-617.

IPCC. International Panel on Climate Change. Climate Change 2007, The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

Welch, D.W., Y. Ishida, and K. Nagasawa. 1998. Thermal limits and ocean migrations of sockeye salmon (Oncorhynchus nerka): long-term consequences of global warming. Can. J. Fish. Aquat. Sci. 55:937-948.

Appendix 3 – Revised Section 4.4 Consideration of future action (pollock)

4.3 Consideration of future actions

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. Past and present actions affecting the pollock resource have been incorporated into the impacts analysis in this Chapter. Section 3.4 provides a detailed discussion of reasonably foreseeable future actions that may affect the Bering Sea pollock fishery, the Chinook salmon caught as bycatch in that fishery, and the impacts of salmon bycatch on other resource components analyzed in the EIS.

4.3.1 Ecosystem-sensitive management

Measures to minimize chum salmon bycatch

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 measure to minimize chum salmon bycatch in the pollock fishery. A suite of alternative management measures was proposed in April 2008, and a discussion paper was presented to the Council in October 2008. In December 2008, the Council developed a range of alternatives for analysis. Because any revised chum salmon bycatch measures will also regulate the pollock fishery, there will be a synergistic interaction between the alternatives proposed in this EIS and those considered under the chum salmon action. Analysis has not yet begun on the chum salmon action, but will be underway before this EIS is finalized, and a further discussion of the impact interactions will be included at that time.

Adjusting protections for Steller sea lions

The Council and NMFS may develop additional Steller sea lion protection measures to reduce the pollock fisheries interaction with Steller sea lions. As discussed in section 3.4, NMFS is currently developing a biological opinion on the status quo groundfish fisheries in the BSAI and GOA which is expected to be available in late 2009. Depending on the results of that biological opinion, the Council and NMFS may decide to change the management of the pollock fleet. Additionally, the potential change in listing for the ice seals and northern fur seals could result in management changes. 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.

Changes to fishery management based on ongoing research and understanding of ecosystem interactions and the effects of climate change

Pollock stocks may also be affected by changing climate 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). A study is currently underway linking temperature and salmon bycatch rates, and preliminary evidence indicates a relationship (Ianelli et al. 2009). At this time, it is not possible to forecast in what way changing climate conditions are likely to affect pollock stocks.

4.3.2 Traditional management tools

Development of the salmon excluder device

The development and deployment of the salmon excluder devise may reduce Chinook salmon bycatch and improve the fleets ability to harvest the pollock TAC under a hard cap. The salmon excluder is still being tested in pollock fisheries, and is not yet in wide-scale use, however many of the early design flaws have been corrected at this stage.

Authorization of the pollock fishery in future years

Future harvest specifications will primarily affect fishing mortality as the other significance criteria for pollock (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 produced 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 fisheries to directed fishing as fishermen approach TACs, treat species whose TACs have been taken as prohibited species, and introduce fishing restrictions, or actual fishery closures, in fisheries in which harvests approach OFL. The 2 million mt OY 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.

Increasing enforcement responsibilities

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. Currently the NPFMC is considering separating components of the 'other species' category (sharks, skates, octopus, sculpin). Should that occur, incidental catch of sharks for example could impact management of the pollock fishery. As part of the 2006 'other species' incidental catch of 1,973 mt in the pollock fishery, 504 mt were shark. The tier 6 ABC for shark as part of the 'other species' category in 2006 was 463 mt and OFL 617 mt. If sharks were managed as a separate species group under their current tier, the pollock fishery would likely have been constrained in 2006.

Improved enforcement through VMS

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.

4.3.3 Actions by Other Federal, State, and International Agencies

Future exploration and development of offshore mineral resources

The Minerals Management Service (MMS) 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. The MMS has published a notice of intent to prepare an Environmental Impact Statement for oil and gas lease Sale 214 which is tentatively scheduled for 2011 in the "program area" of North Aleutian Basin, offshore the State of Alaska. A notable proportion of the pollock fishery occurs in the North Aleutian Basin program area, and adverse environmental impacts resulting from exploration and development in the future could impact pollock stocks. The extent to which these impacts may occur is unknown.

4.3.4 Private actions

Commercial pollock fishing

The analysis assumes that the commercial fishery for pollock will continue into the future, and the direct effects analysis has been designed to study the impacts of the fishery.

Additional references

Ianelli, J., J. Gauvin, D. Stram, and P. Stabeno. 2009. Opportunistic temperature-at-depth recorders on Bering Sea pollock trawls to evaluate linkages between location-specific temperatures and pollock, salmon, and other species. Paper presented at the Alaska Marine Science Symposium. January 2009. Anchorage, Alaska.

Ianelli, J.N., S. Barbeaux, T. Honkalehto, S. Kotwicki, K. Aydin, and N. Williamson. 2008. Eastern Bering Sea Walleye Pollock. In, Stock Assessment and Fishery Evaluation (SAFE) report for the Bering Sea and Aleutian Islands groundfish. North Pacific Fishery Management Council, 605 West 4th Avenue, Anchorage, AK.

Appendix 4 – Revised Section 5.3.1.1 Pollock fishery bycatch of Chinook by sector

5.3.1.1 Pollock fishery bycatch of Chinook by sector

Bycatch of Chinook varies seasonally by season and by sector (Fig. 5-36 and Fig. 5-37; Table 5-22). Since 2002 the inshore CV fleet has consistently had the highest bycatch by sector in the A season, but prior to that offshore catcher processor catch was higher on a seasonal basis (Fig. 5-36). Catch by the mothership sector in the A season has always been lower than the other two sectors. Mean Chinook rates (number per 1,000 t of pollock) were presented for summary purposes and shows higher rates during the A-season compared to the B season except for 2005 where the average rates in both seasons were similar (though varied by sector; bottom panel of Table 5-22).

In the B season the inshore CV fleet has had the highest bycatch by sector since 1996 (except for 2001), followed by the offshore CP fleet (Fig. 5-37). As with the A season, historically the mothership fleet sector catch compared to the total has been low.

In recent years, rates for the inshore catcher vessel fleet have been consistently higher than for the other fleets (Fig. 5-38). To illustrate the relative difference between sectors, Table 5-23 shows the contrast of bycatch sector-specific patterns within aggregate season and annual mean levels. This shows a fair degree of inter-annual variability in the relative rates by sectors. The total catch for the mothership fleet was lower than the CP fleet in 2006, their relative rate was higher (Fig. 5-38). In the B season, the inshore fleet has the highest bycatch rates followed consistently in almost all years by the mothership fleet (Fig. 5-39).

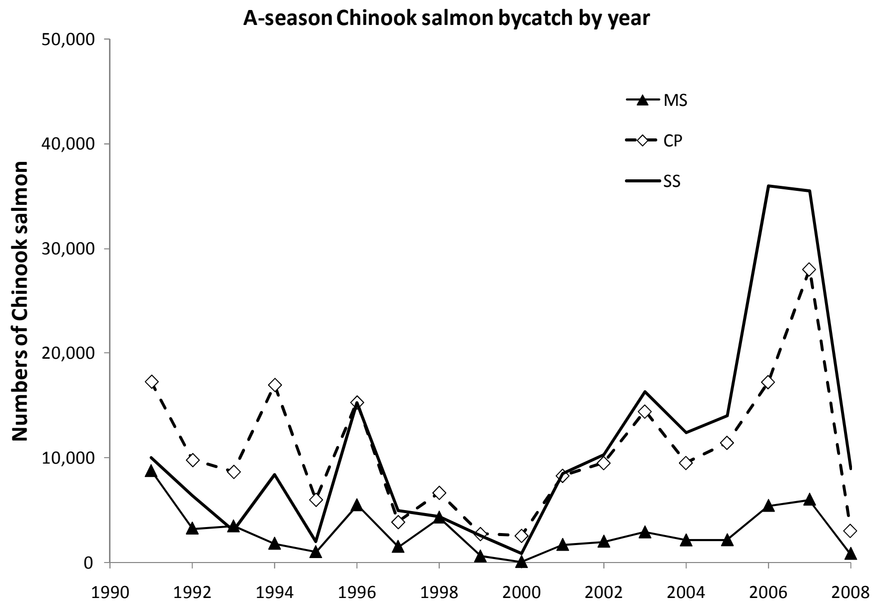


Fig. 5-36 Chinook salmon catch by sector in pollock fishery A season 1991-2008. Data are shown by inshore catcher vessel sector (solid line), offshore catcher processor (dotted line with diamonds) and mothership sector (solid line with triangles).

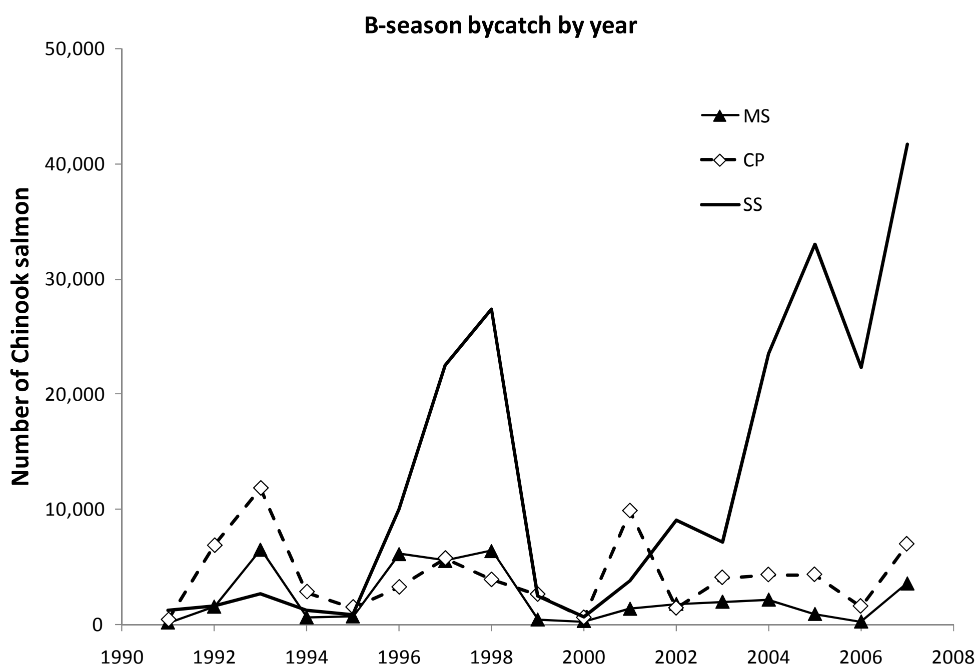


Fig. 5-37 Chinook salmon catch by sector in pollock fishery B season 1991-2007. Data are shown by inshore catcher vessel sector (solid line), offshore catcher processor (dotted line with diamonds) and mothership sector (solid line with triangles).

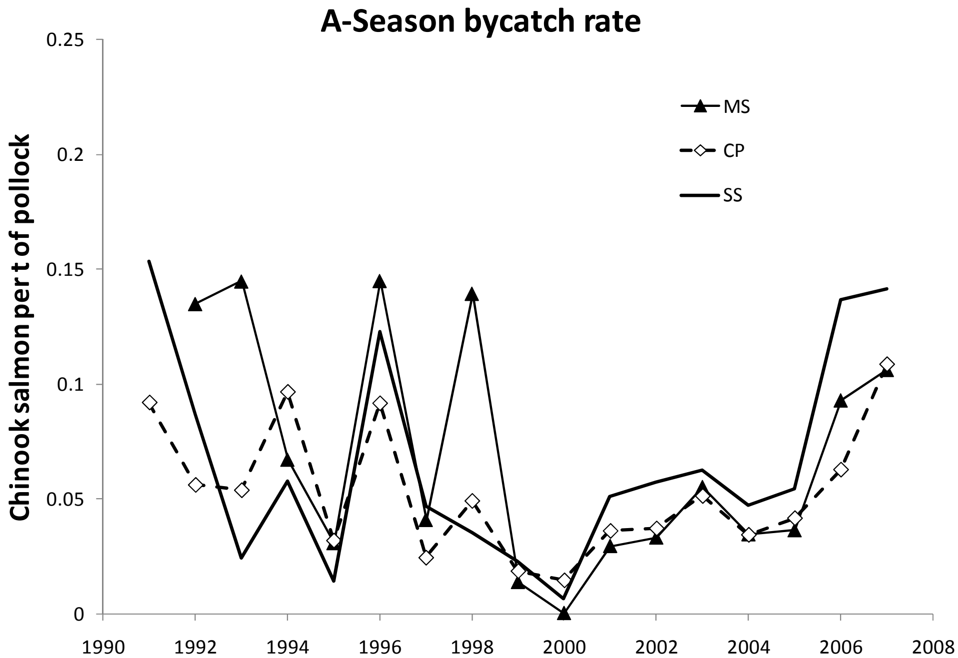


Fig. 5-38 Chinook salmon A season bycatch rates by sector (Chinook per t pollock). Inshore catcher vessel (solid line), offshore catcher processor (dashed line with diamonds) and mothership sector (solid line with filled triangles), 1991-2007.

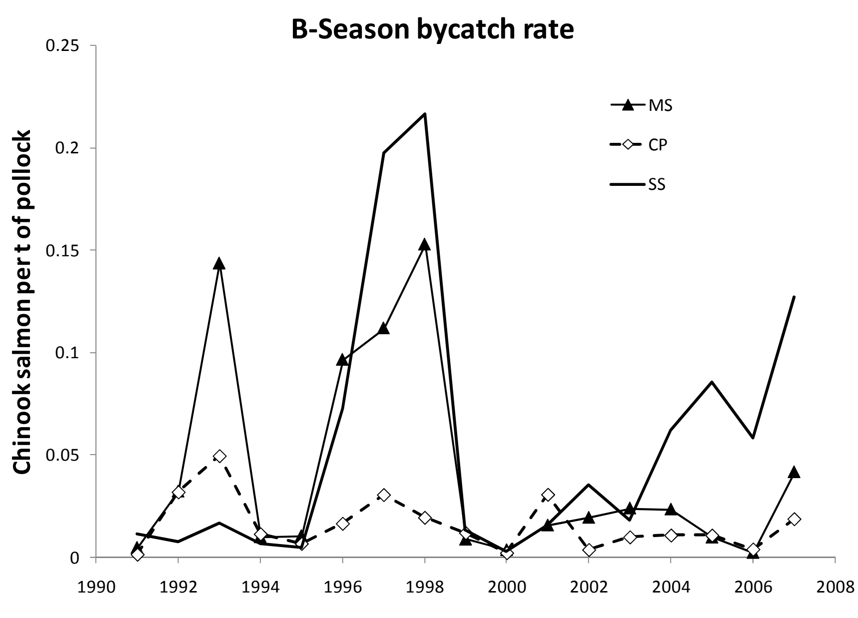


Fig. 5-39 Chinook salmon B season bycatch rates by sector (Chinook per t pollock). Inshore catcher vessel (solid line), offshore catcher processor (dashed line with diamonds) and mothership sector (solid line with filled triangles), 1991-2007.

Table 5-22 Catch of pollock and Chinook salmon along with Chinook rate (per 1,000 t of pollock) by sector and season, 2003-2007. Catches from CDQ are included. M=Mothership sector, P=catcher processor sector, and S=shoreside catcher-vessel sector.

Pollock (t)

Season	Sector	Year 2003	2004	2005	2006	2007
A	M	51,811	60,222	57,802	58,134	56,526
	P	280,505	275,625	273,977	274,279	257,647
	S	260,212	262,570	259,002	262,997	250,726
A	Sub-total	592,528	598,417	590,780	595,410	564,899
B	M	80,817	90,736	89,225	89,303	84,978
	P	413,512	401,570	403,537	405,586	372,737
	S	393,550	378,855	386,473	381,981	327,962
B	Sub-total	887,879	871,160	879,236	876,870	785,677
	Annual Total	1,480,408	1,469,577	1,470,016	1,472,280	1,350,576

Chinook bycatch

	Sector	Year 2003	2004	2005	2006	2007
A	M	2,892	2,092	2,111	5,408	5,860
	P	14,428	9,492	11,421	17,306	27,943
	S	16,488	12,376	14,097	36,039	35,458
A	Sub-total	33,808	23,961	27,630	58,753	69,261
B	M	1,940	2,076	888	200	3,544
	P	4,044	4,289	4,343	1,551	7,148
	S	7,202	23,701	34,986	22,654	41,751
B	Sub-total	13,185	30,067	40,217	24,405	52,443
	Annual Total	46,993	54,028	67,847	83,159	121,704

Chinook / 1,000 t of pollock

	Sector	Year 2003	2004	2005	2006	2007	Mean
A	M	56	35	37	93	104	65
	P	51	34	42	63	108	59
	S	63	47	54	137	141	88
	A-season average	57	40	47	99	123	73
B	M	24	23	10	2	42	20
	P	10	11	11	4	19	11
	S	18	63	91	59	127	70
	B-season average	15	35	46	28	67	37
	Average	32	37	46	56	90	52

Table 5-23 Sector and season specific bycatch rate (Chinook / t of pollock) relative to the mean value for the A and B seasons (first 6 rows) and for the entire year (last three rows), 2003-2007. M=Mothership sector, P=catcher processor sector, and S=shoreside catcher-vessel sector.

Season	Sector	Year 2003	2004	2005	2006	2007
A	M	98%	87%	78%	94%	85%
	P	90%	86%	89%	64%	88%
	S	111%	118%	116%	139%	115%
B	M	162%	66%	22%	8%	62%
	P	66%	31%	24%	14%	29%
	S	123%	181%	198%	213%	191%
A+B	M	115%	75%	44%	67%	74%
	P	84%	55%	50%	49%	62%
	S	114%	153%	165%	161%	148%

Appendix 5. Revised Table 5-3.

Table 5-3 Overview of Western Alaskan Chinook stock status 2008

Chinook Stock	Total run estimated?	2008 preliminary run estimate above or below projected/forecasted	Escapement estimates?	Escapement goals met?	Stock of concern?
Norton Sound	No	Below	Yes	No	Yield concern (since 2004)
Yukon	Yes	Below	Yes	Most in Alaska No-Canadian treaty goal	Yield concern (since 2000)
Kuskokwim	Yes	Below	Yes	Some [1]	No Yield concern discontinued 2007
Bristol Bay	Yes	Below	Yes	Some	No

[1] For the Kuskokwim: 3 of 4 weir goals were below while 3 of 5 aerial goals were below.

Appendix 6 – Revised Section 5.4 Consideration of future actions (Chinook salmon)

5.4 Considerations of future actions

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. Past and present actions affecting the Chinook salmon resource have been incorporated into the impacts discussion above. Section 3.4 provides a detailed discussion of reasonably foreseeable future actions that may affect the Bering Sea pollock fishery, the salmon caught as bycatch in that fishery, and the impacts of salmon bycatch on other resource components analyzed in the EIS.

5.4.1 Ecosystem-sensitive management

Measures to minimize chum salmon bycatch

The Council is considering action on management measure to minimize chum salmon bycatch in the Bering Sea pollock fishery. A suite of alternative management measures was proposed in April 2008, and a discussion paper was presented to the Council in October 2008. In December 2008, the Council developed a range of alternatives for analysis. Because any revised chum salmon bycatch measures will also regulate the pollock fishery, there will be a synergistic interaction between the alternatives proposed in this EIS and those considered under the chum salmon action. Analysis has not yet begun on the chum salmon action, but will be underway before this EIS is finalized, and a further discussion of the impact interactions will be included at that time. 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 non-target species, such as Chinook salmon.

Changes to fishery management based on ongoing research and understanding of ecosystem interactions and the effects of climate change

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 (see Section 5.1). 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 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 is underway and preliminary evidence indicates a relationship, even when factoring for month and area (Ianelli et al. 2009).

Compelling evidence from studies of changes in Bering Sea and Arctic climate, ocean conditions, sea ice cover, and 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.

5.4.2 Traditional management tools

Development of the salmon excluder device

The development and deployment of the salmon excluder device may reduce Chinook salmon bycatch and improve the fleet's ability to harvest the pollock TAC under a hard cap. The salmon excluder is still being tested in pollock fisheries, and is not yet in wide-scale use, however many of the early design flaws have been corrected at this stage.

5.4.3 Actions by Other Federal, State, and International Agencies

State salmon fishery management

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. Yukon River salmon fisheries management includes obligations under an international treaty with Canada. Subsistence fisheries management includes coordination with U.S. Federal government agencies where federal rules apply under 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.

Future exploration and development of offshore mineral resources

The Minerals Management Service (MMS) 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. The MMS has published a notice of intent to prepare an Environmental Impact Statement for oil and gas lease Sale 214 which is tentatively scheduled for 2011 in the "program area" of North Aleutian Basin, offshore the State of Alaska. Many of the western Alaska salmon migration corridors pass through the program area identified by MMS, and adverse environmental impacts resulting from exploration and development in the future could impact salmon stocks. The extent to which these impacts may occur is unknown.

Hatchery releases of salmon

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).

5.4.4 Private actions

Commercial pollock and salmon fishing (domestic and foreign), subsistence and sport fisheries for Chinook salmon

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. For transboundary salmon stocks, bycatch may also be occurring in foreign fisheries, which may be impacting Alaskan salmon returns. Information is not available to assess the amount of bycatch caught in foreign fisheries, or the degree to which it is affecting Alaskan stocks. The analysis of direct effects assumes that these activities will continue at similar levels into the future.

Future exploration and development of onshore mineral resources

Salmon stocks may also be affected by onshore mining activities, to the extent that pollutants or contaminants from those operations may affect salmon spawning streams. Some instances of mining operations in southwestern Alaska are discussed in Section 3.4.

Hydrokinetic power generation

The Federal Energy Regulatory Commission has issued 12 preliminary permits for in-river turbines on Alaskan mainstem rivers. One very small project operated for 60 days on the Yukon River at Ruby last year, and one larger project is likely to be installed at Eagle this year. No studies have been completed yet on the impacts of hydrokinetic turbines on Chinook salmon, however this impact analysis will be conducted as part of the pilot licenses for these projects. Possible effects may be minor because these projects are designed to work in the highest current or flow areas of the river and fish generally avoid the high current areas. NMFS statutory authorities require alternative energy permitting and licensing agencies to consult with NMFS regarding the impacts of proposed ocean energy projects on ocean and anadromous resources. FPA also grants NMFS the authority to prescribe fishways and to propose conservation measures to address any adverse effects to fish and wildlife resources at projects licensed by FERC. These consultations offer the opportunity to provide recommendations to both the permitting agencies and energy companies on how to avoid, minimize, or mitigate the impacts of their energy projects on living marine resources and essential habitat. Therefore, NMFS will be aware and review any future studies on the impacts of the hydrokinetic turbines. Additionally, NMFS is reviewing a proposal for ocean kinetic energy generation near Teller-Brevig Mission. To date, no studies have been conducted on the impacts of ocean kinetic energy generation on Chinook salmon. The NMFS Alaska Region web page provides more information at [http://www.nmfs.noaa.gov/habitat/habitatprotection/oceanrenewableenergy/index2.html] (Sue Walker, Hydropower Coordinator, NMFS Alaska Region, personal communication)

References

Arctic Climate Impact Assessment [ACIA]. 2005. Cambridge University Press. 1,042 p. http://www.acia.uaf.edu

Azumaya, T., T. Nagasawa, O. Yamamura, M. Kawana, G. Khen, and O. Temnykh. 2006. Spatial Distributions of Chum Salmon and Environments of their Habitat in the Bering Sea during Summer and Autumn. NPAFC Technical Report No. 6.

Crozier, L., and R. Zabel. 2006. Climate impacts at multiple scales: evidence for differential populations responses in juvenile Chinook salmon. Journal of Animal Ecology 75. pp. 1100-1109.

Friedland, K.D., R.V. Walker, N.D. Davis, K.W. Myers, G.W. Boehlert, S. Urawa and Y. Ueno. 2001. Open-ocean orientation and return migration routes of chum salmon based on temperature data from data storage tags. Mar. Ecol. Prog. Ser. 216: 235-252.

Holt, C., M. Rutherford, R. Peterman. 2008. International cooperation among nation-states of the North Pacific Ocean on the problem of competition among salmon for a common pool of prey resources. Marine Policy 32. pp. 607-617.

Ianelli, J., J. Gauvin, D. Stram, and P. Stabeno. 2009. Opportunistic temperature-at-depth recorders on Bering Sea pollock trawls to evaluate linkages between location-specific temperatures and pollock, salmon, and other species. Paper presented at the Alaska Marine Science Symposium. January 2009. Anchorage, Alaska.

Ianelli, J.N., S. Barbeaux, T. Honkalehto, S. Kotwicki, K. Aydin, and N. Williamson. 2008. Eastern Bering Sea Walleye Pollock. In, Stock Assessment and Fishery Evaluation (SAFE) report for the Bering Sea and Aleutian Islands groundfish. North Pacific Fishery Management Council, 605 West 4th Avenue, Anchorage, AK.

Mantua, N., S. Hare, Y. Zhang, J. Wallace, and R. Francis. 1997. Bulletin of the American Meteorological Society. Vol. 78, no. 6. June 1997. pp. 1069-1079.

Marine, K. and J. Cech. 2004. Effects of high water temperature on growth, smoltification, and predator avoidance in juvenile Sacramento River Chinook Salmon. North American Journal of Fisheries Management 24. pp. 198-210.

Schindler, D., X. Augerot, E. Fleishman, N. Mantua, B. Riddell, M. Ruckelshaus, J. Seeb, and M. Webster. 2008. Fisheries, vol. 33, no. 10. October 2008. pp. 502-506.

Welch, D.W., Y. Ishida, and K. Nagasawa. 1998. Thermal limits and ocean migrations of sockeye salmon (Oncorhynchus nerka): long-term consequences of global warming. Can. J. Fish. Aquat. Sci. 55:937-948.

Appendix 7 – Revised Section 6.6 Consideration of future actions (chum)

6.6 Consideration of future actions

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. Past and present actions affecting the chum salmon resource have been incorporated into the impacts discussion above. Section 3.4 provides a detailed discussion of reasonably foreseeable future actions that may affect the Bering Sea pollock fishery, the salmon caught as bycatch in that fishery, and the impacts of salmon bycatch on other resource components analyzed in the EIS.

6.6.1 Ecosystem-sensitive management

Measures to minimize chum salmon bycatch

The Council is considering action on management measure to minimize chum salmon bycatch in the Bering Sea pollock fishery. A suite of alternative management measures was proposed in April 2008, and a discussion paper was presented to the Council in October 2008. In December 2008, the Council developed a range of alternatives for analysis. Because any revised chum salmon bycatch measures will also regulate the pollock fishery, there will be a synergistic interaction between the alternatives proposed in this EIS and those considered under the chum salmon action. Analysis has not yet begun on the chum salmon action, but will be underway before this EIS is finalized, and a further discussion of the impact interactions will be included at that time. 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 non-target species, such as chum salmon.

Changes to fishery management based on ongoing research and understanding of ecosystem interactions and the effects of climate change

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 (see Section 5.1). 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 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 is underway and preliminary evidence indicates a relationship, even when factoring for month and area (Ianelli et al. 2009).

Compelling evidence from studies of changes in Bering Sea and Arctic climate, ocean conditions, sea ice cover, and 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.

6.6.2 Traditional management tools

Development of the salmon excluder device

The development and deployment of the salmon excluder device may reduce chum salmon bycatch. The salmon excluder is still being tested in pollock fisheries, and is not yet in wide-scale use, however many of the early design flaws have been corrected at this stage.

