State of Alaska **Tony Knowles, Governor**

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Run Forecasts and Harvest Projections for 1997 Alaska Salmon Fisheries and Review of the 1996 Season

Edited by
Harold J. Geiger
Brian Frenette
and
Deborah Hart

June 1997

Alaska Department of Fish and Game
P.O. Box 25526, Juneau, Alaska 99802-5526

Frank Rue
Commissioner

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Acknowledgments

This report is based on information contributed by Commercial Fisheries Management and Development Division biologists located in field offices throughout the state. Individual credit for forecast material is contained in area forecast discussions in the Appendix. Area biologists throughout the state supplied reviews of the 1996 fishing season.

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Executive Summary

Alaska salmon biologists are expecting the 1997 statewide catch to be very close to the all-species 1996 harvest. The outlook calls for a total 1997 catch of 171 million salmon distributed as 579 thousand chinook salmon, 45.5 million sockeye salmon, 6.74 million coho salmon, 100 million pink salmon, and 17.8 million chum salmon. Table 1 shows specific projection numbers, by species and fishing area.

The 1996 all-species salmon harvest reached 176 million. The catch would have been higher had there been additional markets. The 1996 catch was down from an incredible 218 million salmon harvested in 1995. Even though the catch declined slightly, the value of the commercial salmon fishery declined even more. The estimated exvessel value of the 1996 catch was $365 million, down from estimated exvessel values for the 1995 fishery of $461 million and for the 1994 fishery of $468 million. The 1996 harvest was distributed as 512 thousand chinook salmon, 50.2 million sockeye salmon, 6.06 million coho salmon, 97.6 million pink salmon, and 21.1 million chum salmon. Table 2 provides harvest numbers by specific fishing area and Table 3 provides harvest statistics in thousands of pounds.

The following briefly describes Alaska Department of Fish and Game formal forecasts of the major pink and sockeye runs, which make up about 85% of the expected 1997 harvest. For sockeye salmon, the Bristol Bay forecast calls for a slight drop in harvest. Last year's catch of sockeye salmon in Bristol Bay was 29.6 million, while the 1997 catch is predicted to be near 24.8 million. The forecast for upper Cook Inlet sockeye salmon is for a run of 6.8 million and a catch of 5.3 million. As for pink salmon, we are expecting a statewide harvest of 100 million fish, which compares to the 1996 harvest of 97.6 million. Forecasters in Southeast Alaska expect a strong run of pink salmon, which means they expect a harvest between 26 and 48 million. Biologists in Kodiak expect a run of 23.9 million pink salmon with a catch of 21.6 million. Forecasters in Prince William Sound expect a pink salmon run of 32.9 million, with 20.5 million available for the common property fishery and 9.7 million available for hatchery cost recovery.

Look for inseason harvest information, postseason statistics, and preseason outlooks on the World Wide Web at *http://www.state.ak.us/adfg/cfmd/cfmdhome.htm*.

Introduction

The Alaska Department of Fish and Game's (ADF&G) four major fishery management regions (Southeast, Central, Arctic-Yukon-Kuskokwim, and Westward) are shown in Figure 1. These regions supersede any references to the department's former statistical regions.

Forecasts of runs (catch + escapement) for major salmon fisheries and projections of the statewide commercial salmon harvest have been published every year by ADF&G since 1969 (ADF&G 1969–1973, 1975–1983; Eggers 1985, 1986; Eggers and Dean 1987, 1988; Geiger and Savikko, 1989–1993; Geiger and Simpson 1994, 1995; and Geiger and Frenette 1996–1997). Though the department does not produce formal run size forecasts for all salmon runs in the state, local salmon biologists prepare harvest projections or harvest outlooks for all areas. Projections are based on formal forecasts, when available; when the formal forecasts are not available, local biologists use average historical catches and local knowledge of recent events to develop these outlooks. Projections for the 1997 Alaska commercial salmon harvest, by species and area, are found in Table 1. Harvest outlooks for the Arctic-Yukon-Kuskokwim Region are developed as ranges; these ranges are listed in Appendix B. Trends in total statewide salmon harvests and catch projections in numbers of fish, by species, are found in Figures 2–6. Tables 2–7 provide detailed information on the 1996 harvest.