6.6.3 Actions by Other Federal, State, and International Agencies

State salmon fishery management

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 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.

Future exploration and development of offshore mineral resources

The Minerals Management Service (MMS) 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. The MMS has published a notice of intent to prepare an Environmental Impact Statement for oil and gas lease Sale 214 which is tentatively scheduled for 2011 in the “program area” of North Aleutian Basin, offshore the State of Alaska. Many of the western Alaska salmon migration corridors pass through the program area identified by MMS, and adverse environmental impacts resulting from exploration and development in the future could impact salmon stocks. The extent to which these impacts may occur is unknown.

Hatchery releases of salmon

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).

6.6.4 Private actions

Commercial pollock and salmon fishing (domestic and foreign), subsistence and sport fisheries for Chinook salmon

The reasonable foreseeable future actions that will most impact chum salmon stocks are the continuation of the management of the directed commercial, subsistence, and sport fisheries for chum salmon and changes to the management of the Bering Sea pollock fishery. The analysis of direct effects assumes that these activities will continue at similar levels into the future.

Future exploration and development of onshore mineral resources

Salmon stocks may also be affected by onshore mining activities, to the extent that pollutants or contaminants from those operations may affect salmon spawning streams. Some instances of mining operations in southwestern Alaska are discussed in Section 3.4.

References

Arctic Climate Impact Assessment [ACIA]. 2005. Cambridge University Press. 1,042 p. http://www.acia.uaf.edu

Azumaya, T., T. Nagasawa, O. Yamamura, M. Kawana, G. Khen, and O. Temnykh. 2006. Spatial Distributions of Chum Salmon and Environments of their Habitat in the Bering Sea during Summer and Autumn. NPAFC Technical Report No. 6.

Crozier, L., and R. Zabel. 2006. Climate impacts at multiple scales: evidence for differential populations responses in juvenile Chinook salmon. Journal of Animal Ecology 75. pp. 1100-1109.

Friedland, K.D., R.V. Walker, N.D. Davis, K.W. Myers, G.W. Boehlert, S. Urawa and Y. Ueno. 2001. Open-ocean orientation and return migration routes of chum salmon based on temperature data from data storage tags. Mar. Ecol. Prog. Ser. 216: 235-252.

Holt, C., M. Rutherford, R. Peterman. 2008. International cooperation among nation-states of the North Pacific Ocean on the problem of competition among salmon for a common pool of prey resources. Marine Policy 32. pp. 607-617.

Ianelli, J., J. Gauvin, D. Stram, and P. Stabeno. 2009. Opportunistic temperature-at-depth recorders on Bering Sea pollock trawls to evaluate linkages between location-specific temperatures and pollock, salmon, and other species. Paper presented at the Alaska Marine Science Symposium. January 2009. Anchorage, Alaska.

Ianelli, J.N., S. Barbeaux, T. Honkalehto, S. Kotwicki, K. Aydin, and N. Williamson. 2008. Eastern Bering Sea Walleye Pollock. In, Stock Assessment and Fishery Evaluation (SAFE) report for the Bering Sea and Aleutian Islands groundfish. North Pacific Fishery Management Council, 605 West 4th Avenue, Anchorage, AK.

Mantua, N., S. Hare, Y. Zhang, J. Wallace, and R. Francis. 1997. Bulletin of the American Meteorological Society. Vol. 78, no. 6. June 1997. pp. 1069-1079.

Marine, K. and J. Cech. 2004. Effects of high water temperature on growth, smoltification, and predator avoidance in juvenile Sacramento River Chinook Salmon. North American Journal of Fisheries Management 24. pp. 198-210.

Schindler, D., X. Augerot, E. Fleishman, N. Mantua, B. Riddell, M. Ruckelshaus, J. Seeb, and M. Webster. 2008. Fisheries, vol. 33, no. 10. October 2008. pp. 502-506.

Welch, D.W., Y. Ishida, and K. Nagasawa. 1998. Thermal limits and ocean migrations of sockeye salmon (Oncorhynchus nerka): long-term consequences of global warming. Can. J. Fish. Aquat. Sci. 55:937-948.

Appendix 8 – Revised Table ES-13 and Table 10-59

Table 10-59 Summary of escapement goals obtained, restrictions imposed and potential management changes with additional AEQ salmon to rivers over the time period 2003-2007.

River	Escapement met from 2003-2007	Additional restrictions imposed from 2003-2007			Likely management changes if additional AEQ salmon had been available 2003-2007
		Subsistence	Commercial	Sport	
Yukon	2006 some key goals not met	More conservative management plan imposed since 2001			2006-2007 additional fish would accrue towards meeting escapement; in all years increased potential for higher subsistence and commercial harvest
	2007 Treaty goal not met	2007 Canada	Below average 2005-2007	2007 Canada	
Kuskokwim	Most	More conservative management plan imposed 2001-2006			Potential for increased commercial harvests within market constraints
	2007 Most	No	No	No	
Bristol Bay (Nushagak)	2007 goals not met	No	No	2007	If sufficient additional to meet escapement then 2007 sport fish restriction would not have been imposed; In all years additional fish towards escapement, increased potential for higher subsistence and commercial harvest
Norton Sound subdistricts 5 and 6	2003-2006 Unalakleet goal not met	2003-2004; 2006-2007	2003-2007	2003-2004; 2006-2007	Additional fish would accrue to escapement

Appendix 9 – New subsistence section

Note: This section is still under development and more recent information may be provided by ADF&G. Any additional information will be incorporated into this section for the Final EIS.

Preliminary Draft section for the Final EIS on Potentially Affected Salmon Fisheries

This section first provides an overview of the management of the Chinook salmon fisheries in Alaska. Second, it provides an overview of the subsistence Chinook salmon fisheries in western and interior Alaska and a description of the subsistence fishery existing conditions by region. Third, it provides an overview of the Chinook commercial fisheries and a description of the commercial fishery existing conditions by region [not included in this version, from Chapter 10 of DEIS]. Fourth, it provides an overview of the personal use and sport Chinook salmon fishery and a description of the sport and personal use fishery by region [not included in this version, from Chapter 10 of DEIS].

1.1 Management of Chinook salmon fishing

The State of Alaska manages sport, commercial, personal use, and State subsistence harvest on lands and waters throughout Alaska. 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. The 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 Alaska Board of Fisheries (BOF) adopts regulations through a public process to conserve and allocate fisheries resources to the various user groups. Yukon River salmon fisheries management includes obligations under an international treaty with Canada. Subsistence fisheries management includes coordination with U.S. government agencies where Federal rules apply under ANILCA. The Federal government manages subsistence uses on Federal lands and waters in Alaska, consistent with the subsistence priority for rural Alaska residents as provided by Title VIII of ANILCA.

1.1.1 State subsistence management

ADF&G, under the direction of the Alaska BOF, manages subsistence, personal use, and commercial Chinook salmon harvests on waters flowing in state lands. The State defines subsistence uses of wild resources as noncommercial, customary, and traditional uses for a variety of purposes. These include:

> Direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation, for the making and selling of handicraft articles out of nonedible by-products of fish and wildlife resources taken for personal or family consumption, and for the customary trade, barter, or sharing for personal or family consumption (AS 16.05.940[33]).

Under Alaska's subsistence statute, the BOF must identify fish stocks that support subsistence fisheries and, if there is a harvestable surplus of these stocks, adopt regulations that provide reasonable opportunities for these subsistence uses to take place. Whenever it is necessary to restrict harvests, subsistence fisheries have a preference over other uses of the stock (AS 16.05.258). ADF&G, Division of Commercial Fisheries, manages the subsistence fisheries in the area of potential effect.

Alaska subsistence fishery regulations do not in general permit the sale of resources taken in a subsistence fishery. However, State law does recognize "customary trade" as a potential subsistence use. Alaska Statute defines customary trade as the limited noncommercial exchange, for minimal amounts of cash, as restricted by the appropriate board, of fish or game resources (AS 16.05.940(8)).

For more information on State management of the salmon subsistence fisheries, refer to the Alaska Subsistence Salmon Fisheries 2005 Annual Report, available on the State of Alaska website at: http://www.subsistence.adfg.state.ak.us/TechPap/tp318.pdf**.** This is the most recent report available, published in December 2007 (ADF&G 2007). Subsequent sections of this EIS frequently summarize and incorporate by reference information from this report, when applicable, to focus the analysis on the key issues and eliminate repetitive information. Additional information and analysis on subsistence harvest in Alaska is available on the ADF&G Subsistence Division website.[2]

1.1.2 State management of personal use and sport salmon fisheries

Alaska Statue defines personal use fishing as the taking, fishing for, or possession of finfish, shellfish, or other fishery resources, by Alaska residents for personal use and not for sale or barter, with gill or dip net, seine, fish wheel, long line, or other means defined by the BOF (AS 16.05.940(25)). Personal use fisheries are different from subsistence fisheries because they either do not meet the criteria established by the Joint Board for identifying customary and traditional fisheries (5 AAC 99.010), or because they occur within nonsubsistence areas.

The Joint Board of Fisheries and Game is required to identify 'nonsubsistence areas', where 'dependence upon subsistence is not a principal characteristic of the economy, culture, and way of life of the area or community." (AS 16.05.258(c)). The BOF may not authorize subsistence fisheries in nonsubsistence areas. Personal use fisheries provide opportunities for harvesting fish with gear other than rod and reel in nonsubsistence areas.[3,4]

Generally, fish may be taken for personal use purposes only under authority of a permit issued by ADF&G. Personal use fishing is primarily managed by ADF&G, Sport Fish Division, but some regional or area fisheries for various species of fish are managed by the Division of Commercial Fisheries. For more information on State management of the personal use fisheries, refer to the ADF&G website: http://www.adfg.state.ak.us/special/special_fisheries/personal_use.php.

The ADF&G Sport Fish Division also manages the state's sport (recreational) fisheries. Alaska statute defines sport fishing as the taking of or attempting to take for personal use, and not for sale or barter, any fresh water, marine, or anadromous fish by hook and line held in the hand, or by hook and line with the line attached to a pole or rod which is held in the hand or closely attended, or by other means defined by the Board of Fisheries (AS 16.05.940(30). By law, the Division's mission is to protect and improve the state's recreational fisheries resources. For more information on State management of recreational fisheries, refer to the ADF&G website: http://www.sf.adfg.state.ak.us/statewide/index.cfm.

Also per Alaska Statute (5 AAC 75.075(c)), the ADF&G Division of Sport Fish is responsible for overseeing the annual licensing of sport fish businesses and guides. A "sport fishing guide" means a

[2]http://www.subsistence.adfg.state.ak.us/geninfo/publctns/articles.cfm#SUBSISTENCE_2000
[3]Refer to Alaska Subsistence Salmon Fisheries 2005 Annual Report. (p. 1). www.subsistence .adfg.state.ak.us/TechPap/tp318.pdf
[4] The Joint Board has identified five nonsubsistence areas in (5 AAC 99.015): Ketchikan, Juneau, Anchorage-Matsu-Kenai, Fairbanks, and Valdez.

person who is licensed to provide sport fishing guide services to persons who are engaged in sport fishing (AS 16.40.299). "Sport fishing guide services" means assistance, for compensation or with the intent to receive compensation, to a sport fisherman to take or to attempt to take fish by accompanying or physically directing the sport fisherman in sport fishing activities during any part of a sport fishing trip. Salmon is one of the primary species targeted in the States' recreational fisheries, and most anglers sport fishing for anadromous (sea-run) Chinook (king) salmon must have purchased (and have in their possession) a current year's king salmon stamp. For further information, refer to the ADF&G website: http://www.sf.adfg.state.ak.us/Guides/index.cfm/FA/guides.home. This site contains information important to the State of Alaska, Department of Fish and Game requirements for sport fish charter businesses, sport fish guides, and saltwater charter vessels.

1.1.3 State Commercial Chinook salmon fishery management

Finally, commercial fisheries of Alaska fall under a mix of State and Federal management jurisdictions. In general, the State has management authority for all salmon, herring, and shellfish fisheries, and for groundfish fisheries within 3 nautical miles of shore. The Federal government has management authority for the majority of groundfish fisheries from 3 to 200 nautical miles off shore.

The State manages a large number of commercial salmon fisheries in waters from Southeast Alaska to the Bering Strait. Management of the commercial salmon fisheries is the responsibility of the ADF&G Commercial Fisheries Division, under the direction of the BOF, and are managed under a limited entry system. Participants need to hold a limited entry permit for a fishery in order to fish, and the number of permits for each fishery is limited. The State originally issued permits to persons with histories of participation in the various salmon fisheries. Permits can be bought and sold, thus new persons have entered since the original limitation program was implemented, by buying permits on the open market.

Like the sport, subsistence, and personal use fisheries managed by the State, Alaska's commercial salmon fisheries are administered through the use of management districts throughout the state. The value of the commercial salmon harvest varies both with the size of the runs and with foreign currency exchange rates. Average annual value of the 2000 – 2004 harvest was in excess of $230 million.[5] Because of the magnitude of commercial fisheries for salmon, state biologists collect extensive information and statistics for management decisions. For information on commercial regulations refer to: http://www.cf.adfg.state.ak.us/geninfo/regs/cf_regs.php.

1.1.4 Federal subsistence management

The Alaska National Interest Lands Conservation Act (ANILCA), passed by Congress in 1980, mandates that rural residents of Alaska be given a priority for subsistence uses of fish and wildlife. In 1986, Alaska passed a law mandating a rural subsistence priority to bring it into compliance with ANILCA. However, in 1989, the Alaska Supreme Court ruled that the rural priority in the state's subsistence law violated provisions of the Alaska Constitution. As a result, the Federal government manages subsistence uses on Federal public lands and waters in Alaska—about 230 million acres or 60% of the land within the state. To help carry out the responsibility for subsistence management, the Secretaries of the Interior and Agriculture established the Federal Subsistence Management Program (FSMP).

On July 1, 1990, the U.S. Departments of the Interior and of Agriculture assumed responsibility for implementation of Title VIII of ANILCA on public lands. The Departments administer Title VIII by

[5]http://www.cf.adfg.state.ak.us/geninfo/finfish/salmon/salmhome.php.

regulations in the Code of Federal Regulations. The Departments established a Federal Subsistence Board and 10 Regional Advisory Councils to administer the Federal Subsistence Management Program. The Federal Subsistence Board's composition includes a Chair appointed by the Secretary of the Interior with concurrence of the Secretary of Agriculture; the Alaska Regional Director, U.S. Fish and Wildlife Service; the Alaska Regional Director, National Park Service; the Alaska State Director, Bureau of Land Management; the Alaska Regional Director, Bureau of Indian Affairs; and the Alaska Regional Forester, USDA Forest Service.

Through the Federal Subsistence Board, these agencies participate in the development of regulations which establish the program structure, determine which Alaska residents are eligible to take specific species for subsistence uses, and establish seasons, harvest limits, and methods and means for subsistence take of species in specific areas. The Regional Advisory Councils provide recommendations and information to the Board; review proposed regulations, policies and management plans; and provide a public forum for subsistence issues. Each Council consists of residents representing subsistence, sport, and commercial fishing and hunting interests.

1.2 Importance of subsistence

This section provides a description of the importance of the subsistence to Native peoples of Alaska and other rural Alaska residents. As discussed in Chapter 5, analysis of the stock composition of Chinook salmon incidentally caught in the Bering Sea pollock fishery has shown that the stock structure is dominated by western Alaska stocks. Therefore, this section focuses on the importance of subsistence to people who live in western and interior Alaska.

Subsistence salmon fisheries are important nutritionally, culturally, as well as greatly contribute to local economies. Many researchers have described the importance of subsistence to individual Alaskan communities and households (Coffing 1991; Krieg et al. 2007; Moncrieff 2007; Magdanz et al. 2005; Walker and Coffing 1993; Walker et al. 1989; Wolfe 1987; Wolfe 2003; Wolfe 2007; Wolfe and Walker 1987). Alaska Native communities in the action area are historically subsistence societies. A relatively early report on findings from the Alaska Natives Commission (1994) devoted an entire volume to Alaska Native subsistence.[6] This report notes that during the past 250 years, much of the technology of Native subsistence has changed profoundly, as people often use more modern instruments of harvest, transportation, and storage. On the surface, then, today's subsistence activities may look very different from those prior to the mid-18th century, prior to the arrival of the first non-Natives. However, beneath the visible level, older patterns of behavior and values continue. The report states: "As we try to define what subsistence really is in contemporary Alaska, we must distinguish between form and function. How Native people practice it today has changed profoundly over the centuries, but what they are doing is mainly what they have always done. And what they have always done is very different from the economic organization and personal relationships of contemporary mass culture."

The most recent statewide summary of subsistence harvest and use in Alaska (modeled statewide summary) indicates that on average among rural residents of Alaska, 60% of all fish and wildlife resources harvested are fish, and that on average, 78% of households in the Arctic region harvest fish, while 96% of Arctic households use subsistence caught fish (Wolfe 2000). Similarly, 75% of households

[6]The Alaska Natives Commission (joint Federal-State Commission on Policies and Programs Affecting Alaska Natives) was created by Congress in 1990, to conduct a comprehensive study of the social and economic status of Alaska Natives and the effectiveness of the policies and programs of the U.S. and the State of Alaska that affect Alaska Natives (1994). See the UAA Justice Center link: http://justice.uaa.alaska.edu/rlinks/natives/ak_subsistence.html.

in the Interior region harvest fish and 92% of households use fish; while 98% of Yukon-Kuskokwim Delta households harvest fish and 100% use fish (Wolfe 2000).[7]

Subsistence salmon harvests in the Arctic-Yukon-Kuskokwim (AYK) region, for example, have cultural and practical significance to many of the approximately 120 communities, representing approximately 14,711 households and approximately 58,596 residents (in 2007) in the AYK region. In addition, more than 57,000 residents in the Fairbanks North Star and Denali Boroughs, many of whom also depend upon AYK salmon stocks for dietary and other cultural needs. There are also Canadian residents who rely on AYK salmon stocks. In Bristol Bay, 18 communities harvest Chinook salmon for subsistence. [8]

Subsistence foods in general are important components of regional diets. The Alaska Subsistence Salmon Fisheries 2005 Annual Report[9] states that of the estimated 43.7 million pounds of wild foods produced in rural Alaska communities annually, subsistence fisheries contribute about 60% from finfish and 2% from shellfish (Figure New-1). Although producing a major portion of the food supply, subsistence harvests represent a small part of the annual harvest of all wild resources in Alaska (about 2%). Commercial fisheries take 97% of the wild resource harvest, and sport fisheries and hunts take about 1%.

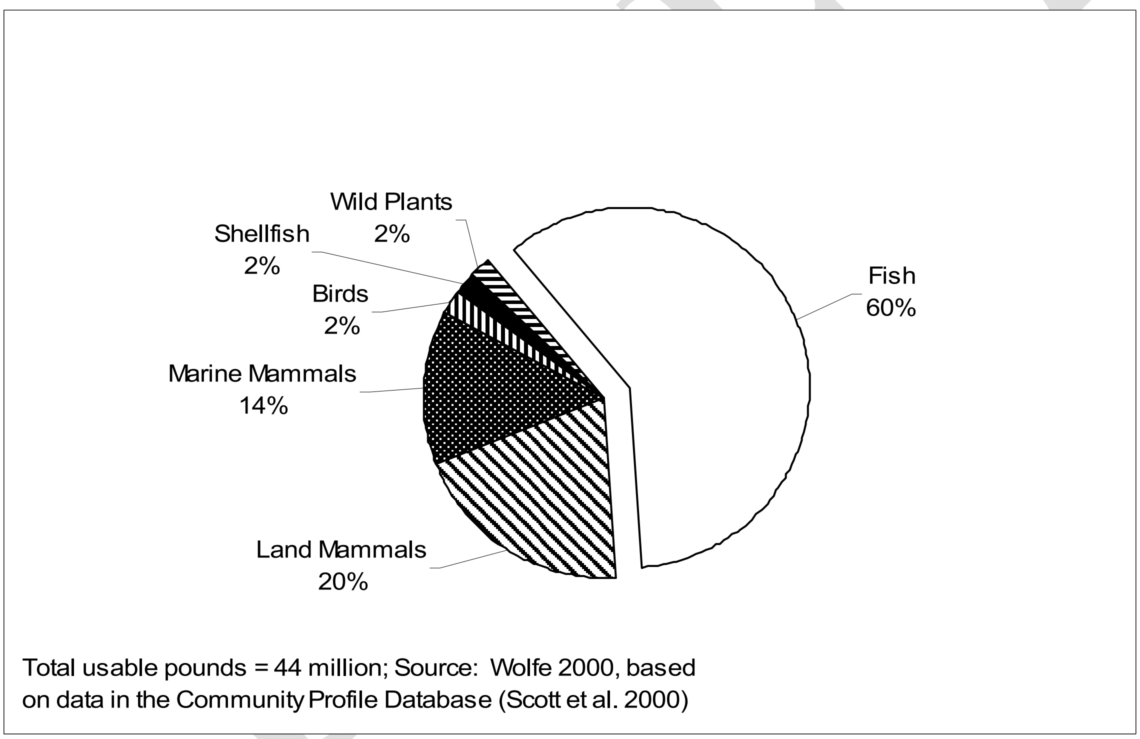


Fig. New -1 Composition of subsistence harvest by rural Alaska Residents
Source: The Alaska Subsistence Salmon Fisheries 2005 Annual Report.

Most rural Alaska communities today have mixed subsistence and market-based economies, in which subsistence harvests are a prominent part of the local economy and the mainstay of social welfare of the people (Wolfe and Walker 1987). In 'mixed' economies, small to moderate amounts of cash are provided at different times of the year by limited resources. Subsistence activities provide the material basis that

[7]Source: www.subsistence.adfg.state.ak.us/geninfo/publctns/articles.cfm#SUBSISTENCE_2000.
[8]Source: ADF&G Division of Subsistence, February 3, 2009.
[9]http://www.subsistence.adfg.state.ak.us/TechPap/tp318.pdf. p. 7.

allows these emerging mixed subsistence and market-based economies[10] to continue. They also provide a context within which the traditional subsistence elements of these cultures can persist. Cultural practices in regional communities will vary between broad ethnic groupings and between smaller groups within these larger groupings. However, each of these subsistence communities was once organized completely around wild resource use, and these communities require access to these resources to support the personal relationships, and ways of thought, that emerged in those earlier times.

During the development of the EIS, many individuals wrote public comment letters to NMFS and testified to the Council on the importance of subsistence harvest to their livelihoods, family, tribe, culture, and community. Public comments received explained that salmon are especially significant to the cultural, spiritual, and nutritional needs of Alaska Native peoples, and that analysis of impacts on subsistence users and subsistence resources must reflect the values obtained from a broad range of uses, not simply the commercial value or monetary replacement costs of these fish. Comments emphasized that strong returns of healthy salmon are critical to the future human and wildlife uses of those fish and to the continuation of the subsistence way of life. These comments are part of the administrative record and are considered during decision making. Enabling the people potentially impacted by an action to explain how they are impacted, and the magnitude of the impacts, is a primary role of the public process. For example, public comment from the Bering Sea Elders Advisory Group (pp. 1 – 2) follows:

> *"Our subsistence practices and, specifically, ties to salmon go beyond commercial value or the monetary replacement cost of food. The English language term "subsistence" is not in our Yupik language and does not describe the totality of our ties to salmon.*
>
> *Traditionally, Alaska Native peoples derive their food, nutrition, ethics, and values of stewardship, languages, codes of conduct, stories, songs, dances, ceremonies, rites of passage, history, and sense of place and spirituality from the lands, waters, fish, and wildlife they have depended on for millennia. Many White persons imagine that subsistence is merely the act of an individual going hunting or fishing. Subsistence, in actual fact, is a complicated economic system and it demands the organized labor of practically every man, woman and child in a village. There are countless tasks, such as maintenance of equipment…, preparing the outfit for major hunting and fishing expeditions…dressing thousands of pounds of fish….sharing harvest of meat and fish with other communities.*

While the economic value of the subsistence harvest is significant, subsistence is clearly more than an economic system and cannot solely be measured by harvest levels; it is the social foundation for many rural and Native communities. The Alaska Natives Commission report (1994) referenced subsistence surveys in 98 communities, and emphasized that virtually all of the meat, fish, and poultry annually consumed in half of the surveyed communities came from the harvest of wild resources. The report states that if subsistence resources are denied to subsistence-dependent communities, the result would be the deterioration of nutrition, public health, and social stability, primarily because the cost of buying, transporting, and storing imported replacements would be impossible for local people to bear over time. The long-term consequence would be the gradual erosion and disappearance of many rural communities through out-migration. In this way, subsistence is tied to the survival of human communities and cultures. This point is also made in Wolfe (2007), which states that "Changes in the salmon fisheries, such as decreases in subsistence and commercial harvests can have broad impacts on the local ways of life, including traditional cultures, local economies, personal identities, and societies."

Subsistence activities commonly involve an entire community. According to Wolfe (2007), "in the AYK region, salmon is harvested primarily within family groups…[c]ommonly men harvest and women

[10] The term is from Wolfe and Walker, 1987.

process salmon for subsistence food, consumed within extended families and shared with others in the community." Subsistence Chinook salmon may be consumed directly by the person or family that harvests it, or may be distributed to other persons in the community. Many studies indicate that the traditional wide-scale sharing of subsistence products is a central activity that unifies extended families and communities. With reduced subsistence opportunities come fewer opportunities for young people to learn cultural subsistence practices and techniques, and this knowledge may be lost to them in the future. Wolfe (2007) provides more information on the relationship between salmon and culture in the AYK region.

Subsistence communities also appear to specialize by household, with a relatively small percentage (which researchers have called 'super-households') being extremely productive, harvesting most of their community's annual supplies and distributing them to less productive families. In western Alaska, entire families migrate seasonally to summer fishcamps. These annual migrations, and fishcamp life itself, are important elements of rural and cultural life. [11]

Extensive non-market sharing and exchange take place in communities with mixed subsistence economies. Through sharing, local communities' values are expressed and transmitted across generations. Salmon may be given or shared with other persons without the expectation that something specific will be given in exchange. Fish may be shared with family members or friends, in the region or outside of it. An example from the Tanana: "…salmon is given to individual elders, elders' residences and people who do not have access or ability to fish. Almost all the fishermen interviewed stated that the first salmon caught were given away to share the taste of the first fish and bring luck to the fishermen." (Moncrieff, 2007)

Chinook salmon may also be exchanged for other goods. Trade of subsistence goods between communities has a long history in regional Native cultures. As Russians came into increasing contact with Natives on the Asian side of the Bering Straits several centuries ago, there was increasing trade in western manufactured goods and products, and increasing use of monetary sales as goods were exchanged. These processes continue today. An example from Holy Cross notes that Yukon River Chinook: "…is traded for a variety of items. Some people bring salmon or moose when they travel and give it as a gift to the family they stay with. One participant traded fish for pizza from another village: one pizza for one Chinook salmon, each valued at about $12. Others traded their salmon for Kuskokwim River fish, berries from the stores in Anchorage, berries from the other areas, or crafts or services. Trade relationships, active in the precontact era, continue to exist today." (Moncrieff, 2007)

Given the significance of the subsistence harvest in rural Alaska, subsistence use should also be viewed as having substantial economic value. Food costs and living expenses are high in rural Alaska. Materials have to be transported long distances with limited transportation and distribution infrastructures, consequently, these services are expensive. Small populations may not be able to support returns to scale in transportation, distribution, or storage, or support the large numbers of firms that would provide for competitive markets. The Cooperative Extension Service of the University of Alaska Fairbanks routinely surveys communities to gather information on living costs. In December 2007, it found that it cost 189% more to purchase a week of food in Bethel than in Anchorage. Food costs in other communities in the action area were also higher than in Anchorage. Compared to Anchorage, costs in Kotzebue were 208% higher, costs in Naknek/King Salmon were 218% higher, and costs in Nome were 171% higher (UAF 2007).

[11] Wolfe, Robert J. 1987. "The super-household: specialization in subsistence economies". Paper presented at the 14th Annual Meeting of the Alaska Anthropological Association. March 12-13. Anchorage, Alaska.

It is also important to understand that subsistence harvesting activity is not without cost, and that often a household's subsistence use is 'capitalized' by its cash income, since the efficient harvest of large amounts of fish cannot be accomplished without goods such as fishnets, motors, fuel, etc. So while many view the subsistence and cash economies as inversely related, subsistence is its own economic sector, highly significant to those who practice it, and fully co-existing with cash-market activities. Subsistence salmon harvesters often use the same or similar types of set and/or drift gillnets, boats, and other equipment as commercial harvesters. Some subsistence harvesters also participate in commercial salmon fisheries, and they depend on income earned in the commercial fisheries to help offset the costs, both of acquiring equipment and of operating it, associated with subsistence salmon fishing. While it appears that sufficient opportunities for subsistence harvests have occurred in most areas in recent years, reductions in the commercial harvest may greatly affect the subsistence fishery, to the extent some households use commercial catch to offset costs incurred in the subsistence fishery. Wolfe (2003) provides a more complete discussion of the commercial and subsistence relationships.[12]

12 Wolfe, Robert J. 2003. People and Salmon of the Arctic, Yukon, and Kuskokwim. Socioeconomic Dimensions: Fishery Harvests, Culture Change, and Local Knowledge Systems. Paper presented to the Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative Workshop, Anchorage, November 18-20, 2003, 35 pp.

1.2.1 Discussions by Region

The vast majority of the information in this section is from the Alaska Subsistence Salmon Fisheries 2005 Annual Report (ADF&G 2007), as cited previously, unless otherwise noted. When available, more recent information on subsistence harvests is provided. Chapter 5 contains the status of the Chinook salmon stocks through 2008. Additional recent information was provided through public comment on the DEIS and is incorporated in the following sections.

1.2.1.1 Overview of Regional Subsistence Harvests

The amount of Chinook salmon harvested for subsistence use and the portion of subsistence Chinook salmon harvested relative to other species of salmon varies greatly by region (Figure New-2, Figure New-3). Figure New-2 reports subsistence Chinook harvests in 2005 (155,658 Chinook) by general harvest area. The largest estimated subsistence harvests of Chinook salmon in 2005 occurred in the Kuskokwim area (74,354 salmon; 48%), followed by Yukon (53,547 salmon; 34%), Bristol Bay (15,212 salmon; 10%), Northwest (4,239 salmon; 3%), the Glennallen Subdistrict of the Prince William Sound Area (2,785 salmon; 2%), and the Chitina Subdistrict of the Prince William Sound Area (2,182 salmon; 1%).

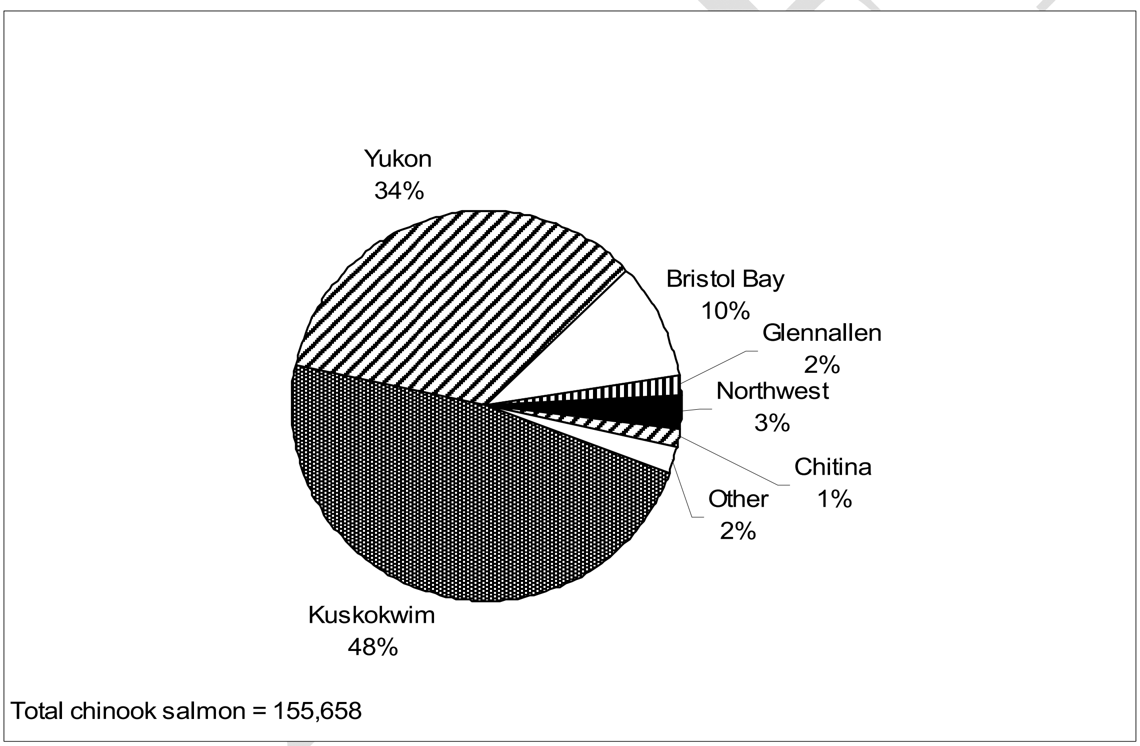


Fig. New -2 Estimated subsistence Chinook salmon harvest by area, 2005
Source: The Alaska Subsistence Salmon Fisheries 2005 Annual Report.

The estimated total subsistence harvest of salmon in Alaska in 2005, based on annual harvest assessment programs, was 1,052,564 fish.[13] The estimated statewide harvest by species was as follows: 461,804

[13]Note that personal use salmon harvests from Southeast Alaska, the Yukon Area, and the Chitina Subdistrict of the Upper Copper River are included in this statistic. Personal use fisheries that take place in nonsubsistence area of the

sockeye (43%), 257,977 chum (25%), 155,658 Chinook (15%), 100,095 coho (10%), and 77,031 pink salmon (7%).[14] Table II-2 (pp. 10 – 16) of the Alaska Subsistence Salmon Fisheries 2005 Annual Report reports subsistence harvests in 2005 by species and place of residence of participants, including total harvests from all subsistence fisheries combined. Figure New-3 below summarizes the report's estimates of subsistence takes of Chinook, chum, and other salmon, by subsistence harvest area for the period from 1994 - 2004.

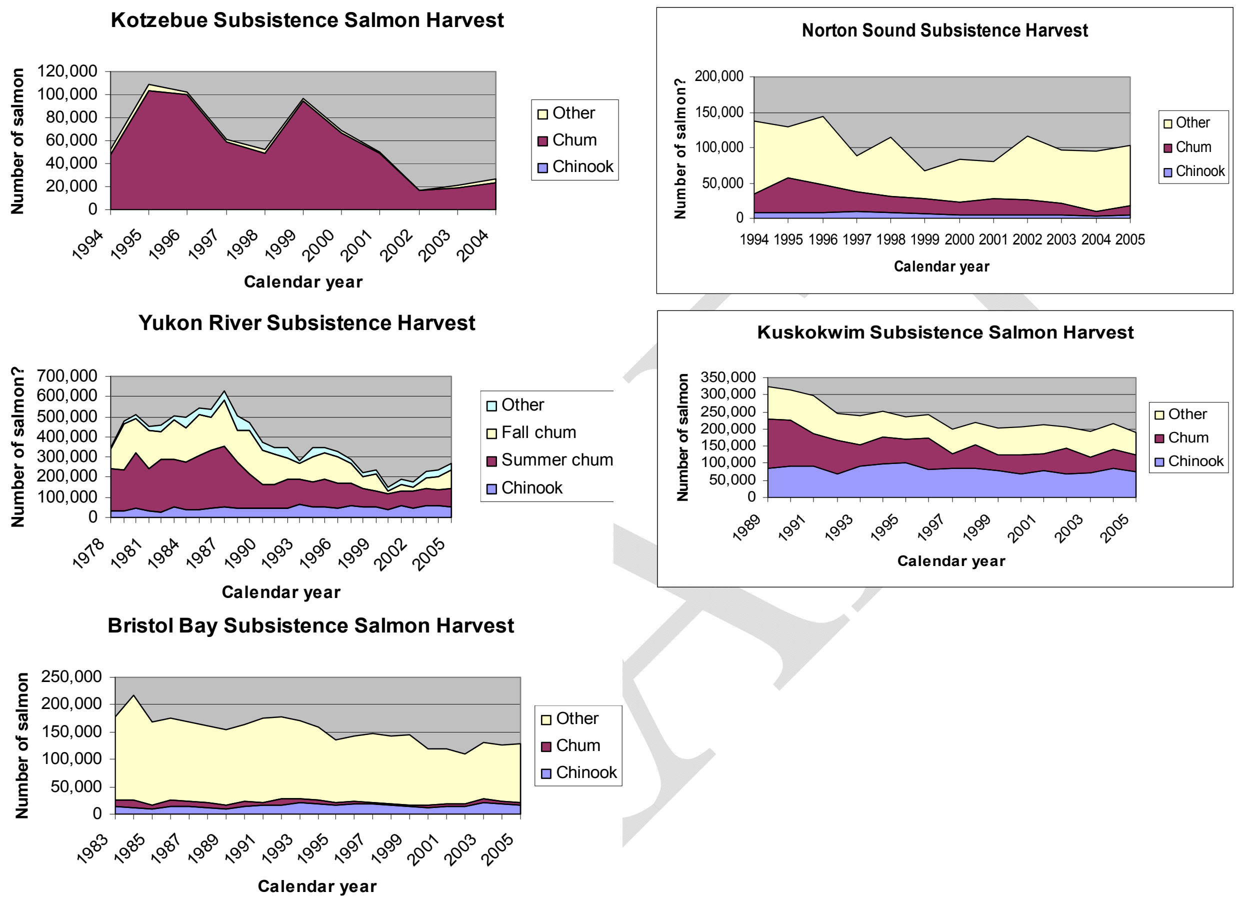


Fig. New -3 Estimated Subsistence Harvests of Chinook, Chum, and Other Salmon, by key management regions

Source: Based on information in the Alaska Subsistence Salmon Fisheries 2005 Annual Report.

The following list contains some primary points regarding regional significance:

- Chinook salmon appears to be of relatively limited importance in subsistence harvests north of Cape Prince of Wales in Kotzebue Sound and on Alaska's North Slope. Chinook salmon also appears to be of relatively limited importance along the Alaska Peninsula and Aleutians. Chinook did not appear to comprise more than 1% of subsistence harvests in Kotzebue between 1994 and 2004, no more than 3% on the Alaska Peninsula between 1985 and 2005, and to be almost 0% in the Aleutians in the same period. For simplicity, these areas are not included in the figure above.

Cook Inlet Management Area are not included. For background, see Chapter 1 of the Alaska Subsistence Salmon Fisheries 2005 Annual Report.

[14]See Figure II-2, p. 18, of the Alaska Subsistence Salmon Fisheries 2005 Annual Report.

- The Norton Sound region includes the Port Clarence and Norton Sound Districts. In this region, subsistence salmon harvests were dominated by chum salmon. For the district as a whole, Chinook accounted for between 4% and 10% of the subsistence salmon harvested between 1994 and 2005. Chinook were more important in the region's more southerly Norton Sound District, where they accounted for between 4% and 11% of the salmon caught; in the more northerly Port Clarence District they accounted for between 0% and 2% of the salmon caught.

- Chinook salmon are clearly a key species on the Yukon River. Summer and fall chum are still more important in numbers of fish, but Chinook currently account for 20% to 25% of the number of fish harvested. Prior to the large declines in the chum harvests in the early 1990s, Chinook accounted for a significantly smaller proportion of the harvest: from 6% to 23%. However, the count of each type of salmon does not account for other important considerations, including the relative size, flavor, and social and cultural significance.

- Chinook salmon are also clearly an important subsistence species in the Kuskokwim River region. Between 1989 and 2005, Chinook accounted for between 26% and 43% of the annual subsistence salmon harvest.

- Chinook salmon are important in the Bristol Bay region, although as a percentage of the harvest in the entire Bristol Bay area is lower because such a large portion of the area's subsistence harvest is sockeye salmon in the Kvichak drainage where there are no Chinook salmon. In districts where both sockeye and Chinook are available (Togiak, Naknek, and especially Nushagak) Chinook salmon comprise a higher percentage of the total, and in some years in the Nushagak at least may exceed sockeye when the harvests are measured in pounds (James Fall, ADF&G Subsistence Division, personal communication). Since 1993, Chinook harvests have ranged between 9% and 16% of subsistence harvests; before that, from 1983 to 1993, they ranged between 5% and 9%.

- Chinook salmon are the first salmon to arrive in the spring which is key to their importance for subsistence.

1.2.1.2 Northwest (Norton Sound and Port Clarence)

According to the Alaska Subsistence Salmon Fisheries 2005 Annual Report (ADF&G 2007):

> *Subsistence salmon fishing has been a major feature of life in northwest Alaska for centuries. In the early twenty-first century, most local residents in the region continue to participate in a mixed subsistence-cash economy, depending on local wild foods for cultural and nutritional sustenance. In summer, subsistence fishers harvest salmon with gillnets or seines in the main Seward Peninsula rivers and in the coastal marine waters. Beach seines are used near the spawning grounds to catch schooling or spawning salmon and other species of fish. The major portion of fish taken during the summer months is air dried or smoked for later consumption by local residents. Chum, pink, and coho salmon are found throughout the Norton Sound and Port Clarence districts, with Chinook salmon more common in eastern and southern Norton Sound and sockeye salmon more common in Port Clarence drainages.*[15]

[15] Alaska Subsistence Salmon Fisheries 2005 Annual Report, p. 23.

As stated previously, many individuals and organizations provided written comment letters and testified to the Council during the development of the EIS, on their dependence on Chinook salmon. These comments are part of the administrative record and considered during decision making. One example of public comment received from the Kawerak, Inc. (p. 1) follows

> *The people of the Bering Strait/Norton Sound region depend on the salmon they harvest and put away each year. Salmon is a healthy, fresh food and teaching the traditional methods for food production is a time honored way to involve our children.*[16]

According to ADF&G, Unalakleet River Chinook salmon runs have declined precipitously since 2000. Escapement goals have only been reached once since 2003. Additionally, early closures to the Chinook salmon subsistence fishery have occurred in five of the previous six years. The 2008 escapement and subsistence harvests were the lowest on record. Unalakleet River Chinook salmon were designated a stock of yield concern in 2004 by the Alaska Board of Fisheries (BOF), and the BOF continued this designation in 2007. In an effort to further conserve Chinook salmon and restore the stock to historical yield levels, the BOF adopted a new management plan (5 AAC 04.395) that incorporates a more restrictive subsistence fishing schedule. Prior to 2007, subsistence fishing was open continuously in the marine waters and in river subsistence fishing was only closed for 36 hours a week. Under the newly adopted plan, subsistence fishing from June 15 to July 15 in the Unalakleet Subdistrict is limited to two 48-hour periods per week in the marine waters, and two 36-hour periods per week in the Unalakleet River. Under the newly adopted plan, subsistence fishing from June 15 to July 15 in the Unalakleet Subdistrict is limited to two 48-hour periods per week in the marine waters, and two 36-hour periods per week in the Unalakleet River. The new management plan also directs ADF&G to close the fishery if it is projected that the lower end of the North River tower-based sustainable escapement goal range (1,200-2,600) will not be reached. Prior to 2007, management biologists implemented restrictions and/or early closures based on test fishery catches and tower counts. Since 2007, subsistence fishery catch rates in conjunction with Chinook passage estimates have been used to evaluate run strength in season. (Scott Kent, ADF&G, personal communication).

Magdanz et al. (2005) reviewed several studies of subsistence consumption for the Norton Sound and Port Clarence areas Average per capita consumption of subsistence foods was on the order of 600 pounds per year in some communities. Salmon accounted for a significant part of this with weights ranging from about 100 pounds to about 160 pounds per capita, depending on the study. One analysis of dietary sources of meat and fished showed that 75% was derived from subsistence sources and 25% from store-bought meats (see Figure New-4). A third of the meat and fish was salmon, and the remainder was from land or marine mammals, or other fish. In this region, Chinook salmon accounted for 3% of meat and fish consumption, while chum salmon accounted for about 6% (Magdanz et al. 2005).

Figure New-4 below outlines results of a traditional diet survey in the Norton Sound and Port Clarence Districts, focused on sources of meat and fish (see Magdanz et al, 2005).[17]

[16] Letter from L. Bullard, President, Kawerak, Inc., to D. Mecum, Acting Administrator, AK Region, NMFS. Comment letter 12, dated January 30, 2009.
[17] http://www.subsistence.adfg.state.ak.us/TechPap/tp294.pdf, p. 25

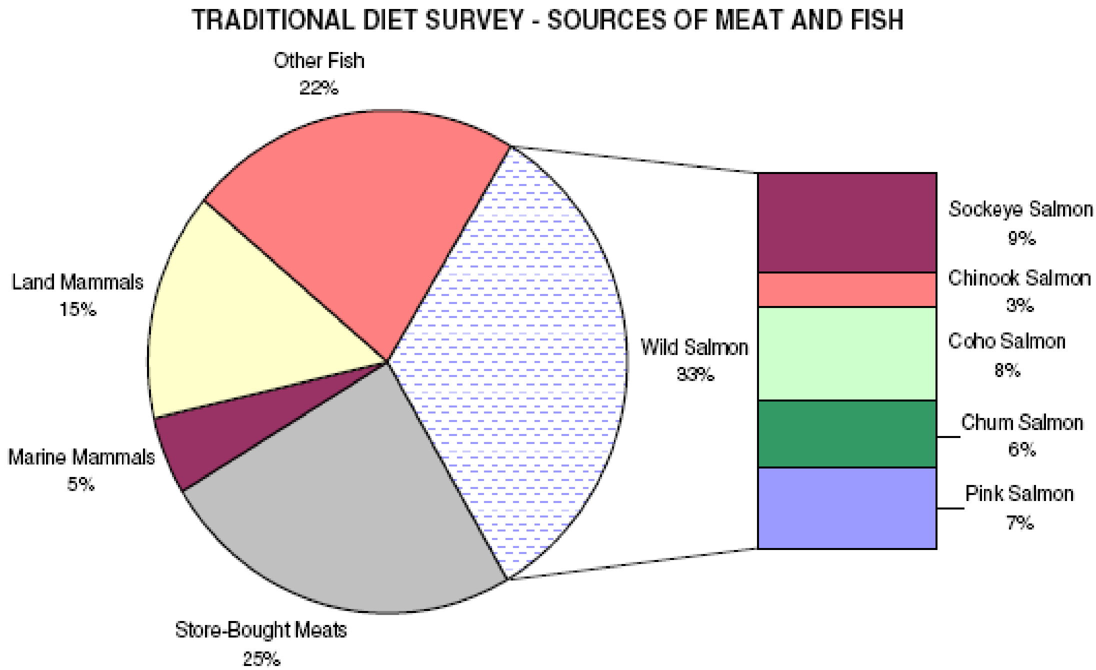


Fig. New -4 Results of a traditional diet of meat and fish survey in the Norton Sound and Port Clarence Districts
Source: Magdanz et al. 2005, citing Ballew et al. 2004[18]

Estimated subsistence salmon harvests from 1994 through 2003 trended lower by 5.8 percent annually. Most of the declines occurred during the first five years (1994 - 1998), when harvests trended lower by about 8 percent annually. During the latter years (1999 - 2003), harvests trended lower by about 1 percent annually across all communities. While harvests appeared to have stabilized in the latter years, it would not be correct to characterize the overall situation as improving, at least through 2003. For half of the study communities, the lowest estimated harvests occurred in 2003.

Despite variation in household harvests, there were harvest patterns, patterns that might be used to refine estimation and prediction. Through many different levels of abundance, through a decade of varied weather, with harvests ranging from 67,000 to 140,000 salmon, each year about 23 percent (range varies from 21.8 percent to 24.6 percent) of the households harvested 70 percent of the salmon, by weight. Predictable patterns were also apparent in the harvests by the age and gender of household heads.[19]

The Alaska Subsistence Salmon Fisheries 2005 Annual Report provides the estimated subsistence salmon harvests by the three districts in Northwest Alaska, from 1994 – 2005 (refer to Table III-2 in that report).[20] The estimated 2005 subsistence harvest of salmon by study communities in the Norton Sound District was 84,000 fish, with 4,087 being Chinook. This was the highest overall salmon harvest since 1998, with the exception of 2002. There was a strong coho return in 2005, and above average runs of

[18] http://www.subsistence.adfg.state.ak.us/TechPap/tp294.pdf, p. 25
[19] Magdanz et al. Patterns and Trends in Subsistence Salmon Harvests, Norton Sound and Port Clarence, 1994 – 2003. August 2005. ADF&G, Division of Subsistence, Technical Paper Series, No. 294, Abstract, page i. http://www.subsistence.adfg.state.ak.us/TechPap/tp294.pdf
[20] Alaska Subsistence Salmon Fisheries 2005 Annual Report, p. 28. http://www.subsistence.adfg.state.ak.us/TechPap/tp318.pdf

chum and pinks. The Chinook run was poor (Menard 2005:1). Figures New-5 and New-6 show the species composition of the total subsistence salmon in 2005 for Norton Sound and Port Clarence. Very little of the documented subsistence salmon harvest was taken by residents from outside the district.

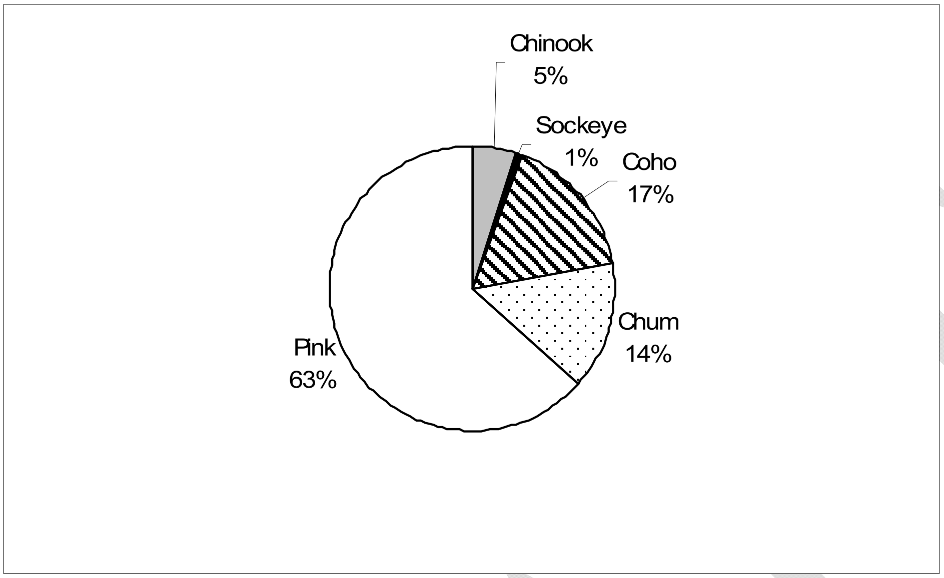


Fig. New -5 Species composition of 2005 estimated subsistence salmon harvests, Norton Sound District

Source: The Alaska Subsistence Salmon Fisheries 2005 Annual Report.

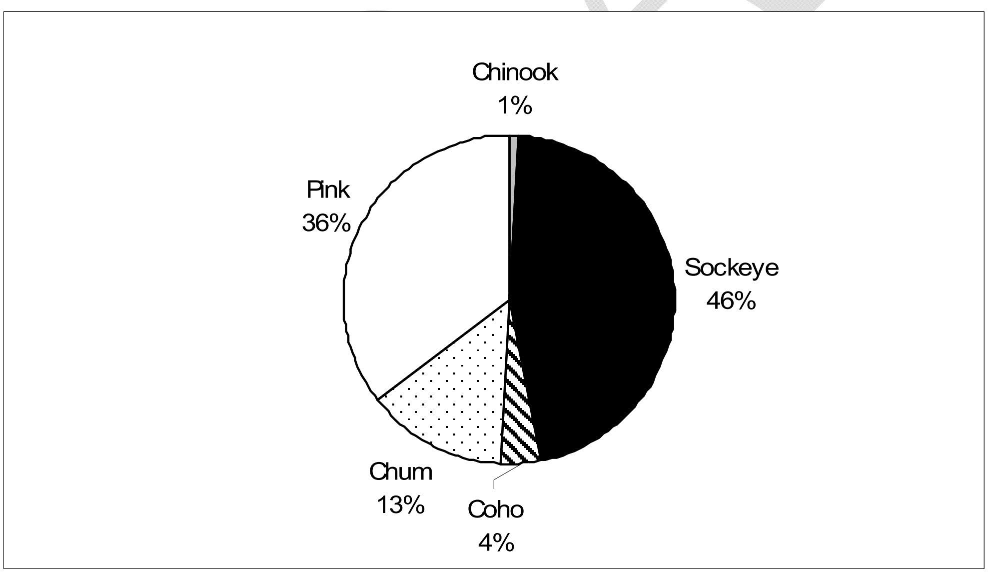


Fig. New -6 Species composition of 2005 estimated subsistence salmon harvests, Port Clarence District

Source: The Alaska Subsistence Salmon Fisheries 2005 Annual Report.

1.2.1.3 Yukon

According to the Alaska Subsistence Salmon Fisheries 2005 Annual Report (ADF&G 2007):

> *The majority of this section is excerpted from the Alaska Subsistence Salmon Fisheries 2005 Annual Report, unless noted otherwise. Residents of the Yukon River drainage have long relied on fish for human food and other subsistence uses. While non-salmon fish species provide an important component of the overall fish harvest (Andersen et al., 2004; Brown et al., 2005), salmon comprises the bulk of the fish harvested for subsistence. Chinook, summer chum, fall chum, and coho salmon comprise the majority of the salmon harvests in the Yukon river drainage, and the number of salmon harvested for subsistence in this region is significant. Unlike many marine and coastal fisheries where commercial harvests predominate, subsistence salmon harvests within the Yukon drainage often exceed commercial, sport, and personal use harvests combined.21*

Drift gillnets, set gillnets, and fish wheels are used by Yukon Area fishers to harvest the majority of salmon. Set gillnets are utilized throughout the Yukon Area, in the main rivers and coastal marine waters, while drift gillnets are used extensively in some parts of the river (i.e., by state regulation, that portion of the Yukon drainage from the mouth to 18 miles below Galena). Fish wheels are a legal subsistence or non-commercial gear type throughout the Yukon drainage, although due to river conditions and the availability of wood, they are used almost exclusively on the upper Yukon and Tanana rivers.

Depending on the area of the Yukon River drainage and run timing of different salmon species, subsistence fishing occurs from late May through early October. Fishing activities are either based from fish camps or from the home villages; fishing patterns and preferred sites vary from community to community. Extended family groups, typically representing several households, often undertake subsistence salmon fishing together. Households and related individuals typically cooperate to harvest, process, preserve, and store salmon for subsistence use.

The majority of the subsistence salmon harvest is preserved for later use by freezing, drying, or smoking, while the head, cutting scraps, and viscera are often fed to dogs. Chinook salmon are harvested and processed primarily for human consumption, although those fish deemed not suitable for human consumption due to presence of the fungus *Ichthyophonus hoferi* or some other disease or disfigurement are often fed to dogs. Small (jacks) Chinook salmon or spawned out fish may also be fed to dogs. In addition, while chum and coho salmon are primarily taken for human consumption, relatively large numbers are harvested and processed to feed sled dogs. Fall chum and coho salmon typically arrive in the upper portion of the drainage late in the season, coincident with freezing weather, allowing fish to be "cribbed" for use as dog food. This method involves the natural freezing of whole (un-cut) fish. The practice of keeping sled dogs is much more common in communities along the upper Yukon Area than in the lower river communities.

Walker et al (1989)[22] state the following:

> *Salmon fishing occurs from late May through October, although this varies throughout the drainage. Fishing activities are based either from a fish camp or the home village, however, the*

[21] Alaska Subsistence Salmon Fisheries 2005 Annual Report, p. 33.
[22] 1989. Subsistence Harvest of Pacific Salmon in the Yukon River Drainage, Alaska 1977 – 88. http://www.subsistence.adfg.state.ak.us/TechPap/tp187.pdf

> *degree to which one or the other is more prevalent has varied from community to community. Some people from communities not situated along the Yukon River operated fish camps along it, and these have included Birch Creek, Venetie, and some residents of Chalkyitsik. Subsistence salmon fishing was often undertaken by extended family groups representing two or several households in a community. These groups, as well as members of individual households, cooperated to harvest, cut, dry, smoke, and store salmon for subsistence use. Many people who fished for subsistence also operated as commercial fishermen in districts where commercial fishing has been allowed and families had a member with a Commercial Fisheries Entry Commission (CFEC) permit.* (p. 3.)

According to ADF&G, as a result of production rates below expectations of king salmon returning to the Yukon River, the BOF classified the Yukon River king salmon stock as a yield concern. With that, the Board modified the king salmon management plan to a more conservative approach early in the season when run assessment is less certain. Management is still based on inseason assessment, but subsistence fishing opportunity was restricted to fishing windowed periods to spread harvest and reduce risk until the run progresses further when it can be better assessed. The subsistence fishery would then be regulated as appropriate based on the assessed strength of the run inseason with less reliance on the preseason projection. In 2001 there were significant subsistence fishing time reductions with no directed commercial king fishing. Since then, subsistence fishing windows have been in place early in the season and were eventually removed when available surpluses were substantiated by in-river assessment. In some instances, actual subsistence fishing time was increased when in climate weather and fishing conditions hindered fishing efforts. And in 2008, the subsistence fishery began the season on the widowed fishing scheduled. Assessment indicated the king run was low and dictated management to take actions to further conserve the stock. Subsistence fishing times were reduced to 50% throughout the drainage during the peak of the run and gillnet mesh size was restricted to a maximum of 6 inches in the lower river subsistence fishery to provide an opportunity to target summer chum while conserving additional king salmon. Our management is still escapement goal based, but our actions have become more conservative due to the observed decline in Yukon River king salmon production rates which has resulted in less subsistence fishing opportunity and more structured in recent years. (Fredrick Bue, ADF&G, personal communication).

In 2005, 1,022 households (46% of the total households in Districts 1 - 5), 355 subsistence permit holders (91% of the 391 issued), and 69 personal use permit holders (95% of the 73 issued) provided harvest data for the Yukon Area subsistence/personal use salmon fishery (Busher et al., 2007). The estimated 2005 subsistence/personal use salmon harvest for the entire Yukon Area broken down by species included 53,547 Chinook (20%), 93,411 summer chum (35%), 91,667 fall chum (34%), 27,357 coho (10%), and 3,132 pink (1%), for a total estimate of 269,114 salmon (see Figure New-7). (The Alaska Subsistence Salmon Fisheries 2005 Annual Report notes that this is an estimated total based on household surveys and returned permits and calendars, and it includes subsistence harvests, personal use harvests, commercial harvests retained for home use, and fish distributed from ADF&G test fisheries.)

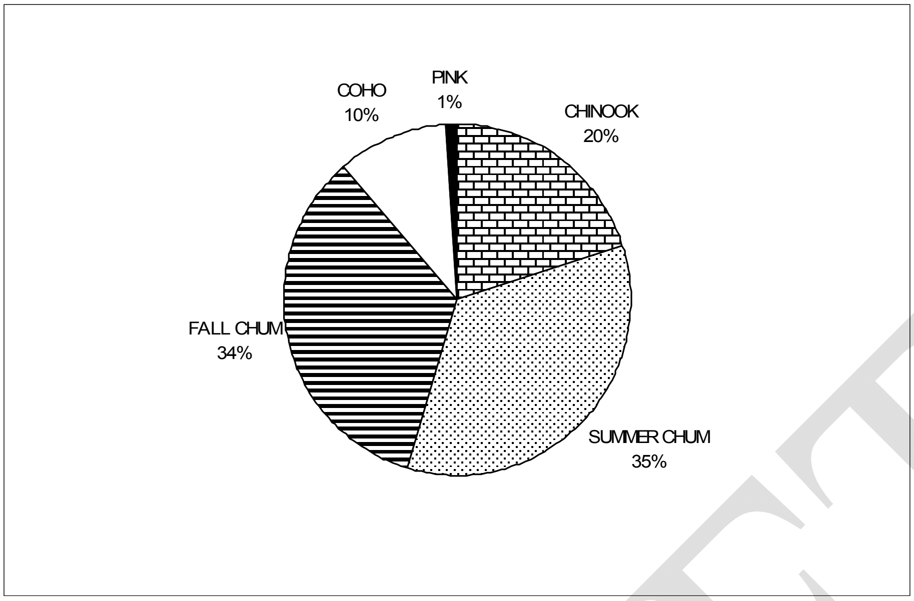


Fig. New -7 Species composition of 2005 estimated subsistence salmon harvests, Yukon District

Source: The Alaska Subsistence Salmon Fisheries 2005 Annual Report.

Since the extremely low harvest levels in 2000 (152,300 total salmon), subsistence Chinook and coho salmon harvests have unsteadily increased while fall chum salmon harvests have rebounded significantly. The 2005 harvest estimates registered above the recent 5-year averages for all species, except the Chinook salmon harvest estimate, which was only 144 fish below the 5-year average. The estimated harvests for all species registered above the most recent 10-year averages. Nonetheless, while summer chum and fall chum salmon estimated harvests are increasing, they still show considerable declines compared to harvests averaged for the last two decades. Note, however, that the ADF&G Alaska Subsistence Salmon Fisheries Annual Report, which provides the majority of these statistics, is only available through 2005.

As stated previously, many individuals and organizations provided written comment letters and testified to the Council during the development of the EIS, both on their dependence on Chinook salmon and the relative declines they are experiencing in the Yukon River drainage area. Again, these comments are part of the administrative record and considered during decision making. One example of public comment received from the Yukon River Drainage Fisheries Association (p. 2) follows:

> *"The weak Chinook salmon run of 2008 has already created problems of crisis proportions along the Yukon River. While subsistence restrictions limited the amount of food available for the winter, the lack of a commercial Chinook fishery cut off one of the only sources of income for many Yukon River residents. Cold winter temperatures and high fuel prices have made the lack of commercial fishery income even more drastic this season. The promise of the same or worse Chinook salmon return in 2009 is no comfort."*

Another example from public comment from the Alakanuk Tribal Council (pg. 1) explains the existing conditions of subsistence on the Yukon River as follows:

> *"The high salmon bycatch numbers of recent years in the pollock fishery threaten our salmon and our way of life. Salmon serves an important cultural and economic role in my community and throughout western Alaska. Salmon provides a primary source of food for us, and the commercial salmon harvest provides the only means of income for many who live in the remote*

> *villages of the Yukon River. Salmon is an irreplaceable resource that must be protected by all means. Once again the lower Yukon River villages will be carrying the burden of conservation, even though the cause of salmon decline is not the result of subsistence users along the river. To our understanding, there may not be enough Chinook salmon for subsistence users this coming summer."*[23]

Finally, note that in 1993, the BOF made a positive finding for Customary and Traditional Use for all salmon in the Yukon-Northern Area. The 'Amount Reasonably Necessary for Subsistence Use' determination (ANS) was established at 348,000 - 503,000 salmon for all species combined. Since 1990, the overall total subsistence salmon harvest in the Yukon Area has declined by approximately 30%. Under this regime, 1992 marked the last year when total subsistence salmon harvests fell within the combined ANS range. In 2001, the BOF broke this figure down by species. A species-specific ANS range provides one index for measuring the extent to which reasonable opportunity was provided in the subsistence fishery. Harvests below the lower bound of the ANS range may indicate, with other evidence such as poor runs and fishing restrictions, that there was not a reasonable opportunity for subsistence uses during the previous season. Harvests consistently lower than the lower bound of the ANS are an indication to the BOF to consider whether additional management actions are necessary to provide reasonable subsistence opportunities. In the years 1998, 2000 to 2003, reduced fishing times or fishery closures were implemented during summer or fall or both seasons due poor or weak runs. Hence opportunity was reduced to allow for escapement (William H. Busher, ADF&G, personal communication).

According to ADF&G, the following management measures were implemented:

- 1998 - Subsistence schedule reduce on upper Yukon and Tanana rivers fall season, Personal Use was closed
- 2000 – Subsistence schedule initially reduced, Personal use closed, then Subsistence closed for fall season drainagewide. WF gear restriction 4 inch mesh or less gillnets
- 2001- Subsistence schedule reduced then closed late summer season, early fall season, then opened in all districts. Personal Use closed part of summer and all of fall season.
- 2002 - Subsistence closures early portion and then reduced schedule during fall season in all districts. Personal use closures most of fall season.
- 2003 - Subsistence reduced schedule early portion of fall season on Yukon except Tanana River

It is important to note that 2005 marked the first year that the harvests of all species were within their respective ANS ranges. See Table New-1 for a comparison of ANS ranges and recent years' subsistence salmon harvests.[24]

[23] Letter from B. Phillip, President, Alakanuk Tribal Council to R. Mecum, Acting Administrator, AK Region, NMFS. Comment letter 5, Dated January 23, 2009.

[24] Alaska Subsistence Salmon Fisheries 2005 Annual Report, p. 43. http://www.subsistence.adfg.state.ak.us/TechPap/tp318.pdf

Table New-1 Comparison of amounts necessary for subsistence (ANS) and estimated subsistence salmon harvests, Yukon Area, 1998-2005

	Estimated Number of Subsistence Salmon Harvested[1]			
	Chinook	Summer Chum	Fall Chum	Coho
ANS[2] / Year	45,500-66,704	83,500-142,192	89,500-167,900	20,500-51,980
1998	52,910	81,858	59,603	16,606
1999	50,711	79,348	84,203	20,122
2000	33,896	72,807	15,152	11,853
2001	53,462	68,544	32,135	21,977
2002	42,117	79,066	17,908	15,619
2003	55,221	78,664	53,829	22,838
2004	55,102	74,532	61,895	24,190
2005	53,409	93,259	91,534	27,250

[1] Estimates for 1998-2004 do not include personal use harvests, ADF&G test fishery distributions, or salmon removed from commercial harvests. Estimates for 2005 include test fishery distributions because the Amounts Necessary for Subsistence are based on harvests from 1990-1999 and included test fishery distributions. Shaded cells indicate harvest amounts are below the minimum ANS.

SOURCE: 2005 harvest data is from the Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report: Subsistence and Personal Use Salmon Harvests in the Alaska Portion of the Yukon River Drainage, 2005. Appendices B1-B4. Preliminary results as of Oct 23, 2006.

Table Source: The Alaska Subsistence Salmon Fisheries 2005 Annual Report.

1.2.1.4 Kuskokwim

According to the Alaska Subsistence Salmon Fisheries 2005 Annual Report (ADF&G 2007):

> *The Kuskokwim Area subsistence salmon fishery is one of the largest in the state. From June through August, the daily activities of many Kuskokwim Area households revolve around harvesting, processing, and preserving salmon for subsistence use. The movement of families from permanent winter residences to summer fish camps situated along rivers and sloughs continues to be a significant element of the annual subsistence harvest effort. The ADF&G Division of Subsistence studies in the region indicate that fish contribute as much as 85% of the total pounds of fish and wildlife harvested in a community, and salmon contribute as much as 53% of the total annual harvest (Coffing, 1991). The harvest of salmon for subsistence use is as much as 650 pounds per capita in some Kuskokwim River communities.*

Walker and Coffing (Subsistence Salmon Harvests in the Kuskokwim Area During 1989)25 state the following:

> *The harvest of salmon in the Kuskokwim Area has been and continues to be important both in the subsistence economy and also in the market economy. Subsistence and commercial fishermen, often the same individuals, share a real interest in the maintenance of the sustained yield of salmon stocks in the Kuskokwim Area.*

[25] http://www.subsistence.adfg.state.ak.us/TechPap/tp189.pdf

> *Communities which depend upon the harvest of salmon for subsistence are situated throughout the Kuskokwim River drainage, along Kuskokwim Bay, and along the Bering Sea coast. In 1989, there were over 3,400 households in these communities, most of which use salmon for subsistence. Although not all households actively participated in harvesting salmon, many were directly involved in cutting and processing the fish and in distributing the finished products to other households.* (p. 58)

For the 15-year period from 1989 through 2003, an estimated annual average of 1,443 households participated in the Kuskokwim Area subsistence salmon fishery (Simon et al. 2007). Many households not directly involved in catching salmon assist family and friends with cutting, drying, smoking, and associated preservation activities (salting, canning, and freezing). Annual subsistence surveys are aimed at gathering harvest data on Chinook, chum, sockeye, and coho salmon.

There are 38 communities consisting of approximately 4,597 households within the Kuskokwim Area. The majority (76%) of the households are situated within the Kuskokwim river drainage. Bethel is the largest community in the region, consisting of approximately 1,739 households. The north Kuskokwim Bay communities of Kwigillingok, Kongiganak, and Kipnuk are comprised of about 357 households. North Kuskokwim Bay subsistence fishers harvest salmon in the Kuskokwim River as well as from areas closer to their communities. Residents of Quinhagak, Goodnews Bay, and Platinum, located along the south shore of Kuskokwim Bay (approximately 220 households), harvest salmon primarily from the Kanektok, Arolik, and Goodnews river drainages. The Bering Sea coast communities of Mekoryuk (on Nunivak Island), Newtok, Tununak, Toksook Bay, Nightmute, and Chefornak are composed of approximately 514 households. Subsistence users from these communities harvest salmon from coastal waters as well as local tributaries.[26]

A summary of the subsistence salmon harvest estimates by community and fishing area is provided in Table V-2 of the Alaska Subsistence Salmon Fisheries 2005 Annual Report, (p. 56). In 2005, subsistence salmon harvest estimates for communities contacted in the Kuskokwim Area totaled 74,354 Chinook (39%), 48,396 chum (25%), 37,003 sockeye (19%), 29,963 coho (16%), and 1,303 pink (1%), for a total estimate of 191,019 salmon (see Fig. New-8 below). The Alaska Subsistence Salmon Fisheries 2005 Annual Report notes in the sampling summary section that these are minimum estimates because no households were contacted in some communities. In other communities, too few households were contacted to produce an expanded community estimate.

[26]Alaska Subsistence Salmon Fisheries 2005 Annual Report, p. 47. http://www.subsistence.adfg.state.ak.us/TechPap/tp318.pdf

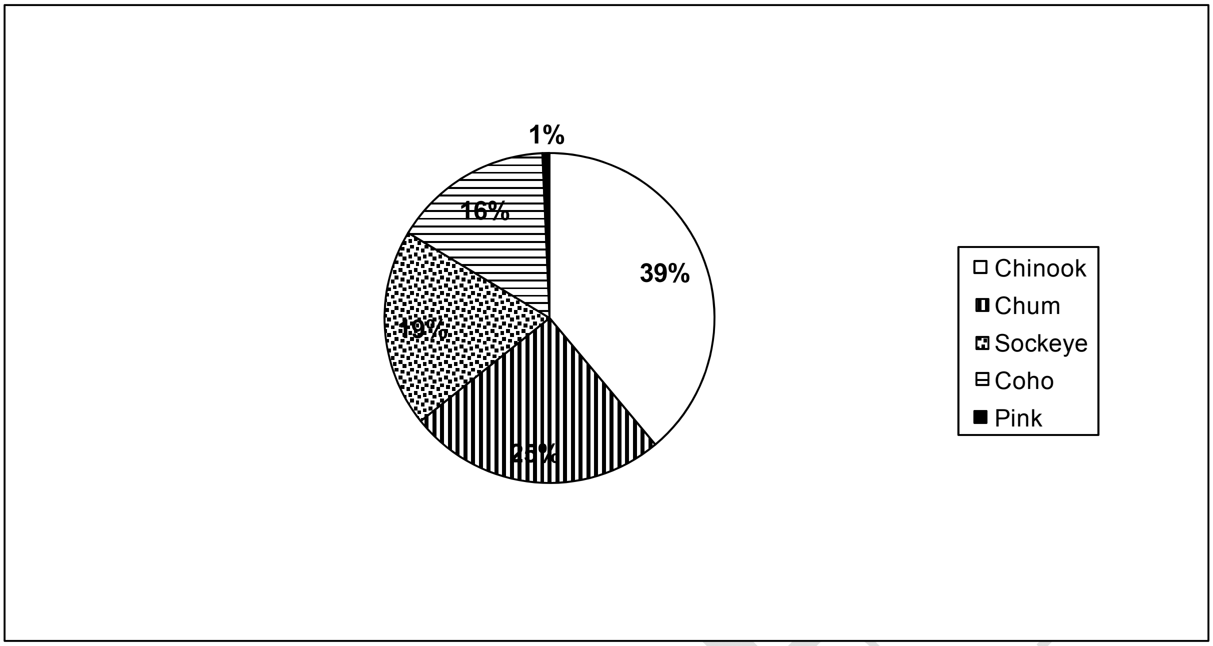


Fig. New -8 Species composition of 2005 estimated subsistence salmon harvests, Kuskokwim Area
Source: The Alaska Subsistence Salmon Fisheries 2005 Annual Report.

Lower Kuskokwim River area communities accounted for 80% of the 2005 subsistence salmon harvests in the Kuskokwim Area and 82% of the entire Chinook subsistence catch. Residents of Bethel accounted for 33% of the Kuskokwim Area subsistence harvests and 33% and 41% of all subsistence caught Chinook and coho salmon, respectively. Subsistence salmon harvests in the Kuskokwim Area in 2005 varied from previous years, with all harvests below recent averages. The estimated 2005 Chinook salmon subsistence harvest represented a decrease of 13% from 2004. The Chinook harvest was 10% below the 1989 - 2005 average, and 2% below the 5-year average.[27]

1.2.1.5 Bristol Bay

According to the Alaska Subsistence Salmon Fisheries 2005 Annual Report (ADF&G 2007):

> *In spite of numerous social, economic, and technological changes, Bristol Bay residents continue to depend on salmon and other fish species as an important source of food. Residents have relied on fish to provide nourishment and sustenance for thousands of years. Subsistence harvests still provide important nutritional, economic, social, and cultural benefits to most Bristol Bay households. All five species of salmon are utilized for subsistence purposes in Bristol Bay, but the most popular are sockeye, Chinook, and coho. Many residents continue to preserve large quantities of fish through traditional methods such as drying and smoking, and fish are also frozen, canned, salted, pickled, fermented, and eaten fresh.28*

[27] Alaska Subsistence Salmon Fisheries 2005 Annual Report, Table V-3, p. 57.
[28] Alaska Subsistence Salmon Fisheries 2005 Annual Report, p. 61.
http://www.subsistence.adfg.state.ak.us/TechPap/tp318.pdf

As stated previously, many individuals and organizations provided written comment letters and testified to the Council during the development of the EIS. The Bristol Bay Alaska Subsistence Regional Advisory Council, which represents 31 Bristol Bay subsistence communities, provided the Council with a letter and resolution approved in October 2008 relative to the proposed action.[29] These comments are part of the administrative record and considered during decision making. Excerpts from that resolution are provided here:

> *"The BBRAC requests the North Pacific Fisheries Management Council (NPFMC) and NOAA to note that in the 2007 and 2008 seasons, several Bristol Bay rivers did not achieve the Chinook salmon escapements forecasted by the Alaska Department of Fish and Game (ADF&G)...Poor or reduced escapements of Chinook salmon into Bristol Bay rivers can have significant effects on the Region's subsistence, commercial and sport fisheries."*(p.2)

A recent ADF&G report of surveys and interviews in five Bristol Bay communities revealed that most subsistence resources in Bristol Bay are distributed through sharing, with no immediate exchange and no expectation of any return in the future (Krieg et al, 2007).30 In the five study communities (Dillingham, Naknek, Togiak, King Salmon and Nondalton), 27 households (21%) had a history of involvement in cash trade of subsistence-caught fish, and 16 households (13%) engaged in cash trade in the 2004 study year. Cash trade most often involved value-added products such as smoked sockeye or Chinook salmon, resembling a form of craft production rather than commercial manufacture. Of 40 cash trade transactions, 28 involved less than $100. In the five study communities, 54 households (42%) had a history of involvement in barter of subsistence-caught fish, and 48 households (38%) bartered fish for other goods or services in 2004. Surveyed households described 143 barter transactions in 2004 that included the exchange of 386 items or services; Chinook salmon (24% of all items bartered) and sockeye salmon (18%) were most often involved in barter. Market goods (17% of the items bartered) and services (7%) were also part of barter transactions for subsistence-caught fish.

This same report notes that exchanges of resources between residents of contemporary Bristol Bay communities, and with residents of communities outside the area, are common. It states:

> "*For example, in Manokotak, a Central Yup'ik community east of Togiak, Schichnes and Chythlook (1988:77-78) identified 18 other communities from which community residents received subsistence foods and 15 to which Manokotak residents sent subsistence foods. The authors speculated that this sharing involved "gifts" (trade was not mentioned) to relatives in Anchorage and Dillingham who could not obtain their customary "Native foods" in those locations.*
>
> *An important point of view expressed by Bristol Bay Yup'ik elders from western Bristol Bay communities during this study and others conducted by the Division of Subsistence was that in the past, they primarily harvested and processed meat, fish, berries, and greens for survival and not with the intent of exchange for cash or other exchange value. They stated that they preferred to give subsistence foods to someone in need, rather than trade the resources for cash. For the most-senior generation of elders, those 80 or more years of age, subsistence foods were never associated with money. Elders stated that if a family was needy, they simply gave subsistence foods to them, and expected nothing back."* (p. 14)

---

[29]Letter and resolution from R. Alvarez, Chair, Bristol Bay Alaska Subsistence Regional Advisory Council to E. Olson, Chair, NPFMC, regarding Chinook salmon bycatch in the Bering Sea pollock fisheries (10/28/08).
[30]Krieg et al., *Sharing, Bartering and Cash Trade in Bristol Bay*, October 2007, abstract, p. v. http://www.subsistence.adfg.state.ak.us/TechPap/Tp326.pdf

The report also states that there is evidence that younger generations in Bristol Bay communities have become more accustomed to the practice of trading subsistence foods for cash rather than for other subsistence products. The report summarizes that the trade or barter in subsistence products has occurred and continues to occur in the Bristol Bay area, and that the role of cash in these types of exchanges has increased with the move toward a 'mixed economy.'

The estimated total Bristol Bay subsistence salmon harvest in 2005 was 128,811 fish.[31] This number was about the same as the estimates for 2003 and 2004, but was higher than the 2002 estimate (109,587). The 2005 harvest was 2% below the recent 10-year average of 131,318 salmon and about 16% below the recent 23-year average of 152,778 salmon. In 2005, as over the last several decades, most of the Bristol Bay Area subsistence harvest was taken in the Naknek/Kvichak (56%) and the Nushagak (37%) districts.

Note that the area-wide Chinook harvest of 15,212 salmon in 2005 was down from the estimate of 18,012 Chinook for 2004 and the record harvest of 21,231 Chinook estimated for 2003, but was higher than any other estimate since 1998 and similar to both the recent 10-year average (15,913 Chinook) and 23-year average (14,998 Chinook).

In 2005, the Bristol Bay subsistence salmon harvest was composed of: 77% sockeye; 12% Chinook; 6% coho; 5% chum; and 1% pink salmon (Figure New-9).[32] Of the entire Bristol Bay Area subsistence salmon harvest in 2005, residents of Bristol Bay communities harvested 119,789 salmon (93%), and other Alaska residents harvested 9,022 salmon (7%).

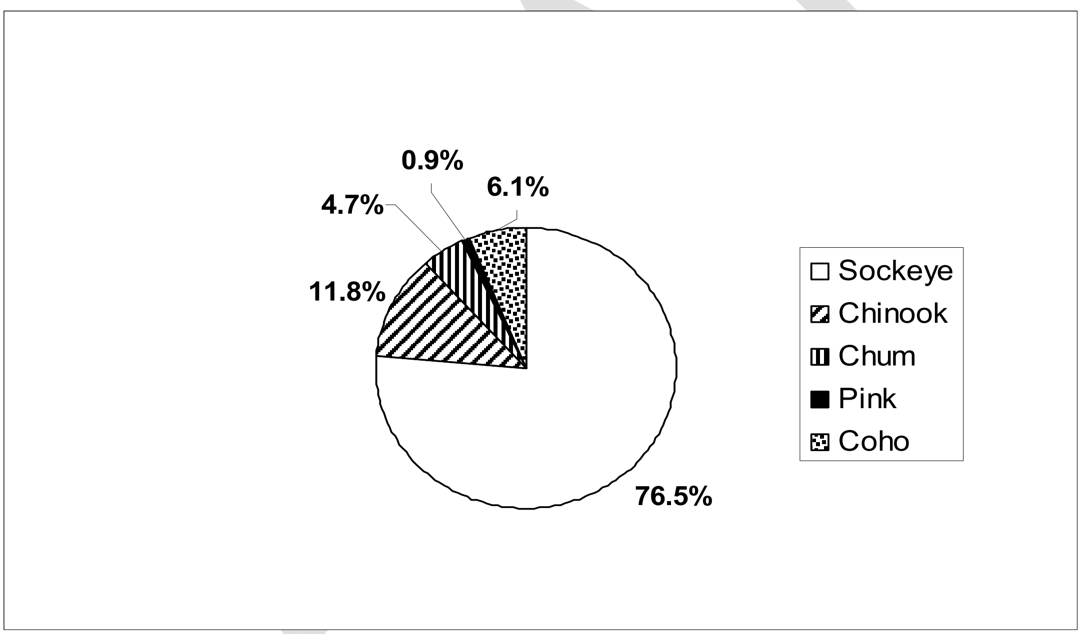


Fig. New -9 Species composition of 2005 estimated subsistence salmon harvests, Bristol Bay Area
Source: The Alaska Subsistence Salmon Fisheries 2005 Annual Report.

[31]Alaska Subsistence Salmon Fisheries 2005 Annual Report, p. 69.
[32]Alaska Subsistence Salmon Fisheries 2005 Annual Report, p. 64.

Additional References not in the DEIS

Alaska Natives Commission. 2004. Final Report. URL: http://www.alaskool.org/resources/anc/anc_toc.htm.

Ballew, C., A. Ross, R. Wells, V. Hiratsuka, K.J. Hanrick, E.D. Nobmann, and S. Barell. 2004. Final Report on the Alaska Traditional Diet Survey. Alaska Native Epidemiological Center. Anchorage, Alaksa.

Bering Sea Elders Advisory Group. 2009. Public comment on the Chinook Salmon Bycatch Draft EIS. Letter from D. Bill, Sr., Chairman to D. Mecum, Acting Regional Administrator, NOAA. February 20, 2009.

Busher, William H., T. Hamazaki and A. M. Marsh. Subsistence and Personal Use Salmon Harvests in the Alaskan Portion of the Yukon River Drainage, 2005. Alaska Department of Fish and Game, Fishery Data Series No. 07-52, Anchorage.

Buklis, Lawrence S. 1999. A Description of Economic Changes in Commercial Salmon Fisheries in a Region of Mixed Subsistence and Market Economies. ARCTIC, Journal of the Arctic Institute of North America, Volume 52, No. 1 (March 1999). P. 46.

Coffing, Michael W. 1991. Kwethluk Subsistence: Contemporary Land Use Patterns, Wild Resource Harvest and Use, and the Subsistence Economy of a Lower Kuskokwim River Area Community. Alaska Department of Fish and Game, Division of Subsistence, Technical Paper Series, No. 157. Juneau, Alaska.

Fall et al. 2007. Alaska Subsistence Salmon Fisheries 2005 Annual Report, December 2007. ADF&G, Division of Subsistence, Technical Paper Series, No. 318. Juneau, Alaska.

Krieg et al. 2007. Sharing, Bartering and Cash Trade in Bristol Bay, October 2007. ADF&G, Division of Subsistence, Technical Paper Series, No. 326. Juneau, Alaska.

Magdanz et al. 2005. Patterns and Trends in Subsistence Salmon Harvests, Norton Sound and Port Clarence, 1994 – 2003. August 2005. ADF&G, Division of Subsistence, Technical Paper Series, No. 294. Juneau, Alaska.

Moncrieff, Catherine F. 2007. Traditional ecological knowledge of customary trade of subsistence harvested salmon on the Yukon River. Yukon River Drainage Fisheries Association, Anchorage, AK.

Simon, Jim, Tracie Krauthoefer, David Koster, and David Caylor. 2007. Subsistence Salmon Harvest Monitoring Report, Kuskokwim Fisheries Management Area, Alaska, 2004. ADF&G, Division of Subsistence, Technical Paper Series, No. 313. Juneau, Alaska.

Walker and Coffing. 1993. Subsistence Salmon Harvests in the Kuskokwim Area During 1989. February 1993. ADF&G, Division of Subsistence, Technical Paper Series, No. 189. Juneau, Alaska.

Walker et al. 1989. Subsistence Harvest of Pacific Salmon in the Yukon River Drainage, Alaska, 1977 – 88. October 1989. ADF&G, Division of Subsistence, Technical Paper Series, No. 187. Juneau, Alaska.

Wolfe, Robert J. 1987. “The super-household: specialization in subsistence economies.” Paper presented at the 14th Annual Meeting of the Alaska Anthropological Association. March 12 – 13, Anchorage, Alaska.

Wolfe, Robert J. and Walker, Robert J. 1987. Subsistence Economies in Alaska: Productivity, Geography, and Development Impacts. ADF&G, Division of Subsistence. Arctic Anthropology, Vol. 24, No. 2, pp. 56-81.

Wolfe, Robert J. 2000. Subsistence in Alaska: A Year 2000 Update. Alaska Department of Fish and Game, Divisions of Subsistence. Juneau.
URL: www.subsistence.adfg.state.ak.us/geninfo/publctns/articles.cfm#SUBSISTENCE_2000.

Wolfe, Robert J. 2003. People and Salmon of the Arctic, Yukon, and Kuskokwim. Socioeconomic Dimensions: Fishery Harvests, Culture Change, and Local Knowledge Systems. Paper presented to the Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative Workshop, Anchorage, November 18-20, 2003, 35 pp.

Wolfe, Robert J. 2007. Human Systems and Sustainable Salmon: Social, Economic, and Cultural Linkages. Paper presented at the Sustainability of the Arctic-Yukon-Kuskokwim Salmon Fisheries Conference, Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative, Fairbanks, February 6-9, 2007, 14 pp.

Yukon River Drainage Association. 2009. Public comment on the Chinook Salmon Bycatch Draft EIS. Letter from R. Gisclair, Policy Director to D. Mecum, Acting Regional Administrator, NOAA, and E. Olson, Chair, NPFMC. January 26, 2009.

Appendix 10 – Price information update for Chapter 10

Chinook Salmon Bycatch Regulatory Impact Review Update for 2007 Pricing Corrections to Potentially Foregone Revenue and Revenue at Risk.

The Draft Environmental Impact Statement/Regulatory Impact Review/Initial Regulatory Flexibility Analysis (DEIS) for Bering Sea Chinook Salmon Bycatch Management contains an analysis of potential impacts on the pollock fishery in terms of potential forgone first wholesale gross revenue (Atl 2, and Alt 4) and in terms of "revenue at risk" (Alt. 3). The revenue analysis uses total first wholesale value of all pollock products combined, divided by total round weight retained tons of landed pollock to establish the round weight equivalent first wholesale value, per ton, of pollock catch that could potentially be forgone and/or put at risk by the proposed action.

Total first wholesale value of all pollock products is tabulated by the Alaska Fisheries Science Center in preparing the annual Economic Status of Groundfish Fisheries off Alaska report (the Econ. SAFE) and is tabulate from data submitted by industry. Retained tons of pollock is tabulated from the National Marine Fisheries Service, Alaska Region e-landings system. The tabulation of total value is completed in November of the following year. Thus, 2007 total value data, and hence derived prices, were not available during the analysis of the proposed action in preparation for Council initial review in June of 2008. As a result, 2006 price data was used as a proxy to allow estimation of 2007 potential forgone revenue and revenue at risk. Further, analysis contained in the Public Review DEIS was completed prior to finalization of the 2007 numbers in order to allow internal review and document processing. Thus, the revision of the DEIS to its final version will contain updated 2007 prices, and revenue estimates, as depicted in this appendix to the Comments Analysis Report.

As shown in the following table (Note: this table does not appear in the DEIS and is shown here to illustrate the price difference between 2006 and 2007), pollock product total value and, hence prices per metric ton, increase considerably between 2006 and 2007 (except for Mothership A season prices). Note that CDQ data is confidential at the sector level in 2007. For all sectors combined, CDQ prices increased 11.4%, while non-CDQ prices increased 10.6%. The changes in non-CDQ sector prices are also shown below. These price changes are documented in the tables contained herein and these tables will replace the table (or the 2007 section of the table) of the same number in the DEIS when it is made final.

Percentage Increase in 2007 prices versus 2006 prices.

Percentage Difference			
Sector	Season	2007 versus 2006	
		CDQ	non-CDQ
CP	A	Conf	9.5%
	B	Conf	16.5%
	Total	**Conf**	**12.5%**
M	A	Conf	-2.5%
	B	Conf	20.0%
	Total	**Conf**	**8.3%**
S	A	n/a	8.0%
	B	n/a	9.0%
	Total	**n/a**	**9.2%**
All	A	6.7%	7.4%
	B	16.5%	13.3%
	Total	**11.4%**	**10.6%**

Note: Conf: Confidential due to fewer than three entities reported and/or the reporting of a sector split and the total for the category would violate confidentiality, thus the total is reported but not the sector data.

Corrected Wholesale Value Tables

Table 10-79: First Wholesale value of retained Pollock by sector, 2003-2007 ($ millions)

Sector	Season	2003		2004		2005		2006		2007	
		CDQ	non-CDQ	CDQ	non-CDQ	CDQ	non-CDQ	CDQ	non-CDQ	CDQ	non-CDQ
CP	A	$61.0	$200.7	$58.2	$253.9	$57.7	$282.1	$63.0	$258.8	Conf	$250.1
	B	$55.4	$172.9	$46.0	$188.2	$62.3	$244.2	$60.5	$241.1	Conf	$255.4
	Total	**$116.4**	**$373.6**	**$104.2**	**$442.0**	**$120.0**	**$526.3**	**$123.5**	**$499.8**	**Conf**	**$505.5**
M	A	$6.0	$36.7	$6.7	$44.1	$6.9	$28.4	$6.2	$50.7	Conf	$46.6
	B	$5.4	$32.4	$5.0	$33.2	$5.5	$24.1	$5.0	$43.9	Conf	$47.9
	Total	**$11.3**	**$69.1**	**$11.8**	**$77.3**	**$12.4**	**$52.5**	**$11.1**	**$94.6**	**Conf**	**$94.6**
S	A	$0.0	$206.3	$0.0	$220.9	$0.0	$262.4	$0.0	$249.2	0	$249.7
	B	$0.0	$249.3	$0.0	$225.4	$0.0	$273.6	$0.0	$268.6	0	$250.6
	Total	**$0.0**	**$455.6**	**$0.0**	**$446.3**	**$0.0**	**$535.9**	**$0.0**	**$517.8**	**0**	**$500.3**
All	A	$66.9	$443.7	$64.9	$518.9	$64.6	$572.9	$69.2	$558.7	$68.0	$546.5
	B	$60.8	$454.6	$51.1	$446.7	$67.8	$541.9	$65.4	$553.6	$70.4	$554.0
	Total	**$127.7**	**$898.3**	**$116.0**	**$965.6**	**$132.4**	**$1,114.8**	**$134.6**	**$1,112.3**	**$138.4**	**$1,100.4**

Sources: Terry Hiatt: Alaska Fisheries Science Center, from data compiled for the Economic Status and Fishery Evaluation Report, 2007. Note: Conf: Confidential due to fewer than three entities reported and/or the reporting of a sector split and the total for the category would violate confidentiality, thus the total is reported but not the sector data.

Table 10-80: First Wholesale Value of Retained Pollock by Sector, CDQ and Non-CDQ Combined, 2003-2007

Sector	Season	2003 Total	2004 Total	2005 Total	2006 Total	2007 Total
CP	A	$261.7	$312.1	$339.7	$321.8	**Conf**
	B	$228.3	$234.2	$306.5	$301.5	**Conf**
	Total	**$490.0**	**$546.2**	**$646.3**	**$623.3**	**Conf**
M	A	$42.6	$50.8	$35.3	$56.9	**Conf**
	B	$37.8	$38.2	$29.6	$48.8	**Conf**
	Total	**$80.4**	**$89.0**	**$64.9**	**$105.8**	**Conf**
CP+M	A	$304.3	$362.9	$375.0	$378.7	$249.7
	B	$266.1	$272.4	$336.2	$350.4	$250.6
	Total	**$570.4**	**$635.3**	**$711.2**	**$729.1**	**$500.3**
S	A	$206.3	$220.9	$262.4	$249.2	$249.7
	B	$249.3	$225.4	$273.6	$268.6	$250.6
	Total	**$455.6**	**$446.3**	**$535.9**	**$517.8**	**$500.3**
All	A	$510.6	$583.8	$637.4	$627.9	$614.5
	B	$515.4	$497.8	$609.7	$619.0	$624.4
	Total	**$1,026.0**	**$1,081.6**	**$1,247.2**	**$1,246.9**	**$1,238.9**

Sources: Terry Hiatt: Alaska Fisheries Science Center, from data compiled for the Economic Status and Fishery Evaluation Report, 2007.
Note: Conf: Confidential due to fewer than three entities reported and/or the reporting of a sector split and the total for the category would violate confidentiality, thus the total is reported but not the sector data.

Table 10-81: Round weight Equivalent First Wholesale value of retained pollock by sector, 2003-2007 ($/mt)

Sector	Season	2003		2004		2005		2006		2007	
		CDQ	non-CDQ	CDQ	non-CDQ	CDQ	non-CDQ	CDQ	non-CDQ	CDQ	non-CDQ
CP	A	$1,180	$921	$1,126	$1,145	$1,089	$1,284	$1,165	$1,172	Conf	$1,283
	B	$712	$533	$591	$591	$766	$768	$748	$748	Conf	$871
	Total	**$899**	**$689**	**$804**	**$818**	**$893**	**$979**	**$915**	**$920**	**Conf**	**$1,035**
M	A	$716	$706	$806	$850	$1,101	$552	$963	$982	Conf	$957
	B	$428	$412	$403	$429	$566	$304	$514	$550	Conf	$660
	Total	**$543**	**$529**	**$564**	**$598**	**$777**	**$402**	**$693**	**$720**	**Conf**	**$780**
CP+M	A	$1,116	$880	$1,081	$1,089	$1,090	$1,145	$1,144	$1,136	Conf	$1,217
	B	$672	$509	$565	$559	$745	$675	$723	$709	Conf	$829
	Total	**$849**	**$658**	**$771**	**$776**	**$881**	**$866**	**$892**	**$881**	**Conf**	**$984**
S	A	$0	$797	$0	$849	$0	$1,018	$0	$947	0	$1,023
	B	$0	$633	$0	$596	$0	$700	$0	$700	0	$763
	Total	**$0**	**$698**	**$0**	**$699**	**$0**	**$827**	**$0**	**$800**	**0**	**$874**
All	A	$1,116	$839	$1,081	$972	$1,090	$1,083	$1,144	$1,043	1,221	$1,120
	B	$672	$570	$565	$577	$745	$688	$723	$704	842	$798
	Total	**$849**	**$677**	**$771**	**$738**	**$881**	**$847**	**$892**	**$842**	**994**	**$931**

Sources: Terry Hiatt: Alaska Fisheries Science Center, from data compiled for the Economic Status and Fishery Evaluation Report, 2007, and round weight of retained pollock by sector, season, year, and CDQ vs. non-CDQ from NMFS Alaska Region e-landings catch accounting system.

Note: Conf: Confidential due to fewer than three entities reported and/or the reporting of a sector split and the total for the category would violate confidentiality, thus the total is reported but not the sector data.

Table 10-82: Round Weight Equivalent First Wholesale Value of Retained pollock by Sector, CDQ and Non-CDQ Combined, 2003–2007

Sector	Season	2003 Total	2004 Total	2005 Total	2006 Total	2007 Total
CP	A	$971	$1,141	$1,246	$1,170	**Conf**
	B	$567	$591	$767	$748	**Conf**
	Total	**$729**	**$816**	**$962**	**$919**	**Conf**
M	A	$708	$844	$612	$980	**Conf**
	B	$414	$425	$333	$546	**Conf**
	Total	**$531**	**$593**	**$443**	**$717**	**Conf**
CP+M	A	$923	$1,088	$1,135	$1,137	**Conf**
	B	$539	$560	$688	$711	**Conf**
	Total	**$693**	**$775**	**$869**	**$883**	**Conf**
S	A	$797	$849	$1,018	$947	**$1,023**
	B	$633	$596	$700	$700	**$763**
	Total	**$698**	**$699**	**$827**	**$800**	**$874**
All	A	$867	$983	$1,084	$1,053	**$1,131**
	B	$581	$576	$694	$706	**$803**
	Total	**$695**	**$742**	**$850**	**$847**	**$938**

Sources: Terry Hiatt: Alaska Fisheries Science Center, from data compiled for the Economic Status and Fishery Evaluation Report, 2007, and round weight of retained pollock by sector, season, year, and CDQ vs. non-CDQ from NMFS Alaska Region e-landings catch accounting system.
Note: Conf: Confidential due to fewer than three entities reported and/or the reporting of a sector split and the total for the category would violate confidentiality, thus the total is reported but not the sector data.

Section 10.5.2.2 Potentially Foregone Gross Revenue under Alternative 2

Table 10-85: 2007 estimated forgone gross revenue by sector for Alternative 2, option 2d (70/30 season split, cap 68,100), compared with PPA1 (cap 68,392) (in millions of $)

Sector		**CDQ**	**Inshore CV**	**Mothership**	**Offshore CP**	**Total**
Alternative 2: option 2d						
	A season	$0.0	$134.8	$20.1	$118.3	$273.2
	B season	$2.5	$40.9	$1.8	$4.2	$49.3
Total Alternative 2		$2.5	$175.7	$21.9	$122.5	$322.5
Alternative 4: PPA1						
	A season	$0	$123	$12	$115	$249
	B season	$4	$36	$2	$22	$64
Total Alternative 4		$4	$159	$14	$137	$313

Table 10-86: 2007 estimated forgone revenue for Alternative 2, option 2d (70/30 season split, cap 48,700) compared with PPA2 (cap 47,591) (in millions of $)

Sector		**CDQ**	**Inshore CV**	**Mothership**	**Offshore CP**	**Total**
Alternative 2: option 2d						
	A season	$23.7	$200.6	$33.7	$155.9	$413.7
	B season	$4.5	$54.7	$3.7	$13.1	$76.0
Total Alternative 2		$28.20	$255.30	$37.40	$169.00	$489.70
Alternative 4: PPA2						
	A season	$13	$154	$28	$172	$367
	B season	$5	$46	$4	$30	$86
Total Alternative 4		$18	$200	$32	$202	$453

Table 10-87: Hypothetical forgone pollock gross revenue, by year and by season, under the Alternative 2 options for fleet-wide caps. ($ Millions)

			2007		
Seas	Cap	Sect	50/50	58/42	70/30
A	87,500	CDQ	$0.0	$0.0	$0.0
		NonCDQ	$346.5	$272.1	$144.8
	87,500 Total		$346.5	$272.1	$144.8
	68,100	CDQ	$10.4	$1.1	$0.0
		NonCDQ	$422.5	$350.6	$274.9
	68,100 Total		$432.9	$351.7	$274.9
	48,700	CDQ	$37.7	$24.1	$10.4
		NonCDQ	$431.0	$427.6	$422.5
	48,700 Total		$468.7	$451.7	$432.9
	29,300	CDQ	$49.8	$49.3	$38.6
		NonCDQ	$518.4	$515.7	$511.6
	29,300 Total		$568.3	$565.0	$550.3
B	87,500	CDQ	$0.0	$0.0	$2.0
		NonCDQ	$13.4	$15.8	$55.8
	87,500 Total		$13.4	$15.8	$57.8
	68,100	CDQ	$0.0	$1.8	$2.3
		NonCDQ	$35.7	$55.1	$74.1
	68,100 Total		$35.7	$57.0	$76.4
	48,700	CDQ	$2.1	$2.3	$4.4
		NonCDQ	$56.3	$74.1	$89.7
	48,700 Total		$58.4	$76.4	$94.1
	29,300	CDQ	$4.4	$4.5	$6.2
		NonCDQ	$89.7	$107.7	$131.2
	29,300 Total		$94.1	$112.3	$137.4

NOTE: The DEIS miscalculated the B season values for 2007 by mistakenly using the A season prices, which are generally higher than B season prices. As a result, the numbers shown here for the B season are smaller than shown in the DEIS because the difference between A and B season prices was greater than the price increases between 2006 and 2007.

Table 10-88: Hypothetical forgone pollock gross revenue in percent of total gross revenue, by year and by season, under the Alternative 2 options for fleet-wide caps.

			2007		
Seas	Cap	Sect	50/50	58/42	70/30
A	87,500	CDQ	0%	0%	0%
		NonCDQ	63%	50%	27%
	87,500 Total		56%	44%	24%
	68,100	CDQ	15%	2%	0%
		NonCDQ	77%	64%	50%
	68,100 Total		70%	57%	45%
	48,700	CDQ	55%	35%	15%
		NonCDQ	79%	78%	77%
	48,700 Total		76%	74%	70%
	29,300	CDQ	73%	72%	57%
		NonCDQ	95%	94%	94%
	29,300 Total		92%	92%	90%
B	87,500	CDQ	0%	0%	3%
		NonCDQ	2%	3%	10%
	87,500 Total		2%	3%	9%
	68,100	CDQ	0%	3%	4%
		NonCDQ	6%	10%	13%
	68,100 Total		6%	9%	13%
	48,700	CDQ	3%	4%	7%
		NonCDQ	10%	13%	16%
	48,700 Total		10%	13%	15%
	29,300	CDQ	7%	7%	9%
		NonCDQ	16%	19%	24%
	29,300 Total		15%	18%	23%

Table 10-97: Hypothetical forgone pollock gross revenue, by season and sector, under Alternative 2, for 2007.

2007			opt1(AFA)			opt2a			opt2d		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	$0.0	$0.0	$0.0	$39.4	$38.7	$37.7	$9.4	$0.0	$0.0
		M	$19.6	$6.1	$0.0	$33.6	$32.9	$20.0	$26.7	$19.8	$6.1
		P	$115.8	$90.4	$67.1	$156.6	$154.6	$151.5	$152.1	$117.3	$113.9
		S	$200.5	$168.9	$134.7	$102.6	$2.1	$0.0	$136.7	$133.3	$2.2
	87,500 Total		$336.0	$265.4	$201.7	$332.1	$228.3	$209.2	$324.8	$270.4	$122.2
	68,100	CDQ	$0.0	$0.0	$0.0	$50.1	$49.6	$39.0	$23.7	$10.4	$0.0
		M	$32.9	$20.2	$11.5	$34.4	$33.9	$33.2	$33.7	$33.0	$20.1
		P	$152.4	$117.6	$114.2	$189.8	$157.8	$155.4	$155.9	$153.7	$118.3
		S	$203.7	$201.9	$170.1	$168.0	$134.6	$22.2	$200.6	$169.0	$134.8
	68,100 Total		$389.0	$339.7	$295.8	$442.3	$375.9	$249.8	$413.8	$366.1	$273.2
	48,700	CDQ	$10.8	$9.4	$0.0	$51.0	$50.6	$50.1	$38.5	$37.7	$23.7
		M	$34.2	$33.7	$32.9	$43.1	$42.7	$34.4	$42.5	$34.3	$33.7
		P	$157.2	$155.2	$152.3	$236.6	$191.2	$189.8	$190.1	$158.1	$155.9
		S	$235.1	$233.7	$203.7	$202.5	$200.4	$168.0	$204.7	$203.1	$200.6
	48,700 Total		$437.3	$432.0	$389.0	$533.2	$484.9	$442.3	$475.8	$433.2	$413.7
	29,300	CDQ	$38.9	$38.1	$24.4	$59.3	$51.7	$51.3	$50.3	$49.8	$39.3
		M	$43.4	$43.0	$42.5	$44.1	$43.8	$43.5	$43.7	$43.4	$43.0
		P	$236.3	$191.0	$189.6	$240.4	$239.5	$238.1	$238.4	$237.1	$235.3
		S	$238.6	$237.8	$236.5	$235.7	$234.3	$204.5	$237.1	$236.0	$234.4
	29,300 Total		$557.2	$509.8	$492.9	$579.5	$569.4	$537.4	$569.5	$566.4	$552.0
B	87,500	CDQ	$0.0	$0.0	$0.0	$2.5	$4.4	$4.6	$0.0	$1.0	$2.2
		M	$0.0	$0.0	$0.0	$0.0	$0.0	$1.7	$0.0	$0.0	$0.0
		P	$0.0	$0.0	$0.0	$0.0	$0.0	$4.5	$0.0	$0.0	$0.0
		S	$30.0	$30.7	$40.9	$7.2	$18.5	$30.3	$18.7	$29.7	$40.1
	87,500 Total		$30.0	$30.7	$40.9	$9.7	$22.9	$41.1	$18.7	$30.7	$42.3
	68,100	CDQ	$0.0	$0.0	$1.9	$4.5	$4.5	$6.2	$1.0	$2.1	$2.5
		M	$0.0	$0.0	$1.5	$0.0	$1.6	$3.6	$0.0	$0.0	$1.8
		P	$0.0	$0.0	$0.0	$0.0	$0.2	$13.0	$0.0	$0.0	$4.2
		S	$40.1	$40.6	$54.5	$19.0	$30.0	$40.3	$30.1	$30.7	$40.9
	68,100 Total		$40.1	$40.6	$58.0	$23.5	$36.3	$63.1	$31.1	$32.8	$49.3
	48,700	CDQ	$1.0	$1.9	$2.4	$6.2	$6.2	$8.4	$2.3	$2.5	$4.5
		M	$0.0	$1.5	$3.5	$1.8	$3.6	$6.3	$1.5	$1.8	$3.7
		P	$0.0	$0.0	$4.8	$5.0	$13.0	$26.1	$0.0	$4.2	$13.1
		S	$41.1	$54.5	$65.3	$30.6	$40.3	$46.7	$40.4	$40.9	$54.7
	48,700 Total		$42.0	$58.0	$76.1	$43.5	$63.1	$87.5	$44.2	$49.3	$76.0
	29,300	CDQ	$2.4	$4.3	$4.5	$8.4	$8.5	$11.5	$4.5	$4.6	$6.3
		M	$3.5	$3.7	$8.2	$6.3	$8.3	$14.6	$3.7	$6.3	$11.9
		P	$4.8	$12.9	$26.0	$26.1	$32.7	$51.3	$13.1	$19.9	$32.8
		S	$65.3	$65.6	$66.0	$46.7	$54.7	$65.4	$54.7	$55.0	$65.7
	29300 Total		$76.1	$86.5	$104.7	$87.5	$104.2	$142.8	$76.0	$85.7	$116.7

Table 10-98: Hypothetical forgone pollock revenue in percent of total gross revenue, by season and sector, under Alternative 2, for 2007.

2007			opt1(AFA)			opt2a			opt2d		
Seas	Cap	Sect	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	CDQ	0%	0%	0%	58%	57%	55%	14%	0%	0%
		M	42%	13%	0%	72%	71%	43%	57%	42%	13%
		P	46%	36%	27%	63%	62%	61%	61%	47%	46%
		S	80%	68%	54%	41%	1%	0%	55%	53%	1%
	87,500 Total		55%	43%	33%	54%	37%	34%	53%	44%	20%
	68,100	CDQ	0%	0%	0%	74%	73%	57%	35%	15%	0%
		M	70%	43%	25%	74%	73%	71%	72%	71%	43%
		P	61%	47%	46%	76%	63%	62%	62%	61%	47%
		S	82%	81%	68%	67%	54%	9%	80%	68%	54%
	68,100 Total		63%	55%	48%	72%	61%	41%	67%	60%	44%
	48,700	CDQ	16%	14%	0%	75%	74%	74%	57%	55%	35%
		M	73%	72%	70%	92%	92%	74%	91%	74%	72%
		P	63%	62%	61%	95%	76%	76%	76%	63%	62%
		S	94%	94%	82%	81%	80%	67%	82%	81%	80%
	48,700 Total		71%	70%	63%	87%	79%	72%	77%	71%	67%
	29,300	CDQ	57%	56%	36%	87%	76%	75%	74%	73%	58%
		M	93%	92%	91%	94%	94%	93%	94%	93%	92%
		P	94%	76%	76%	96%	96%	95%	95%	95%	94%
		S	96%	95%	95%	94%	94%	82%	95%	95%	94%
	29,300 Total		91%	83%	80%	94%	93%	87%	93%	92%	90%
B	87,500	CDQ	0%	0%	0%	4%	6%	7%	0%	1%	3%
		M	0%	0%	0%	0%	0%	4%	0%	0%	0%
		P	0%	0%	0%	0%	0%	2%	0%	0%	0%
		S	12%	12%	16%	3%	7%	12%	7%	12%	16%
	87,500 Total		5%	5%	7%	2%	4%	7%	3%	5%	7%
	68,100	CDQ	0%	0%	3%	6%	6%	9%	1%	3%	4%
		M	0%	0%	3%	0%	3%	8%	0%	0%	4%
		P	0%	0%	0%	0%	0%	5%	0%	0%	2%
		S	16%	16%	22%	8%	12%	16%	12%	12%	16%
	68,100 Total		6%	7%	9%	4%	6%	10%	5%	5%	8%
	48,700	CDQ	1%	3%	3%	9%	9%	12%	3%	4%	6%
		M	0%	3%	7%	4%	8%	13%	3%	4%	8%
		P	0%	0%	2%	2%	5%	10%	0%	2%	5%
		S	16%	22%	26%	12%	16%	19%	16%	16%	22%
	48,700 Total		7%	9%	12%	7%	10%	14%	7%	8%	12%
	29,300	CDQ	3%	6%	6%	12%	12%	16%	6%	7%	9%
		M	7%	8%	17%	13%	17%	30%	8%	13%	25%
		P	2%	5%	10%	10%	13%	20%	5%	8%	13%
		S	26%	26%	26%	19%	22%	26%	22%	22%	26%
	29300 Total		12%	14%	17%	14%	17%	23%	12%	14%	19%

10.5.2.3 Potentially Foregone Gross Revenue under Alternative 4

Table 10-99:ypothetical forgone pollock revenue by year and season under PPA1 and PPA2.
($ Millions)

PPA	A-season Transfer-Ability	Year	A-Season				A total	A-B Roll over	B-Season				B Total	Annual Total
			CDQ	M	P	S			CDQ	M	P	S		
1	No	2003	$0	$0	$0	$0	**$0**	**0%**	$0	$0	$0	$0	**$0**	**$0**
		2004	$0	$0	$0	$0	**$0**		$9	$0	$0	$10	**$20**	**$20**
		2005	$0	$0	$0	$0	**$0**		$0	$0	$0	$20	**$20**	**$20**
		2006	$0	$8	$8	$122	**$138**		$0	$0	$0	$11	**$11**	**$149**
		2007	$0	$15	$115	$123	**$252**		$4	$2	$22	$36	**$64**	**$317**
	Yes	2003	$0	$0	$0	$0	**$0**		$0	$0	$0	$0	**$0**	**$0**
		2004	$0	$0	$0	$0	**$0**		$9	$0	$0	$10	**$20**	**$20**
		2005	$0	$0	$0	$0	**$0**		$0	$0	$0	$20	**$20**	**$20**
		2006	$0	$4	$0	$116	**$120**		$0	$0	$0	$11	**$11**	**$131**
		2007	$0	$12	$115	$123	**$249**		$4	$2	$22	$36	**$64**	**$314**
2	No	2003	$0	$0	$56	$0	**$56**		$0	$1	$0	$0	**$1**	**$57**
		2004	$0	$0	$0	$0	**$0**		$21	$1	$1	$18	**$41**	**$41**
		2005	$0	$0	$0	$0	**$0**		$0	$0	$29	$27	**$57**	**$57**
		2006	$0	$15	$60	$169	**$244**		$0	$0	$0	$27	**$27**	**$272**
		2007	$13	$28	$154	$172	**$367**		$5	$4	$30	$46	**$86**	**$452**
	Yes	2003	$0	$0	$22	$0	**$22**		$0	$1	$0	$0	**$1**	**$22**
		2004	$0	$0	$0	$0	**$0**		$21	$1	$1	$18	**$41**	**$41**
		2005	$0	$0	$0	$0	**$0**		$0	$0	$29	$27	**$57**	**$57**
		2006	$0	$15	$39	$162	**$216**		$0	$0	$0	$27	**$27**	**$243**
		2007	$13	$28	$154	$172	**$367**		$5	$4	$30	$46	**$86**	**$452**
1	No	2003	$0	$0	$0	$0	**$0**	**80%**	$0	$0	$0	$0	**$0**	**$0**
		2004	$0	$0	$0	$0	**$0**		$0	$0	$0	$0	**$0**	**$0**
		2005	$0	$0	$0	$0	**$0**		$0	$0	$0	$0	**$0**	**$0**
		2006	$0	$8	$8	$122	**$138**		$0	$0	$0	$9	**$9**	**$147**
		2007	$0	$15	$115	$123	**$252**		$4	$2	$20	$36	**$62**	**$315**
	Yes	2003	$0	$0	$0	$0	**$0**		$0	$0	$0	$0	**$0**	**$0**
		2004	$0	$0	$0	$0	**$0**		$0	$0	$0	$0	**$0**	**$0**
		2005	$0	$0	$0	$0	**$0**		$0	$0	$0	$0	**$0**	**$0**
		2006	$0	$4	$0	$116	**$120**		$0	$0	$0	$9	**$9**	**$129**
		2007	$0	$12	$115	$123	**$249**		$4	$2	$20	$36	**$62**	**$312**
2	No	2003	$0	$0	$56	$0	**$56**		$0	$0	$0	$0	**$0**	**$56**
		2004	$0	$0	$0	$0	**$0**		$0	$0	$0	$10	**$10**	**$10**
		2005	$0	$0	$0	$0	**$0**		$0	$0	$8	$21	**$29**	**$29**
		2006	$0	$15	$60	$169	**$244**		$0	$0	$0	$27	**$27**	**$272**
		2007	$13	$28	$154	$172	**$367**		$5	$4	$30	$46	**$86**	**$452**
	Yes	2003	$0	$0	$22	$0	**$22**		$0	$1	$0	$0	**$1**	**$22**
		2004	$0	$0	$0	$0	**$0**		$0	$0	$0	$10	**$10**	**$10**
		2005	$0	$0	$0	$0	**$0**		$0	$0	$8	$21	**$29**	**$29**
		2006	$0	$15	$39	$162	**$216**		$0	$0	$0	$27	**$27**	**$243**
		2007	$13	$28	$154	$172	**$367**		$5	$4	$30	$46	**$86**	**$452**

Table 10-100: Hypothetical forgone pollock revenue, in percent of total forgone pollock revenue, by sector and scenario (% of total wholesale revenue)

PPA	A-season Transfer-Ability	Year	A-Season				A total	A-B Roll over	B-Season				B Total	Annual Total
			CDQ	M	P	S			CDQ	M	P	S		
1	No	2003	0%	0%	0%	0%	**0%**	0%	0%	0%	0%	0%	**0%**	**0%**
		2004	0%	0%	0%	0%	**0%**		18%	1%	0%	4%	**4%**	**2%**
		2005	0%	0%	0%	0%	**0%**		0%	0%	0%	7%	**3%**	**2%**
		2006	0%	16%	3%	49%	**22%**		0%	0%	0%	4%	**2%**	**12%**
		2007	0%	31%	46%	49%	**41%**		6%	4%	9%	14%	**10%**	**26%**
	Yes	2003	0%	0%	0%	0%	**0%**		0%	0%	0%	0%	**0%**	**0%**
		2004	0%	0%	0%	0%	**0%**		18%	1%	0%	4%	**4%**	**2%**
		2005	0%	0%	0%	0%	**0%**		0%	0%	0%	7%	**3%**	**2%**
		2006	0%	8%	0%	47%	**19%**		0%	0%	0%	4%	**2%**	**10%**
		2007	0%	25%	46%	49%	**41%**		6%	4%	9%	14%	**10%**	**25%**
2	No	2003	0%	0%	28%	0%	**11%**		0%	2%	0%	0%	**0%**	**6%**
		2004	0%	0%	0%	0%	**0%**		41%	4%	0%	8%	**8%**	**4%**
		2005	0%	0%	0%	0%	**0%**		0%	0%	12%	10%	**9%**	**5%**
		2006	0%	30%	23%	68%	**39%**		0%	0%	0%	10%	**4%**	**22%**
		2007	18%	60%	61%	69%	**60%**		7%	8%	12%	18%	**14%**	**37%**
	Yes	2003	0%	0%	11%	0%	**4%**		0%	2%	0%	0%	**0%**	**2%**
		2004	0%	0%	0%	0%	**0%**		41%	4%	0%	8%	**8%**	**4%**
		2005	0%	0%	0%	0%	**0%**		0%	0%	12%	10%	**9%**	**5%**
		2006	0%	30%	15%	65%	**34%**		0%	0%	0%	10%	**4%**	**19%**
		2007	18%	60%	61%	69%	**60%**		7%	8%	12%	18%	**14%**	**37%**
1	No	2003	0%	0%	0%	0%	**0%**	**80%**	0%	0%	0%	0%	**0%**	**0%**
		2004	0%	0%	0%	0%	**0%**		0%	0%	0%	0%	**0%**	**0%**
		2005	0%	0%	0%	0%	**0%**		0%	0%	0%	0%	**0%**	**0%**
		2006	0%	16%	3%	49%	**22%**		0%	0%	0%	3%	**1%**	**12%**
		2007	0%	31%	46%	49%	**41%**		5%	4%	8%	14%	**10%**	**25%**
	Yes	2003	0%	0%	0%	0%	**0%**		0%	0%	0%	0%	**0%**	**0%**
		2004	0%	0%	0%	0%	**0%**		0%	0%	0%	0%	**0%**	**0%**
		2005	0%	0%	0%	0%	**0%**		0%	0%	0%	0%	**0%**	**0%**
		2006	0%	8%	0%	47%	**19%**		0%	0%	0%	3%	**1%**	**10%**
		2007	0%	25%	46%	49%	**41%**		5%	4%	8%	14%	**10%**	**25%**
2	No	2003	0%	0%	28%	0%	**11%**		0%	0%	0%	0%	**0%**	**5%**
		2004	0%	0%	0%	0%	**0%**		0%	0%	0%	4%	**2%**	**1%**
		2005	0%	0%	0%	0%	**0%**		0%	0%	3%	8%	**5%**	**2%**
		2006	0%	30%	23%	68%	**39%**		0%	0%	0%	10%	**4%**	**22%**
		2007	18%	60%	61%	69%	**60%**		7%	8%	12%	18%	**14%**	**37%**
	Yes	2003	0%	0%	11%	0%	**4%**		0%	2%	0%	0%	**0%**	**2%**
		2004	0%	0%	0%	0%	**0%**		0%	0%	0%	4%	**2%**	**1%**
		2005	0%	0%	0%	0%	**0%**		0%	0%	3%	8%	**5%**	**2%**
		2006	0%	30%	15%	65%	**34%**		0%	0%	0%	10%	**4%**	**19%**
		2007	18%	60%	61%	69%	**60%**		7%	8%	12%	18%	**14%**	**37%**

10.5.2.4 Revenue at Risk under Alternative 3

Table 10-106: Hypothetical Revenue At Risk (millions of dollars (upper) percent of total revenue (lower)) based on retained tons of pollock caught by all vessels after A-season closures would have been triggered.

Pollock			Sector (All), A season				
Cap scenario	Option	CAP	2003	2004	2005	2006	2007
87,500	1-1: 70/30	61,250	$0.0	$0.0	$0.0	$0.0	$134.4
	1-2: 58/42	50,750	$0.0	$0.0	$0.0	$77.5	$282.5
	1-3: 55/45	48,125	$0.0	$0.0	$0.0	$157.0	$289.7
	1-4: 50/50	43,750	$0.0	$0.0	$0.0	$234.9	$301.1
68,100	1-1: 70/30	47,670	$0.0	$0.0	$0.0	$168.1	$289.7
	1-2: 58/42	39,498	$0.0	$0.0	$0.0	$265.8	$337.4
	1-3: 55/45	37,455	$0.0	$0.0	$0.0	$276.1	$350.3
	1-4: 50/50	34,050	$0.0	$0.0	$0.0	$300.1	$369.9
48,700	1-1: 70/30	34,090	$0.0	$0.0	$0.0	$300.1	$369.9
	1-2: 58/42	28,246	$92.3	$0.0	$0.0	$376.9	$413.9
	1-3: 55/45	26,785	$108.3	$0.0	$40.6	$376.9	$423.7
	1-4: 50/50	24,350	$141.0	$0.0	$151.5	$399.8	$442.9
29,300	1-1: 70/30	20,510	$241.5	$65.4	$232.1	$432.8	$486.2
	1-2: 58/42	16,994	$266.0	$129.3	$320.5	$442.6	$520.2
	1-3: 55/45	16,115	$272.1	$137.9	$338.7	$442.6	$520.2
	1-4: 50/50	14,650	$285.2	$179.2	$350.5	$442.6	$520.2

Pollock			Sector (All), A season				
Cap scenario	Option	CAP	2003	2004	2005	2006	2007
87,500	1-1: 70/30	61,250	0%	0%	0%	0%	22%
	1-2: 58/42	50,750	0%	0%	0%	12%	46%
	1-3: 55/45	48,125	0%	0%	0%	25%	47%
	1-4: 50/50	43,750	0%	0%	0%	37%	49%
68,100	1-1: 70/30	47,670	0%	0%	0%	27%	47%
	1-2: 58/42	39,498	0%	0%	0%	42%	55%
	1-3: 55/45	37,455	0%	0%	0%	44%	57%
	1-4: 50/50	34,050	0%	0%	0%	48%	60%
48,700	1-1: 70/30	34,090	0%	0%	0%	48%	60%
	1-2: 58/42	28,246	18%	0%	0%	60%	67%
	1-3: 55/45	26,785	21%	0%	6%	60%	69%
	1-4: 50/50	24,350	28%	0%	24%	64%	72%
29,300	1-1: 70/30	20,510	47%	11%	36%	69%	79%
	1-2: 58/42	16,994	52%	22%	50%	70%	85%
	1-3: 55/45	16,115	53%	24%	53%	70%	85%
	1-4: 50/50	14,650	56%	31%	55%	70%	85%

Table 10-107: Hypothetical Revenue At Risk based on retained tons of pollock caught by catcher/ processors after A-season closures would have been triggered (millions of dollars (upper) percent of total revenue (lower)).

Pollock Cap scenario	Option	CAP	CPs, A season 2003	2004	2005	2006	2007
87,500	1-1: 70/30	61,250	$0.0	$0.0	$0.0	$0.0	$73.6
	1-2: 58/42	50,750	$0.0	$0.0	$0.0	$38.0	$147.3
	1-3: 55/45	48,125	$0.0	$0.0	$0.0	$86.8	$151.1
	1-4: 50/50	43,750	$0.0	$0.0	$0.0	$119.9	$155.7
68,100	1-1: 70/30	47,670	$0.0	$0.0	$0.0	$91.5	$151.1
	1-2: 58/42	39,498	$0.0	$0.0	$0.0	$134.1	$170.7
	1-3: 55/45	37,455	$0.0	$0.0	$0.0	$139.5	$176.7
	1-4: 50/50	34,050	$0.0	$0.0	$0.0	$148.7	$187.2
48,700	1-1: 70/30	34,090	$0.0	$0.0	$0.0	$148.7	$187.2
	1-2: 58/42	28,246	$59.8	$0.0	$0.0	$187.9	$210.0
	1-3: 55/45	26,785	$67.7	$0.0	$15.2	$187.9	$218.1
	1-4: 50/50	24,350	$84.3	$0.0	$78.9	$196.7	$230.7
29,300	1-1: 70/30	20,510	$138.3	$33.2	$119.3	$213.2	$247.1
	1-2: 58/42	16,994	$149.0	$71.1	$167.3	$219.2	$263.4
	1-3: 55/45	16,115	$152.1	$74.6	$177.6	$219.2	$263.4
	1-4: 50/50	14,650	$157.7	$97.3	$183.7	$219.2	$263.4

Pollock Cap scenario	Option	CAP	CPs, A season 2003	2004	2005	2006	2007
87,500	1-1: 70/30	61,250	0%	0%	0%	0%	24%
	1-2: 58/42	50,750	0%	0%	0%	12%	47%
	1-3: 55/45	48,125	0%	0%	0%	27%	49%
	1-4: 50/50	43,750	0%	0%	0%	37%	50%
68,100	1-1: 70/30	47,670	0%	0%	0%	28%	49%
	1-2: 58/42	39,498	0%	0%	0%	42%	55%
	1-3: 55/45	37,455	0%	0%	0%	43%	57%
	1-4: 50/50	34,050	0%	0%	0%	46%	60%
48,700	1-1: 70/30	34,090	0%	0%	0%	46%	60%
	1-2: 58/42	28,246	23%	0%	0%	58%	68%
	1-3: 55/45	26,785	26%	0%	4%	58%	70%
	1-4: 50/50	24,350	32%	0%	23%	61%	74%
29,300	1-1: 70/30	20,510	53%	11%	35%	66%	80%
	1-2: 58/42	16,994	57%	23%	49%	68%	85%
	1-3: 55/45	16,115	58%	24%	52%	68%	85%
	1-4: 50/50	14,650	60%	31%	54%	68%	85%

Table 10-108: Hypothetical Revenue At Risk based on Retained tons of pollock caught by Inshore Catcher Vessels after A-season closures would have been triggered (millions of dollars (upper) percent of total revenue (lower)).

Pollock Cap scenario	Option	CAP	Inshore catcher vessels, A season 2003	2004	2005	2006	2007
87,500	1-1: 70/30	61,250	$0.0	$0.0	$0.0	$0.0	$54.1
	1-2: 58/42	50,750	$0.0	$0.0	$0.0	$34.7	$115.8
	1-3: 55/45	48,125	$0.0	$0.0	$0.0	$63.2	$117.8
	1-4: 50/50	43,750	$0.0	$0.0	$0.0	$100.0	$123.0
68,100	1-1: 70/30	47,670	$0.0	$0.0	$0.0	$68.7	$117.8
	1-2: 58/42	39,498	$0.0	$0.0	$0.0	$112.4	$139.3
	1-3: 55/45	37,455	$0.0	$0.0	$0.0	$116.0	$145.4
	1-4: 50/50	34,050	$0.0	$0.0	$0.0	$127.3	$153.6
48,700	1-1: 70/30	34,090	$0.0	$0.0	$0.0	$127.3	$153.6
	1-2: 58/42	28,246	$29.8	$0.0	$0.0	$158.7	$172.4
	1-3: 55/45	26,785	$37.4	$0.0	$24.9	$158.7	$173.9
	1-4: 50/50	24,350	$51.5	$0.0	$68.3	$169.5	$179.3
29,300	1-1: 70/30	20,510	$91.5	$28.9	$104.7	$182.2	$201.0
	1-2: 58/42	16,994	$103.5	$52.3	$139.2	$186.1	$215.5
	1-3: 55/45	16,115	$106.1	$56.4	$145.8	$186.1	$215.5
	1-4: 50/50	14,650	$113.2	$71.6	$151.0	$186.1	$215.5

Pollock Cap scenario	Option	CAP	Inshore catcher vessels, A season 2003	2004	2005	2006	2007
87,500	1-1: 70/30	61,250	0%	0%	0%	0%	22%
	1-2: 58/42	50,750	0%	0%	0%	14%	46%
	1-3: 55/45	48,125	0%	0%	0%	25%	47%
	1-4: 50/50	43,750	0%	0%	0%	40%	49%
68,100	1-1: 70/30	47,670	0%	0%	0%	28%	47%
	1-2: 58/42	39,498	0%	0%	0%	45%	56%
	1-3: 55/45	37,455	0%	0%	0%	47%	58%
	1-4: 50/50	34,050	0%	0%	0%	51%	62%
48,700	1-1: 70/30	34,090	0%	0%	0%	51%	62%
	1-2: 58/42	28,246	14%	0%	0%	64%	69%
	1-3: 55/45	26,785	18%	0%	10%	64%	70%
	1-4: 50/50	24,350	25%	0%	26%	68%	72%
29,300	1-1: 70/30	20,510	44%	13%	40%	73%	80%
	1-2: 58/42	16,994	50%	24%	53%	75%	86%
	1-3: 55/45	16,115	51%	26%	56%	75%	86%
	1-4: 50/50	14,650	55%	32%	58%	75%	86%

Table 10-109: Hypothetical Revenue At Risk based on retained tons of pollock caught by Mothership Processors after A-season closures would have been triggered (millions of dollars (upper) percent of total revenue (lower)).

Pollock Cap scenario	Option	CAP	Mothership operations, A season 2003	2004	2005	2006	2007
87,500	1-1: 70/30	61,250	$0.0	$0.0	$0.0	$0.0	$8.2
	1-2: 58/42	50,750	$0.0	$0.0	$0.0	$4.3	$20.9
	1-3: 55/45	48,125	$0.0	$0.0	$0.0	$8.0	$22.3
	1-4: 50/50	43,750	$0.0	$0.0	$0.0	$14.8	$23.7
68,100	1-1: 70/30	47,670	$0.0	$0.0	$0.0	$8.7	$22.3
	1-2: 58/42	39,498	$0.0	$0.0	$0.0	$18.7	$28.0
	1-3: 55/45	37,455	$0.0	$0.0	$0.0	$20.1	$28.7
	1-4: 50/50	34,050	$0.0	$0.0	$0.0	$23.0	$29.7
48,700	1-1: 70/30	34,090	$0.0	$0.0	$0.0	$23.0	$29.7
	1-2: 58/42	28,246	$5.2	$0.0	$0.0	$29.1	$32.4
	1-3: 55/45	26,785	$5.8	$0.0	$0.5	$29.1	$33.3
	1-4: 50/50	24,350	$7.9	$0.0	$5.7	$31.9	$35.9
29,300	1-1: 70/30	20,510	$14.9	$2.9	$9.6	$35.6	$39.2
	1-2: 58/42	16,994	$16.5	$6.5	$15.1	$35.7	$42.3
	1-3: 55/45	16,115	$16.9	$7.2	$16.3	$35.7	$42.3
	1-4: 50/50	14,650	$17.2	$10.8	$16.9	$35.7	$42.3

Pollock Cap scenario	Option	CAP	Mothership operations, A season 2003	2004	2005	2006	2007
87,500	1-1: 70/30	61,250	0%	0%	0%	0%	15%
	1-2: 58/42	50,750	0%	0%	0%	8%	39%
	1-3: 55/45	48,125	0%	0%	0%	14%	41%
	1-4: 50/50	43,750	0%	0%	0%	26%	44%
68,100	1-1: 70/30	47,670	0%	0%	0%	15%	41%
	1-2: 58/42	39,498	0%	0%	0%	33%	52%
	1-3: 55/45	37,455	0%	0%	0%	35%	53%
	1-4: 50/50	34,050	0%	0%	0%	40%	55%
48,700	1-1: 70/30	34,090	0%	0%	0%	40%	55%
	1-2: 58/42	28,246	12%	0%	0%	51%	60%
	1-3: 55/45	26,785	14%	0%	1%	51%	62%
	1-4: 50/50	24,350	19%	0%	16%	56%	66%
29,300	1-1: 70/30	20,510	35%	6%	27%	63%	72%
	1-2: 58/42	16,994	39%	13%	43%	63%	78%
	1-3: 55/45	16,115	40%	14%	46%	63%	78%
	1-4: 50/50	14,650	40%	21%	48%	63%	78%

Table 10-110: Hypothetical Revenue At Risk (millions of dollars (upper) percent of total revenue (lower)) based on retained tons of pollock caught by all vessels after B-season closures would have been triggered.

Pollock Cap scenario	Option	CAP	Sector (All), B season 2003	2004	2005	2006	2007
87,500	1-1: 70/30	26,250	$0.0	$3.1	$15.8	$0.0	$57.0
	1-2: 58/42	36,750	$0.0	$0.0	$0.4	$0.0	$17.2
	1-3: 55/45	39,375	$0.0	$0.0	$0.0	$0.0	$12.1
	1-4: 50/50	43,750	$0.0	$0.0	$0.0	$0.0	$2.1
68,100	1-1: 70/30	20,430	$0.0	$11.7	$24.2	$14.4	$67.7
	1-2: 58/42	28,602	$0.0	$1.2	$9.9	$0.0	$48.2
	1-3: 55/45	30,645	$0.0	$0.0	$6.7	$0.0	$42.8
	1-4: 50/50	34,050	$0.0	$0.0	$1.5	$0.0	$25.0
48,700	1-1: 70/30	14,610	$0.0	$22.7	$35.2	$40.6	$89.7
	1-2: 58/42	20,454	$0.0	$11.7	$24.2	$14.4	$67.7
	1-3: 55/45	21,915	$0.0	$9.1	$22.6	$7.2	$64.8
	1-4: 50/50	24,350	$0.0	$4.8	$19.2	$0.0	$62.0
29,300	1-1: 70/30	8,790	$16.1	$79.8	$104.9	$117.3	$122.8
	1-2: 58/42	12,306	$7.1	$34.5	$54.4	$68.0	$104.0
	1-3: 55/45	13,185	$0.0	$23.7	$48.2	$61.7	$94.4
	1-4: 50/50	14,650	$0.0	$22.7	$35.2	$40.6	$89.7

Pollock Cap scenario	Option	CAP	Sector (All), B season 2003	2004	2005	2006	2007
87,500	1-1: 70/30	26,250	0%	1%	3%	0%	9%
	1-2: 58/42	36,750	0%	0%	0%	0%	3%
	1-3: 55/45	39,375	0%	0%	0%	0%	2%
	1-4: 50/50	43,750	0%	0%	0%	0%	0%
68,100	1-1: 70/30	20,430	0%	2%	4%	2%	11%
	1-2: 58/42	28,602	0%	0%	2%	0%	8%
	1-3: 55/45	30,645	0%	0%	1%	0%	7%
	1-4: 50/50	34,050	0%	0%	0%	0%	4%
48,700	1-1: 70/30	14,610	0%	5%	6%	7%	14%
	1-2: 58/42	20,454	0%	2%	4%	2%	11%
	1-3: 55/45	21,915	0%	2%	4%	1%	10%
	1-4: 50/50	24,350	0%	1%	3%	0%	10%
29,300	1-1: 70/30	8,790	3%	16%	17%	19%	20%
	1-2: 58/42	12,306	1%	7%	9%	11%	17%
	1-3: 55/45	13,185	0%	5%	8%	10%	15%
	1-4: 50/50	14,650	0%	5%	6%	7%	14%

Table 10-111: Hypothetical Revenue At Risk based on retained tons of pollock caught by catcher/processors after B-season closures would have been triggered (millions of dollars (upper) percent of total revenue (lower)).

Pollock			CPs, B season				
Cap scenario	Option	CAP	2003	2004	2005	2006	2007
87,500	1-1: 70/30	26,250	$0.0	$0.0	$0.0	$0.0	$19.8
	1-2: 58/42	36,750	$0.0	$0.0	$0.0	$0.0	$5.9
	1-3: 55/45	39,375	$0.0	$0.0	$0.0	$0.0	$3.6
	1-4: 50/50	43,750	$0.0	$0.0	$0.0	$0.0	$0.3
68,100	1-1: 70/30	20,430	$0.0	$0.0	$0.0	$0.7	$23.0
	1-2: 58/42	28,602	$0.0	$0.0	$0.0	$0.0	$17.1
	1-3: 55/45	30,645	$0.0	$0.0	$0.0	$0.0	$15.5
	1-4: 50/50	34,050	$0.0	$0.0	$0.0	$0.0	$8.8
48,700	1-1: 70/30	14,610	$0.0	$1.6	$2.4	$9.6	$32.8
	1-2: 58/42	20,454	$0.0	$0.0	$0.0	$0.7	$23.0
	1-3: 55/45	21,915	$0.0	$0.0	$0.0	$0.0	$22.1
	1-4: 50/50	24,350	$0.0	$0.0	$0.0	$0.0	$21.2
29,300	1-1: 70/30	8,790	$1.0	$25.4	$37.5	$41.6	$47.2
	1-2: 58/42	12,306	$0.0	$6.8	$11.0	$22.4	$39.0
	1-3: 55/45	13,185	$0.0	$1.9	$9.1	$19.0	$34.7
	1-4: 50/50	14,650	$0.0	$1.6	$2.4	$9.6	$32.8

Pollock			CPs, B season				
Cap scenario	Option	CAP	2003	2004	2005	2006	2007
87,500	1-1: 70/30	26,250	0%	0%	0%	0%	8%
	1-2: 58/42	36,750	0%	0%	0%	0%	2%
	1-3: 55/45	39,375	0%	0%	0%	0%	1%
	1-4: 50/50	43,750	0%	0%	0%	0%	0%
68,100	1-1: 70/30	20,430	0%	0%	0%	0%	9%
	1-2: 58/42	28,602	0%	0%	0%	0%	7%
	1-3: 55/45	30,645	0%	0%	0%	0%	6%
	1-4: 50/50	34,050	0%	0%	0%	0%	3%
48,700	1-1: 70/30	14,610	0%	1%	1%	3%	13%
	1-2: 58/42	20,454	0%	0%	0%	0%	9%
	1-3: 55/45	21,915	0%	0%	0%	0%	9%
	1-4: 50/50	24,350	0%	0%	0%	0%	8%
29,300	1-1: 70/30	8,790	0%	11%	12%	14%	18%
	1-2: 58/42	12,306	0%	3%	4%	7%	15%
	1-3: 55/45	13,185	0%	1%	3%	6%	14%
	1-4: 50/50	14,650	0%	1%	1%	3%	13%

Table 10-112: Hypothetical Revenue At Risk based on retained tons of pollock caught by Inshore Catcher Vessels after B-season closures would have been triggered (millions of dollars (upper) percent of total revenue (lower)).

Pollock			**Inshore catcher vessels, B season**				
Cap scenario	**Option**	**CAP**	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	26,250	$0.0	$1.9	$13.5	$0.0	$28.7
	1-2: 58/42	36,750	$0.0	$0.0	$0.5	$0.0	$7.8
	1-3: 55/45	39,375	$0.0	$0.0	$0.0	$0.0	$5.8
	1-4: 50/50	43,750	$0.0	$0.0	$0.0	$0.0	$0.9
68,100	1-1: 70/30	20,430	$0.0	$10.1	$20.2	$10.6	$34.7
	1-2: 58/42	28,602	$0.0	$0.6	$9.1	$0.0	$23.2
	1-3: 55/45	30,645	$0.0	$0.0	$6.8	$0.0	$20.2
	1-4: 50/50	34,050	$0.0	$0.0	$1.5	$0.0	$12.0
48,700	1-1: 70/30	14,610	$0.0	$19.3	$29.0	$26.0	$44.1
	1-2: 58/42	20,454	$0.0	$10.1	$20.2	$10.6	$34.7
	1-3: 55/45	21,915	$0.0	$7.5	$19.1	$5.4	$33.5
	1-4: 50/50	24,350	$0.0	$3.2	$16.3	$0.0	$31.9
29,300	1-1: 70/30	8,790	$14.1	$41.5	$60.3	$64.7	$57.3
	1-2: 58/42	12,306	$6.4	$21.6	$39.3	$38.6	$48.9
	1-3: 55/45	13,185	$0.0	$19.5	$35.3	$36.0	$46.1
	1-4: 50/50	14,650	$0.0	$19.3	$29.0	$26.0	$44.1

Pollock			**Inshore catcher vessels, B season**				
Cap scenario	**Option**	**CAP**	**2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	26,250	0%	1%	5%	0%	11%
	1-2: 58/42	36,750	0%	0%	0%	0%	3%
	1-3: 55/45	39,375	0%	0%	0%	0%	2%
	1-4: 50/50	43,750	0%	0%	0%	0%	0%
68,100	1-1: 70/30	20,430	0%	4%	7%	4%	14%
	1-2: 58/42	28,602	0%	0%	3%	0%	9%
	1-3: 55/45	30,645	0%	0%	2%	0%	8%
	1-4: 50/50	34,050	0%	0%	1%	0%	5%
48,700	1-1: 70/30	14,610	0%	9%	11%	10%	18%
	1-2: 58/42	20,454	0%	4%	7%	4%	14%
	1-3: 55/45	21,915	0%	3%	7%	2%	13%
	1-4: 50/50	24,350	0%	1%	6%	0%	13%
29,300	1-1: 70/30	8,790	6%	18%	22%	24%	23%
	1-2: 58/42	12,306	3%	10%	14%	14%	20%
	1-3: 55/45	13,185	0%	9%	13%	13%	18%
	1-4: 50/50	14,650	0%	9%	11%	10%	18%

Table 10-113: Hypothetical Revenue At Risk based on Retained tons of pollock caught by Mothership Processors after A-season closures would have been triggered (millions of dollars (upper) percent of total revenue (lower)).

Pollock Cap scenario	Option	CAP	Mothership operations, B season 2003	2004	2005	2006	2007
87,500	1-1: 70/30	26,250	$0.0	$1.0	$1.2	$0.0	$7.1
	1-2: 58/42	36,750	$0.0	$0.0	$0.0	$0.0	$2.9
	1-3: 55/45	39,375	$0.0	$0.0	$0.0	$0.0	$2.2
	1-4: 50/50	43,750	$0.0	$0.0	$0.0	$0.0	$0.7
68,100	1-1: 70/30	20,430	$0.0	$2.8	$3.7	$4.1	$8.2
	1-2: 58/42	28,602	$0.0	$1.0	$0.8	$0.0	$6.6
	1-3: 55/45	30,645	$0.0	$0.0	$0.0	$0.0	$5.9
	1-4: 50/50	34,050	$0.0	$0.0	$0.0	$0.0	$3.5
48,700	1-1: 70/30	14,610	$0.0	$3.7	$3.7	$7.5	$10.8
	1-2: 58/42	20,454	$0.0	$2.8	$3.7	$4.1	$8.2
	1-3: 55/45	21,915	$0.0	$2.7	$3.3	$2.3	$7.6
	1-4: 50/50	24,350	$0.0	$2.4	$2.7	$0.0	$7.3
29,300	1-1: 70/30	8,790	$2.6	$21.9	$9.9	$17.5	$15.6
	1-2: 58/42	12,306	$1.5	$10.2	$4.9	$11.1	$13.7
	1-3: 55/45	13,185	$0.0	$4.5	$4.5	$10.3	$11.5
	1-4: 50/50	14,650	$0.0	$3.7	$3.7	$7.5	$10.8
Pollock Cap scenario	**Option**	**CAP**	**Mothership operations, B season 2003**	**2004**	**2005**	**2006**	**2007**
87,500	1-1: 70/30	26,250	0%	2%	4%	0%	12%
	1-2: 58/42	36,750	0%	0%	0%	0%	9%
	1-3: 55/45	39,375	0%	0%	0%	0%	7%
	1-4: 50/50	43,750	0%	0%	0%	0%	2%
68,100	1-1: 70/30	20,430	0%	7%	12%	8%	25%
	1-2: 58/42	28,602	0%	3%	3%	0%	20%
	1-3: 55/45	30,645	0%	0%	0%	0%	18%
	1-4: 50/50	34,050	0%	0%	0%	0%	11%
48,700	1-1: 70/30	14,610	0%	10%	13%	15%	33%
	1-2: 58/42	20,454	0%	7%	12%	8%	25%
	1-3: 55/45	21,915	0%	7%	11%	5%	23%
	1-4: 50/50	24,350	0%	6%	9%	0%	22%
29,300	1-1: 70/30	8,790	7%	57%	34%	36%	47%
	1-2: 58/42	12,306	4%	27%	16%	23%	42%
	1-3: 55/45	13,185	0%	12%	15%	21%	35%
	1-4: 50/50	14,650	0%	10%	13%	15%	33%

10.5.6.1 Potential Forgone State and Local Tax Revenue under Alternative 2

Table 10-114: Hypothetical forgone pollock state tax revenue under the Alternative 2 fleet-wide cap levels.

2003			
Cap	50/50	58/42	70/30
87,500	$0	$0	$0
68,100	$22,822	$0	$0
48,700	$1,390,051	$984,659	$22,551
29,300	$2,588,850	$2,095,675	$2,090,633
2004			
Cap	50/50	58/42	70/30
87,500	$0	$0	$20,037
68,100	$0	$6,072	$111,110
48,700	$51,057	$111,004	$315,645
29,300	$1,444,205	$1,465,423	$1,295,830
2005			
Cap	50/50	58/42	70/30
87,500	$0	$20,711	$299,903
68,100	$79,187	$141,158	$261,730
48,700	$1,271,194	$262,367	$601,543
29,300	$3,501,746	$3,124,620	$2,761,402
2006			
Cap	50/50	58/42	70/30
87,500	$3,395,290	$2,169,862	$20,814
68,100	$2,363,528	$1,705,486	$1,761,431
48,700	$3,086,755	$3,167,343	$2,879,551
29,300	$4,553,396	$3,782,593	$4,188,643
2007			
Cap	50/50	58/42	70/30
87,500	$6,198,274	$4,958,475	$3,489,429
68,100	$3,947,526	$3,442,470	$2,959,165
48,700	$4,439,726	$4,448,058	$4,439,072
29,300	$5,579,120	$5,704,230	$5,792,389

10.5.6.2 Potential Forgone State and Local Tax Revenues under Alternative 4

Table 10-115: Hypothetical forgone pollock state tax revenue under Chinook bycatch options under PPA1 and PPA2.

PPA	A-season Transferability	Year	A-B Rollover	Annual Total	A/P Tax Impact
1	No	2003	0%	**0%**	$0
		2004		**2%**	$173,346
		2005		**2%**	$175,671
		2006		**12%**	$1,346,659
		2007		**26%**	$2,685,310
	Yes	2003		**0%**	$0
		2004		**2%**	$173,346
		2005		**2%**	$175,671
		2006		**10%**	$1,183,035
		2007		**25%**	$2,659,598
2	No	2003		**6%**	$512,115
		2004		**4%**	$362,425
		2005		**5%**	$492,139
		2006		**22%**	$2,455,520
		2007		**37%**	$3,835,410
	Yes	2003		**2%**	$201,303
		2004		**4%**	$362,425
		2005		**5%**	$492,139
		2006		**19%**	$2,196,496
		2007		**37%**	$3,835,410
1	No	2003	80%	**0%**	$0
		2004		**0%**	$0
		2005		**0%**	$3,942
		2006		**12%**	$1,330,376
		2007		**25%**	$2,668,472
	Yes	2003		**0%**	$0
		2004		**0%**	$0
		2005		**0%**	$3,942
		2006		**10%**	$1,166,752
		2007		**25%**	$2,642,759
2	No	2003		**5%**	$506,762
		2004		**1%**	$89,332
		2005		**2%**	$249,970
		2006		**22%**	$2,455,520
		2007		**37%**	$3,834,257
	Yes	2003		**2%**	$201,303
		2004		**1%**	$89,332
		2005		**2%**	$249,970
		2006		**19%**	$2,196,496
		2007		**37%**	$3,834,257

Table 10-116: Hypothetical forgone pollock state tax revenue under Chinook salmon bycatch options for triggered closures.

Pollock Cap scenario	Option	All Sectors All State Pollock Tax Impact Annual Totals				
		2003	2004	2005	2006	2007
87,500	1-1: 70/30	$0	$27,320	$137,593	$0	$1,611,937
	1-2: 58/42	$0	$0	$3,904	$701,026	$2,524,344
	1-3: 55/45	$0	$0	$0	$1,419,664	$2,541,925
	1-4: 50/50	$0	$0	$0	$2,124,681	$2,553,787
68,100	1-1: 70/30	$0	$103,457	$210,236	$1,650,185	$3,010,121
	1-2: 58/42	$0	$10,948	$86,109	$2,404,015	$3,248,183
	1-3: 55/45	$0	$0	$58,400	$2,497,216	$3,311,109
	1-4: 50/50	$0	$0	$13,050	$2,713,562	$3,326,158
48,700	1-1: 70/30	$0	$200,124	$305,527	$3,081,129	$3,871,281
	1-2: 58/42	$829,678	$103,457	$210,236	$3,538,203	$4,056,537
	1-3: 55/45	$973,458	$80,194	$549,656	$3,473,050	$4,114,558
	1-4: 50/50	$1,267,004	$42,011	$1,482,947	$3,615,505	$4,252,444
29,300	1-1: 70/30	$2,314,688	$1,279,847	$2,927,657	$4,974,637	$5,129,486
	1-2: 58/42	$2,454,887	$1,444,376	$3,257,130	$4,617,237	$5,258,337
	1-3: 55/45	$2,444,996	$1,424,992	$3,360,936	$4,560,375	$5,177,422
	1-4: 50/50	$2,562,989	$1,780,214	$3,350,047	$4,369,846	$5,137,816

Appendix 11 – New CDQ section

COMMUNITY DEVELOPMENT QUOTA (CDQ) PROGRAM

This draft CDQ section combines section 3.4.4.2 (pg 153) and 9.4.8 (pg 462) in the DEIS/RIR/IRFA and provides updated and expanded descriptive information about the CDQ Program. Revisions also are made to the analysis of the impacts of the alternatives on the CDQ Program by adding estimates of foregone pollock CDQ royalties to the existing estimates of foregone gross revenues for the CDQ sector in section 10.5.2 (pg 652).

A portion of the Federal pollock TAC in the BSAI is allocated for harvest by participants in the CDQ Program[33]. The CDQ Program was designed to improve the social and economic conditions in western Alaska communities by facilitating their economic participation in the BSAI fisheries. The large-scale commercial fisheries of the BSAI developed in the eastern Bering Sea without significant participation from rural western Alaska communities. These fisheries are capital-intensive and require large investments in vessels, infrastructure, processing capacity, and specialized gear. The CDQ Program was developed to redistribute some of the BSAI fisheries' economic benefits to adjacent communities by allocating a portion of commercially important BSAI species including pollock, crab, halibut, and various groundfish, to such communities. The percentage of each annual BSAI catch limit allocated to the CDQ Program varies by both species and management area. These allocations, in turn, provide an opportunity for residents of these communities to participate in and benefit from the BSAI fisheries.

A total of 65 communities are authorized under Section 305(i)(1) of the Magnuson-Stevens Act to participate in the program through six CDQ entities.[34] These CDQ entities are non-profit corporations that manage and administer the CDQ allocations, economic development projects, and investments, including ownership interest in the at-sea processing sector and in catcher vessels. Annual CDQ allocations provide a revenue stream for CDQ entities through various channels, including the direct catch and sale of some species, leasing quota to various harvesting partners, and income from a variety of investments.

Geographically dispersed, the members communities extend westward to Atka, on the Aleutian Island chain, and northward along the Bering coast to the village of Wales, near the Arctic Circle. The 2000 population of these communities was just over 27,000 persons of whom approximately 87% were Alaska Native. In general economic terms, CDQ communities are remote, isolated settlements with few commercially valuable natural assets with which to develop and sustain a viable, diversified economic base. As a result, economic opportunities are few, unemployment rates are chronically high, and communities and the region are economically depressed. The CDQ Program ameliorates some of these circumstances by providing an opportunity for residents of CDQ communities to directly benefit from the BSAI fishery resources.

The CDQ Program was implemented by the Council and NMFS in 1992 with allocations of 7.5% of the pollock TAC. Allocations of halibut and sablefish were added to the program in 1995. Authorization for the CDQ Program was added to the Magnuson-Stevens Act by the U.S. Congress in 1996. In 1998, the

[33] Section 11.3 provides an in-depth description of the pollock trawl fishery in which the CDQ entities participate.

[34] The CDQ entities include the Aleutian Pribilof Island Community Development Association (APICDA), the Bristol Bay Economic Development Corporation (BBEDC), the Central Bering Sea Fishermen's Association (CBSFA), the Coastal Villages Region Fund (CVRF), the Norton Sound Economic Development Corporation (NSEDC), and the Yukon Delta Fisheries Development Association (YDFDA).

Council expanded the CDQ Program by adding allocations of the remaining groundfish species, prohibited species, and crab. Currently, the CDQ Program is allocated portions of the groundfish fishery that range from 10.7% for Amendment 80 species, 10% for pollock, and 7.5% for most other species.

In 2007, the six CDQ entities held approximately $543 million in assets. Since inception of the CDQ Program in 1992, the CDQ entities have generated more than $204 million in wages, education, and training benefits. CDQ entities fund fisheries infrastructure investments such as docks, harbors, seafood processing plants, fisheries support centers, and vessels such as motherships and catcher/processors that operate in crab, halibut, and groundfish fisheries. In 2007 fisheries and fishery related investments by the six CDQ entities totaled more than $140 million, primarily in the BSAI. Local programs purchase limited access privileges in the fishery and acquire equity position in existing fishery businesses. The six CDQ entities had total revenues in 2007 of approximately $170 million, of which 41%($70 million) was derived from CDQ royalties. Income from sources other than royalties has exceeded royalty income since 2004, with direct income accounting for 54-59% of revenue annually. (WACDA 2007).

Pollock royalties are a very important source of CDQ Program revenues that directly fund investments in the region. Table 1 shows the estimated total royalties from all CDQ allocations, from pollock CDQ allocations, and an estimate of the average royalty rate ($/mt) for pollock. Pollock royalties have historically represented about 80% of total annual royalties from the CDQ allocations and, in 2005, were approximately $50 million. Specific information about total annual pollock royalties for all CDQ entities combined has not been publically available since 2005.

Table 1. CDQ pollock royalties for 2001-2008. No pollock royalty data is available for 2006 or 2008. *This table contains calculated or estimated values where data were incomplete. The text on page xxx explains how the estimates were calculated.

Year	Total royalties all species (millions $)	Total pollock royalties	% pollock of total royalties	Harvested pollock (mt)	Average royalty ($/mt)
2001	$ 42.6	$ 36.7	86%	139,946	$ 262
2002	$ 46.3	$ 36.6	79%	148,427	$ 247
2003	$ 53.5	$ 42.8	80%	149,121	$ 287
2004	$ 55.4	$ 45.9	83%	149,169	$ 307
2005	$ 61.4	$ 48.5	79%	149,720	$ 324
2006	N/A	N/A	N/A	150,376	N/A
2007	$ 69.7*	$ 43.2*	62%*	139,400	$ 310*
2008	N/A	N/A	N/A	99,959	N/A

The average annual royalty value to the CDQs was calculated from the audited financial statements and data available through public reports and financial statements. CDQ royalty data was collected by species until 2006 therefore no further calculation necessary for 2001-2005. Although NMFS records the weight of pollock harvested by sector annually, insufficient aggregate royalty data are publicly available to estimate forgone pollock royalties for 2006 and 2008. The 2007 estimates are base on an average of APICDA and CVRF total royalties derived from pollock. We applied the average royalty value to the estimates of pollock catch by pollock weight to get our estimates of pollock royalties for the CDQ sector annually. The percentage of pollock royalties was calculated from the total royalty statistics provided in the WACDA 2007 report, 41% of total revenue ($170 million).

Accurate royalty data was collected by NMFS in the CDQ entities audited financial statements. Annually until 2005, NMFS received information about royalties paid, by species or species group, for the CDQ allocations. NMFS not been authorized to require submission of accurate royalty information since the 2006 amendments to the Magnuson-Stevens Fishery Conservation and Management Act. Therefore, we now rely on royalty information from the CDQ entities publically available annual reports prepared primarily for residents of the member communities. Some of the CDQ entities choose to include specific information about royalties, while others choose not to provide this level of detail in their annual reports. Additional information that would improve the analysis of the impacts of the alternative would be to estimate the foregone values of pollock royalties to the CDQ entities under each alternative. This analysis will be added to the Final EIS if that information becomes available.

Table 9-5 below is from the DEIS/RIR/IRFA (page 464) and provides information about the investments that the CDQ entities have made in vessels that participate in the Bering Sea pollock fisheries. These are significant investments that have been largely funded by pollock royalty revenues.

Table 9-5 from DEIS/RIR/IRFA (CDQ groups and their regional importance):

Region	**CDQ group**	**Percent of population in CDQ group**	**Volumes of pollock allocated to CDQ group(s) in 2008**	**Vessel ownership**
Kotzebue	None	0	0	none
Norton Sound	Norton Sound Economic Development Corporation	Fifteen FDQ communities with 8,488 persons account for about 98% of the population in this area (Nome census area, excluding Shishmaref).	22,456 mt	Half interests in three large CPs through their half-ownership of Glacier Fish Company.
Yukon River and delta	Yukon Delta Fisheries Development Association	Six communities with about 3,123 persons account for about 23% of the population in the area (the Wade Hampton and Yukon-Koyukuk census areas minus Takotna, McGrath and Nikolai).	14,266 mt	Significant ownership interests in two large CVs and a pollock mothership
Kuskokwim River and delta	Coastal Villages Region Fund	Twenty communities with about 7,855 persons account for 47% of the regional population (Bethel census area plus Takotna, McGrath, and Nikolai)	24,456 metric tons	46% ownership of American Seafoods and thus has significant interests in eight pollock CPs, and one CV
Bristol Bay, Alaska Peninsula, Aleutians, Pribilofs	Central Bering Sea Fishermen's Association; Aleutian-Pribilof Island Community Development Association; Bristol Bay Economic Development Corporation	Twenty-three communities with 7,605 persons account for about 57% of the regional population (Aleutians East and West, Lake and Peninsula, and Dillingham census districts, minus certain communities around Lake Iliamna.	40,760 metric tons	CBSFA has significant ownership interests in three large CVs; APICDA has significant interests in a large CV and a large CP; BBEDC has significant interests in six CVs and a CP
Elsewhere	None	0	0	None
Notes: Pollock allocations are from 2008 groundfish specifications. Gross revenues associated with vessel interests are confidential and have not been reported. Population information is from the 2000 census. Vessel ownership information is estimated from a variety of sources for 2008.				

CDQ entities have invested in inshore processing plants, for halibut, salmon, Pacific cod, and other species. For example, CVFR owns Coastal Villages Seafoods 7 salmon and halibut processing plants, BBEDC holds 50% ownership in Ocean Beauty Seafoods, APICDA owns processing plants in False Pass and Atka, and YDFDA has invested in a salmon processing barge in Emmonak. CDQ entities have invested in other local fisheries development activities as well. For example,

> A number of CDQ entities have also promoted investment in local, small-scale operations targeting salmon, herring, halibut or other species. Activities include funding permit brokerage services to assist with retention of limited entry salmon permits in CDQ communities, capitalizing revolving loan programs to provide financing to resident fishermen for the purchase of boats and gear and supporting market development for locally-harvested seafood products (Northern Economics 2002).

CDQ entities have also worked to develop regional fisheries infrastructure. The NSEDC has provided funding for a Nome seafood center; the YDFDA has provided funding for the Emmonak Tribal Council's fish plant, the CBSFA purchased a custom halibut vessel, and the CVRF owns 14 fisheries support centers. In some cases these projects are completely funded with earnings from investments in the BSAI pollock fishery (Northern Economics 2002 & 2009; WACDA 2007, Pollock Provides 2008).
CDQ entities invest in projects that directly or indirectly support commercial fishing for halibut, salmon, and other nearshore species. This includes substantial investments in seafood branding and marketing, quality control training, safety and survival training, construction and staffing of maintenance and repair facilities that are used by both fishermen and other community residents, and assistance with bulk fuel procurement and distribution. Several CDQ entities are actively involved in salmon assessment or enhancement projects, either independently or in collaboration with ADF&G. Salmon fishing is a key component of western Alaska fishing activities, both for subsistence and at the commercial level. The CDQ Program provides a means to support and enhance both commercial and artisanal fishing opportunities.

Increasingly CDQ entities contribute to the region by providing educational and training opportunities, contributing to community capital investments, and expanding the state and local tax base. Investments are made to support targeted vocational training and providing post secondary educational scholarship opportunities to residents. CDQ and Non-CDQ villages benefit from a trained workforce well-suited for sustaining a fisheries-based economy. In 2007 CDQ entities invested approximately $2.5 million dollars to create over 1,200 scholarships and training opportunities. Community capital has been expanded in Western Alaska through investment in infrastructure projects such as docks and clinics. In 2007, the increased economic activity generated by the CDQ Program contributed $800,000 in state and regional taxes and fees in addition to the aggregated community capital investments of $40 million (WACDA 2007).

One of the most tangible direct benefits of the CDQ Program has been employment opportunities for western Alaska village residents. CDQ entities provide career track employment opportunities for residents of qualifying communities, and have opened opportunities for non-CDQ Alaskan residents, as well. Jobs generated by the CDQ Program included work aboard a wide range of fishing vessels, internships with the business partners or government agencies, employment at processing plants, and administrative positions. Many of the jobs are associated with shoreside fisheries development projects in CDQ communities. This includes a wide range of projects, including those directly related to commercial fishing. Examples of such projects include building or improving seafood processing facilities, purchasing ice machines, purchasing and building fishing vessel, gear improvements, and construction of docks or other fish handling infrastructure. In 2007 more than 3,000 crew members, commercial fisheries permit holders and wage and salaried employees received payments and wages totaling more than $30 million (WACDA 2007).

CDQ wages vary as a percent of total adjusted gross income within the region. A Northern Economics study from 2002 found that, in 1999, CDQ wages were about 2% of total adjusted gross income within the NSEDA communities, about 10% within the YDFDA communities, about 5% within the CVRF communities, about 2% within the BBEDC communities, about 10% with in the APICDA communities,

and about 9% within the CBSFA. It is expected that continued investments, in various fisheries assets, will increase capacity for earned within these communities and this trend will continue to increase in future years (SWAMC 2007, Northern Economics 2002 & 2009, ADCCED).
CDQ revenues benefit member communities and provide benefits to non-member communities. Non-member fishermen contribute catch to CDQ processing plants and residents of non-member communities gain employment in CDQ related projected. For example, more than 10% of the CVRF employees are residents of non-CDQ communities. There are many non-member communities that may be affected by this action including regional hubs like Bethel that provide salmon buying stations for both member and non-member communities. Communities on the mid to upper Yukon, and tributary rivers of the Yukon and communities above the lower fifty miles or so of the Kuskokwim are not members of CDQ entities. Most communities in Kotzebue Sound would not be included; however, communities in this area are more dependent on chum salmon and may not be greatly affected by an action to minimize Chinook salmon bycatch in the BSAI pollock fishery.

Additions to the Impact Analysis

The DEIS provided estimates of the impacts of the alternatives on the CDQ sector using the same methods and level of information provided for the non-CDQ sectors (Section 10.5.2 starting on page 652). These impacts were based on estimates of the foregone gross revenues for the CDQ sector under the alternatives.

Additional information that would improve the impact analysis would be to estimate the foregone values of pollock royalties to the CDQ entities under each alternative. This analysis is summarized below and will be added to the Final EIS.

Tables were created to examine the expected potential impacts on the CDQ Program in lost royalty revenue attributable to the upper-bound estimates of potential reductions in pollock harvested as a result of a fishery closure under the proposed alternative and options. They provide estimates of the foregone pollock CDQ royalties under each of the alternatives and options. Hypothetical foregone CDQ pollock catch, in mt, by season, from 2003-2007, under Chinook salmon hard cap options are in Tables 4-4 through 4-8 of the DEIS. Similar data on the hypothetical foregone pollock catch under the PPA 1&2 is in Table 4-20 of the DEIS. Average value per metric ton of pollock was estimated and averaged annually and is summarized in Table 1.

Insufficient aggregate royalty data is publicly available to estimate forgone pollock royalties for 2006. Although the estimate of pollock royalty revenue is not based on an average of all CDQ groups, the hypothetical forgone royalty revenues for all CDQ Programs would be higher under PPA 1 than under a 68,100 cap and the 70/30 seasonal split in bycatch allocations (alternative 2:option 2d) see table 10-118a. Using similar royalty estimates for 2007, the hypothetical forgone royalty revenues for all CDQ Programs would be higher under a 48,700 cap and the 70/30 seasonal split in bycatch allocations (alternative 2: option 2d) see table 10-119a than under PPA 2. Royalty revenue would only have been forgone in 2007 A-season in most allocation scenarios except when the hypothetical cap was under 87,500 Chinook salmon. Forgone royalty revenue would hypothetically have occurred in the A-season for all years with a hard cap of 29,300 Chinook salmon. Hypothetical forgone pollock royalties were consistently lower in the a season under a allocation split 50/50 and consistently lower under a 70/30 split; conversely, the hypothetical forgone pollock royalties were consistently higher in the B season under a 70/30 allocation split and consistently lower under a 50/50 split, in all years that data was available except for 2005 (Table 10-XA- 10-XE).

A comparison of allowable rollover scenarios for PPA 1 and PPA 2 resulted in substantial forgone royalty revenues for CDQ groups under a hypothetical 0% A to B season rollover from in both 2004 and 2007.

Analysis of the forgone royalty revenue by CDQ groups showed no difference in B Season foregone CDQ royalties due to A season transfers and rollovers options. Also, there are no hypothetical reductions in foregone CDQ royalties due to transferability by PPA scenario in millions of dollars over the time period 2003-2007 (Table 10-XF).

Table 10-118*a* . 2007 hypothetical forgone pollock royalties to the CDQ Program for Alternative 2, option 2d (70/30 season split, cap 68,100), compared with PPA1 (cap 68,392), data taken from table 4-20.

2007 CDQ		**Foregone pollock (in mt)**	**Forgone royalty (millions of $)**	**% of total pollock royalties**	**% of total royalties**
Alternative 2: option 2d					
	A season	0	$ -	0%	0%
	B season	2,983	$0.9	2%	1%
Total Alternative 2		2,983	$0.9	2%	1%
Alternative 4:PPA1					
	A season	0	$ -	0%	0%
	B season	4,415	$1.4	3%	2%
Total Alternative 4		4,415	$1.4	3%	2%

Table 10-119*a*. 2007 hypothetical forgone pollock royalties to the CDQ Program for Alternative 2, option 2d (70/30 season split, cap 48,700) compared with PPA2 (cap 47,591), data taken from table 4-20.

2007 CDQ		**Foregone pollock (in mt)**	**Forgone royalty (millions of $)**	**% of total pollock royalties**	**% of total royalties**
Alternative 2: option 2d					
	A season	19,389	$6.0	14%	9%
	B season	5,335	$1.7	4%	2%
Total Alternative 2		24,724	$7.7	18%	11%
Alternative 4:PPA2					
	A season	10,281	$3.2	7%	5%
	B season	6,057	$1.9	4%	3%
Total Alternative 4		16,338	$5.1	12%	7%

Estimated foregone pollock (mt) to the CDQ sector from Alternative 2, option 2d is from Table 4-8 of the DEIS and for the PPA is from Table 4-20 of the DEIS. The estimated pollock royalty rate in 2007 was $310/mt.

Table 10-XA. Hypothetical forgone CDQ royalties by year and season under Chinook bycatch options for fleet-wide caps in millions of dollars.

Season		**2003**			**2004**			**2005**			**2006**			**2007**		
	Cap	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	N/A	N/A	N/A	$ -	$ -	$ -
	68,100	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	N/A	N/A	N/A	$2.6	$0.3	$ -
	48,700	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	N/A	N/A	N/A	$9.6	$6.1	$2.6
	29,300	$6.4	$5.9	$0.3	$0.1	$ -	$ -	$1.1	$0.01	$ -	N/A	N/A	N/A	$12.7	$12.5	$9.8
B	87,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	N/A	N/A	N/A	$ -	$ -	$0.7
	68,100	$ -	$ -	$ -	$ -	$ -	$1.1	$ -	$ -	$ -	N/A	N/A	N/A	$ -	$0.7	$0.9
	48,700	$ -	$ -	$ -	$ -	$1.1	$4.7	$ -	$ -	$ -	N/A	N/A	N/A	$0.8	$0.9	$1.6
	29,300	$ -	$ -	$6.9	$4.7	$8.7	$13.9	$ -	$ -	$ -	N/A	N/A	N/A	$1.6	$1.7	$2.3

Table 10-XB. Hypothetical forgone CDQ royalties by season under Chinook bycatch options for 2003 in millions of dollars.

2003		opt1(AFA)			opt2a			opt2d		
Seas	Cap	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	$ -	$ -	$ -	$ 5.8	$ 2.2	$ -	$ -	$ -	$ -
	68,100	$ -	$ -	$ -	$10.7	$ 6.2	$ 2.4	$ -	$ -	$ -
	48,700	$ -	$ -	$ -	$13.8	$13.7	$10.7	$ 0.2	$ -	$ -
	29,300	$ 2.3	$ -	$ -	$14.9	$14.0	$13.9	$12.7	$ 6.4	$ 5.7
B	87,500	$ -	$ -	$ -	$ -	$ -	$ 0.6	$ -	$ -	$ -
	68,100	$ -	$ -	$ -	$ -	$ 0.0	$ 7.1	$ -	$ -	$ -
	48,700	$ -	$ -	$ -	$ 3.1	$ 7.1	$14.9	$ -	$ -	$ -
	29,300	$ -	$ -	$ -	$14.9	$15.1	$15.5	$ -	$ 0.6	$ 7.2

Table 10-XC. Hypothetical forgone CDQ royalties by season under Chinook bycatch options for 2004 in millions of dollars.

2004		opt1(AFA)			opt2a			opt2d		
Seas	Cap	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	68,100	$ -	$ -	$ -	$ 1.2	$ -	$ -	$ -	$ -	$ -
	48,700	$ -	$ -	$ -	$ 4.1	$ 1.6	$ 1.2	$ -	$ -	$ -
	29,300	$ -	$ -	$ -	$ 7.6	$ 7.4	$ 4.4	$ 1.3	$ 0.1	$ -
B	87,500	$ -	$ -	$ -	$ 1.4	$ 4.7	$ 9.0	$ -	$ -	$ 0.8
	68,100	$ -	$ -	$ -	$ 8.5	$ 8.9	$14.0	$ -	$ -	$ 1.4
	48,700	$ -	$ -	$ 1.2	$ 9.1	$14.0	$14.5	$ 1.0	$ 1.4	$ 8.7
	29,300	$ 1.2	$ 4.4	$ 8.8	$14.5	$18.5	$18.7	$ 8.7	$ 9.0	$14.1

Table 10-XD. Hypothetical forgone CDQ royalties by season under Chinook bycatch options for 2005 in millions of dollars.

2005		opt1(AFA)			opt2a			opt2d		
Seas	Cap	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	68,100	$ -	$ -	$ -	$ 3.8	$ 0.9	$ -	$ -	$ -	$ -
	48,700	$ -	$ -	$ -	$ 7.3	$ 6.9	$ 3.8	$ -	$ -	$ -
	29,300	$ -	$ -	$ -	$11.1	$ 8.0	$ 7.7	$ 6.6	$ 1.1	$ -
B	87,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	68,100	$ -	$ -	$ -	$ -	$ -	$ 0.0	$ -	$ -	$ -
	48,700	$ -	$ -	$ -	$ -	$ 0.0	$ 1.8	$ -	$ -	$ -
	29,300	$ -	$ -	$ -	$ 1.8	$ 3.1	$ 4.5	$ -	$ -	$ 0.1

Table 10-XE. Hypothetical forgone CDQ royalties by season under Chinook bycatch options for 2007 in millions of dollars.

2007		opt1(AFA)			opt2a			opt2d		
Seas	Cap	50/50	58/42	70/30	50/50	58/42	70/30	50/50	58/42	70/30
A	87,500	$ -	$ -	$ -	$10.0	$ 9.8	$ 9.6	$ 2.4	$ -	$ -
	68,100	$ -	$ -	$ -	$12.7	$12.6	$ 9.9	$ 6.0	$ 2.6	$ -
	48,700	$ .8	$ 2.4	$ -	$12.9	$12.9	$12.7	$ 9.8	$ 9.6	$ 6.0
	29,300	$ 9.9	$ 9.7	$ 6.2	$15.1	$13.1	$13.0	$12.8	$12.7	$10.0
B	87,500	$ -	$ -	$ -	$ 0.9	$ 1.6	$ 1.7	$ -	$ 0.4	$ 0.8
	68,100	$ -	$ -	$ 0.7	$ 1.6	$ 1.7	$ 2.3	$ 0.4	$ 0.8	$ 0.9
	48,700	$ 0.4	$ .7	$ 0.9	$ 2.3	$ 2.3	$ 3.1	$ 0.8	$ 0.9	$ 1.7
	29,300	$ 0.9	$ 1.6	$ 1.7	$ 3.1	$ 3.1	$ 4.2	$ 1.7	$ 1.7	$ 2.3

Table 10-XF. Hypothetical forgone CDQ royalties by sector and scenario had dates presented in Table x-1 above been invoked as closures assuming 0%, 80%, and 100% allowable rollover from A to B season, in millions of dollars.

PPA	A-seas Transfer-Ability	Year	A-Seas CDQ	A-B Roll over	B-Seas CDQ	A-seas Transfer-Ability	Year	A-Seas CDQ	A-B Roll over	B-Seas CDQ	A-seas Transfer-Ability	Year	A-Seas CDQ	A-B Roll over	B-Seas CDQ
		2003	$ -		$ -		2003	$ -		$ -		2003	$ -		$ -
		2004	$ -		$4.9		2004	$ -		$ -		2004	$ -		$ -
		2005	$ -		$ -		2005	$ -		$ -		2005	$ -		$ -
		2006	$ -		$ -		2006	$ -		$ -		2006	$ -		$ -
1	No	2007	$ -		$1.45	No	2007	$ -		$1.36	No	2007	$ -		$1.36
		2003	$ -		$ -		2003	$ -		$ -		2003	$ -		$ -
		2004	$ -		$4.9		2004	$ -		$ -		2004	$ -		$ -
		2005	$ -		$ -		2005	$ -		$ -		2005	$ -		$ -
		2006	$ -		$ -		2006	$ -		$ -		2006	$ -		$ -
	Yes	2007	$ -	**0%**	$1.45	Yes	2007	$ -	**80%**	$1.36	Yes	2007	$ -	**100%**	$1.36
		2003	$ -		$ -		2003	$ -		$ -		2003	$ -		$ -
		2004	$ -		$11.5		2004	$ -		$ -		2004	$ -		$ -
		2005	$ -		$ -		2005	$ -		$ -		2005	$ -		$ -
		2006	$ -		$ -		2006	$ -		$ -		2006	$ -		$ -
2	No	2007	$3.2		$ 1.9	No	2007	$3.2		$1..9	No	2007	$ 3.2		$1.9
		2003	$ -		$ -		2003	$ -		$ -		2003	$ -		$ -
		2004	$ -		$11.5		2004	$ -		$ -		2004	$ -		$ -
		2005	$ -		$ -		2005	$ -		$ -		2005	$ -		$ -
		2006	$ -		$ -		2006	$ -		$ -		2006	$ -		$ -
	Yes	2007	$3.2		$1.9	Yes	2007	$ 3.2		$1.9	Yes	2007	$ 3.2		$ 1.9

References

Western Alaska Community Development Association (WACDA). Supporting the Advancement of Bering Sea Communities. 2007.

Blue Ribbon Committee on the Western Alaska CDQ Program Report to the Governor of the State of Alaska. August 2005.

Northern Economics. The Seafood Industry in Alaska's Economy. January 2009.

Coastal Villages Region Fund. "Pollock Provides" video. 2008

CBSFA News, v7 issue 1. October 2006.

2005 Annual Reports of the CDQ entities (CVRF, NSEDC)

2006 Annual Reports of the CDQ entities (APICDA, BBEDC, CVRF, NSEDC, YDFDA)

2007 Annual Reports of the CDQ entities (APICDA, BBEDC, CVRF, YDFDA)

Southwest Alaska Municipal Conference (SWAMC). Southwest Alaska Comprehensive Economic Development Strategy Annual Update 2007. July 2007.

State of Alaska Department of Commerce, Community, and Economic Development (ADCCED). N.D. Community Development Quota (CDQ). http://www.commerce.state.ak.us/bsc/cdq/cdq.htm

Appendix 12 – New Shoreside Impacts Section

Chinook Salmon Bycatch Regulatory Impact Review Addendum providing processing value added effects, as a subset of the overall shoreside sector effects, by port group for Alternative 4.

This addendum to the Regulatory Impact Review (RIR) provides a breakout of the shoreside processing sector revenue (processing value added) by port group. It is important to recognize that this breakout must not be added to the estimated effects on potentially forgone first wholesale gross revenue provided in the RIR for the aggregated shoreside (S) sector. These values are a subset of the values presently provided in the RIR and are intended to highlight the potential effects on value added processing by port group, which are used to protect confidentiality. Two port groups have been created, AKU/DUT, and All Others. The AKU/DUT group denotes the aggregate of all processing facilities in the Akutan and Dutch Harbor areas, including some floating processors. The All Others group includes King Cove, Kodiak, Sand Point, and several floating processors.

Shown below are the breakout of ex-vessel and shoreside processing values, as well as their total, and the percent each group-season-year- category is of the annual grand total value. These percentages are used in this addendum to estimate the potential effects on each port group, in each year and season, by multiplying that percentage by estimated effects on the shoreside sector shown in the RIR. This method "allocates" effects on each group-season-year, relative to their observed proportion of total first wholesale value. Thus, this is not an accounting of actual effects, but rather is a proportionality based estimate of where the potential effects may accrue. This has been done, at least in part, to enhance the presentation of crucial economic impact information, while maintaining confidentiality constraints.

Following the value tables are two tables that provide estimates of shoreside processing revenue (value added) effects, and the percentage of total processing revenue they represent, by port group, year, and season for the Preliminary Preferred Alternative (PPA) (Alternative 4). These estimates are tabulated by multiplying the percentages discussed above, by the shoreside sector effects estimates provided for the PPA in table 10-99 of the RIR.

Bering Sea Pollock Ex-Vessel Value by Port Group and Year ($millions)

Port Group	Season	2003	2004	2005	2006	2007
AKU/DUT	A	$68	$73	$85	$85	$78
	B	$82	$75	$88	$92	$78
	Total	**$149**	**$148**	**$173**	**$177**	**$156**
All Others	A	$4	$5	$7	$6	$6
	B	$5	$6	$7	$7	$6
	Total	**$9**	**$11**	**$13**	**$13**	**$12**
	Grand Total	**$158**	**$159**	**$186**	**$190**	**$168**

Sources: Terry Hiatt: Alaska Fisheries Science Center, from data compiled for the Economic Status and Fishery Evaluation Report, 2007.

Bering Sea Pollock Shoreside Processing Value by Port Group and Year ($millions)

Port Group	Season	2003	2004	2005	2006	2007
AKU/DUT	A	$132	$141	$167	$154	$160
	B	$160	$144	$175	$166	$161
	Total	**$292**	**$285**	**$342**	**$319**	**$322**
KCO/KOD/SPT/FLD	A	$3	$2	$4	$4	$5
	B	$3	$2	$4	$4	$5
	Total	**$6**	**$3**	**$8**	**$8**	**$9**
	Grand Total	**$297**	**$288**	**$350**	**$327**	**$331**

Sources: Terry Hiatt: Alaska Fisheries Science Center, from data compiled for the Economic Status and Fishery Evaluation Report, 2007.

Bering Sea Pollock Total Shoreside Sector Value (Ex-Vessel Value plus Shoreside Processing Value Added) by Port Group and Year ($millions)

Port Group	Season	2003	2004	2005	2006	2007
AKU/DUT	A	$200	$214	$252	$239	$238
	B	$241	$218	$263	$257	$239
	Total	**$441**	**$432**	**$515**	**$496**	**$478**
KCO/KOD/SPT/FLD	A	$7	$7	$10	$10	$10
	B	$8	$7	$11	$11	$10
	Total	**$15**	**$14**	**$21**	**$20**	**$21**
	Grand Total	**$456**	**$446**	**$536**	**$517**	**$498**

Sources: Terry Hiatt: Alaska Fisheries Science Center, from data compiled for the Economic Status and Fishery Evaluation Report, 2007.

Bering Sea Pollock Processing Value as a Percent of Total First Wholesale Value

Port Group	Season	2003	2004	2005	2006	2007
AKU/DUT	A	43.83%	47.93%	47.03%	46.22%	47.83%
	B	52.97%	48.90%	49.03%	49.82%	48.01%
	Total	**96.80%**	**96.83%**	**96.07%**	**96.05%**	**95.84%**
KCO/KOD/SPT/FLD	A	1.45%	1.57%	1.92%	1.90%	2.07%
	B	1.75%	1.60%	2.01%	2.05%	2.08%
	Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**
	Grand Total	43.83%	47.93%	47.03%	46.22%	47.83%

Sources: Terry Hiatt: Alaska Fisheries Science Center, from data compiled for the Economic Status and Fishery Evaluation Report, 2007.

Table 10-XX: Hypothetical forgone value added processing revenue by year, season, and aggregated port group under PPA1 and PPA2. ($ Millions)

PPA	A-season Transfer-Ability	Year	A-Season AKU/DUT	A-Season All Other	A-Season Processing Total	A-Season S Total	A-B Rollover	B-Season AKU/DUT	B-Season All Other	B-Season Processing Total	B-Season S Total	Processing Annual Total	Ex-Vessel Annual Total	Shore side Annual Total
1	No	2003	$0	$0	$0	$0	0%	$0	$0	$0	$0	**$0**	**$0**	**$0**
		2004	$0	$0	$0	$0		$5	$0	$5	$10	**$5**	**$5**	**$10**
		2005	$0	$0	$0	$0		$10	$0	$10	$20	**$10**	**$10**	**$20**
		2006	$56	$2	$59	$122		$5	$0	$6	$11	**$64**	**$69**	**$133**
		2007	$59	$3	$61	$123		$17	$1	$18	$36	**$80**	**$80**	**$159**
	Yes	2003	$0	$0	$0	$0		$0	$0	$0	$0	**$0**	**$0**	**$0**
		2004	$0	$0	$0	$0		$5	$0	$5	$10	**$5**	**$5**	**$10**
		2005	$0	$0	$0	$0		$10	$0	$10	$20	**$10**	**$10**	**$20**
		2006	$54	$2	$56	$116		$5	$0	$6	$11	**$61**	**$65**	**$127**
		2007	$59	$3	$61	$123		$17	$1	$18	$36	**$80**	**$80**	**$159**
2	No	2003	$0	$0	$0	$0		$0	$0	$0	$0	**$0**	**$0**	**$0**
		2004	$0	$0	$0	$0		$9	$0	$9	$18	**$9**	**$9**	**$18**
		2005	$0	$0	$0	$0		$13	$1	$14	$27	**$14**	**$13**	**$27**
		2006	$78	$3	$82	$169		$14	$1	$14	$27	**$96**	**$101**	**$197**
		2007	$82	$4	$86	$172		$22	$1	$23	$46	**$109**	**$109**	**$218**
	Yes	2003	$0	$0	$0	$0		$0	$0	$0	$0	**$0**	**$0**	**$0**
		2004	$0	$0	$0	$0		$9	$0	$9	$18	**$9**	**$9**	**$18**
		2005	$0	$0	$0	$0		$13	$1	$14	$27	**$14**	**$13**	**$27**
		2006	$75	$3	$78	$162		$14	$1	$14	$27	**$92**	**$97**	**$189**
		2007	$82	$4	$86	$172		$22	$1	$23	$46	**$109**	**$109**	**$218**
1	No	2003	$0	$0	$0	$0	80%	$0	$0	$0	$0	**$0**	**$0**	**$0**
		2004	$0	$0	$0	$0		$0	$0	$0	$0	**$0**	**$0**	**$0**
		2005	$0	$0	$0	$0		$0	$0	$0	$0	**$0**	**$0**	**$0**
		2006	$56	$2	$59	$122		$4	$0	$5	$9	**$63**	**$68**	**$131**
		2007	$59	$3	$61	$123		$17	$1	$18	$36	**$80**	**$80**	**$159**
	Yes	2003	$0	$0	$0	$0		$0	$0	$0	$0	**$0**	**$0**	**$0**
		2004	$0	$0	$0	$0		$0	$0	$0	$0	**$0**	**$0**	**$0**
		2005	$0	$0	$0	$0		$0	$0	$0	$0	**$0**	**$0**	**$0**
		2006	$54	$2	$56	$116		$4	$0	$5	$9	**$60**	**$64**	**$125**
		2007	$59	$3	$61	$123		$17	$1	$18	$36	**$80**	**$80**	**$159**
2	No	2003	$0	$0	$0	$0		$0	$0	$0	$0	**$0**	**$0**	**$0**
		2004	$0	$0	$0	$0		$5	$0	$5	$10	**$5**	**$5**	**$10**
		2005	$0	$0	$0	$0		$10	$0	$11	$21	**$11**	**$10**	**$21**
		2006	$78	$3	$82	$169		$14	$1	$14	$27	**$96**	**$101**	**$197**
		2007	$82	$4	$86	$172		$22	$1	$23	$46	**$109**	**$109**	**$218**
	Yes	2003	$0	$0	$0	$0		$0	$0	$0	$0	**$0**	**$0**	**$0**
		2004	$0	$0	$0	$0		$5	$0	$5	$10	**$5**	**$5**	**$10**
		2005	$0	$0	$0	$0		$10	$0	$11	$21	**$11**	**$10**	**$21**
		2006	$75	$3	$78	$162		$14	$1	$14	$27	**$92**	**$97**	**$189**
		2007	$82	$4	$86	$172		$22	$1	$23	$46	**$109**	**$109**	**$218**

Notes: AKU/DUT: Denotes the aggregate of all processing facilities in the Akutan and Dutch Harbor areas, including some floating processors.
All Others: May include King Cove, Kodiak, Sand Point, and several floating processors.

Table 10-XX: Hypothetical forgone pollock value-added first wholesale revenue, in percent of total forgone pollock revenue, by port group, season, year, for PPA1 and PPA2.(% of total wholesale revenue).

PPA	A-season Transfer-Ability	Year	A-Season AKU/DUT	A-Season All Other	A-Season Processing Total	A-Season S Total	A-B Roll over	B-Season AKU/DUT	B-Season All Other	B-Season Processing Total	B-Season S Total	**Processing Annual Total**	**Ex-Vessel Annual Total**	**Shore side Annual Total**
1	No	2003	0%	0%	0%	0%	**0%**	0%	0%	0%	0%	**0%**	**0%**	**0%**
		2004	0%	0%	0%	0%		3%	10%	4%	4%	**2%**	**3%**	**2%**
		2005	0%	0%	0%	0%		6%	10%	6%	7%	**3%**	**5%**	**4%**
		2006	37%	62%	37%	49%		3%	5%	3%	4%	**20%**	**36%**	**26%**
		2007	37%	56%	37%	49%		11%	17%	11%	15%	**24%**	**48%**	**32%**
	Yes	2003	0%	0%	0%	0%		0%	0%	0%	0%	**0%**	**0%**	**0%**
		2004	0%	0%	0%	0%		3%	10%	4%	4%	**2%**	**3%**	**2%**
		2005	0%	0%	0%	0%		6%	10%	6%	7%	**3%**	**5%**	**4%**
		2006	35%	59%	35%	47%		3%	5%	3%	4%	**19%**	**34%**	**25%**
		2007	37%	56%	37%	49%		11%	17%	11%	15%	**24%**	**48%**	**32%**
2	No	2003	0%	0%	0%	0%		0%	0%	0%	0%	**0%**	**0%**	**0%**
		2004	0%	0%	0%	0%		6%	18%	6%	8%	**3%**	**6%**	**4%**
		2005	0%	0%	0%	0%		8%	14%	8%	10%	**4%**	**7%**	**5%**
		2006	51%	86%	52%	68%		8%	14%	8%	10%	**29%**	**53%**	**38%**
		2007	51%	79%	52%	69%		14%	21%	14%	18%	**33%**	**65%**	**44%**
	Yes	2003	0%	0%	0%	0%		0%	0%	0%	0%	**0%**	**0%**	**0%**
		2004	0%	0%	0%	0%		6%	18%	6%	8%	**3%**	**6%**	**4%**
		2005	0%	0%	0%	0%		8%	14%	8%	10%	**4%**	**7%**	**5%**
		2006	49%	82%	49%	65%		8%	14%	8%	10%	**28%**	**51%**	**37%**
		2007	51%	79%	52%	69%		14%	21%	14%	18%	**33%**	**65%**	**44%**
1	No	2003	0%	0%	0%	0%	**80%**	0%	0%	0%	0%	**0%**	**0%**	**0%**
		2004	0%	0%	0%	0%		0%	0%	0%	0%	**0%**	**0%**	**0%**
		2005	0%	0%	0%	0%		0%	0%	0%	0%	**0%**	**0%**	**0%**
		2006	37%	62%	37%	49%		3%	4%	3%	3%	**19%**	**36%**	**25%**
		2007	37%	56%	37%	49%		11%	17%	11%	15%	**24%**	**48%**	**32%**
	Yes	2003	0%	0%	0%	0%		0%	0%	0%	0%	**0%**	**0%**	**0%**
		2004	0%	0%	0%	0%		0%	0%	0%	0%	**0%**	**0%**	**0%**
		2005	0%	0%	0%	0%		0%	0%	0%	0%	**0%**	**0%**	**0%**
		2006	35%	59%	35%	47%		3%	4%	3%	3%	**18%**	**34%**	**24%**
		2007	37%	56%	37%	49%		11%	17%	11%	15%	**24%**	**48%**	**32%**
2	No	2003	0%	0%	0%	0%		0%	0%	0%	0%	**0%**	**0%**	**0%**
		2004	0%	0%	0%	0%		3%	10%	4%	4%	**2%**	**3%**	**2%**
		2005	0%	0%	0%	0%		6%	11%	6%	8%	**3%**	**6%**	**4%**
		2006	51%	86%	52%	68%		8%	14%	8%	10%	**29%**	**53%**	**38%**
		2007	51%	79%	52%	69%		14%	21%	14%	18%	**33%**	**65%**	**44%**
	Yes	2003	0%	0%	0%	0%		0%	0%	0%	0%	**0%**	**0%**	**0%**
		2004	0%	0%	0%	0%		3%	10%	4%	4%	**2%**	**3%**	**2%**
		2005	0%	0%	0%	0%		6%	11%	6%	8%	**3%**	**6%**	**4%**
		2006	49%	82%	49%	65%		8%	14%	8%	10%	**28%**	**51%**	**37%**
		2007	51%	79%	52%	69%		14%	21%	14%	18%	**33%**	**65%**	**44%**

Notes: AKU/DUT: Denotes the aggregate of all processing facilities in the Akutan and Dutch Harbor areas, including some floating processors.
All Others: May include King Cove, Kodiak, Sand Point, and several floating processors.