This report contains a detailed review of Alaska's 1996 commercial salmon season. We normally release it before final catch figures are available to provide preliminary information to the Board of Fisheries, the fishing industry, and the public.

Predominate ages and brood years for 1997 salmon runs, by species, are as follows:

	Age of Returning Salmon in Years				
Species	2	3	4	5	6
Pink	1995				
Chum		1994	1993	1992	
Coho		1994	1993		
Sockeye			1993	1992	1991
Chinook			1993	1992	1991

The common and scientific names for Alaska's Pacific salmon species are as follows:

Common (and Vernacular) Names	**Scientific Name**
chinook (king)	*Oncorhynchus tshawytscha*
sockeye (red)	*Oncorhynchus nerka*
coho (silver)	*Oncorhynchus kisutch*
pink (humpy, humpback)	*Oncorhynchus gorbuscha*
chum (dog)	*Oncorhynchus keta*

Definitions of Terms

Biological escapement goal — The number of salmon in a particular stock that ADF&G has determined should be allowed to escape the fishery to spawn to achieve the maximum yield for human use. This determination is based on biological information about the fish stock in question. (Also see *optimum escapement goal*.)

Commercial harvest — Harvests of fish that are used for commercial purposes. This includes fish caught by the commercial common property fishery (see below) and by hatchery operators for cost recovery; it excludes sport, subsistence, and personal use harvests.

Commercial common property harvest — Harvests taken by traditional, competitive commercial fisheries (gillnet, purse seine, and troll), as opposed to commercial harvests resulting from hatchery cost recovery, fishing derbies, and sale of confiscated fish.

Common property harvest	Harvests taken by the commercial common property fisheries (see above), as well as the sport, subsistence, and personal use fisheries. This category excludes hatchery cost recovery harvests.
Cost recovery harvest	Harvests of salmon by hatchery operators in specially designated areas to fund the operation of hatcheries and other enhancement activities.
Enhancement of runs	Hatcheries and other means of artificial propagation to create salmon runs or make existing salmon runs larger. Enhancement includes remote fish stocking, fertilization of lakes, and other techniques.
Escapement, spawning population, or broodstock	The portion of a salmon run that is not harvested and survives to reach the spawning grounds or hatchery.
Harvest projections or harvest outlooks	Harvest outlooks are the best available estimates of upcoming harvest levels. Prepared by local biologists, outlooks are based on formal run forecasts, when available. At other times outlooks are based on historical average catches, subjectively adjusted based on recent trends and local knowledge.
Optimum escapement goal	The number of salmon in a particular stock that should be allowed to spawn to achieve sustainable runs based on biological needs of the stock, as well as social and allocative implications when managing for this level or other relevant considerations.
Run forecast	Forecasts of a run (harvest + escapement) are estimates of the fish returning in a given year based on such information as parent-year escapements, subsequent fry abundance, spring seawater temperatures, and escapement requirements. Run forecasts are generally thought to be more reliable than harvest outlooks, but run forecasts are provided only for selected areas.
Salmon run	The total number of mature salmon returning in a given year from ocean-rearing areas to coastal waters.

Preliminary Review of the 1996 Alaska Commercial Salmon Fisheries

The 1996 Alaska commercial salmon harvest of 176 million salmon was down from the all-time record harvest of 218 million salmon in 1995. The preliminary exvessel value of the 1996 harvest was approximately $365 million, down from estimated exvessel values for 1995 and 1994.

The 1996 season produced a sockeye catch of 50.2 million fish worth an exvessel value of $263 million. Sockeye salmon composed 28% of the total statewide salmon harvest. Commercial fishermen caught 97.6 million pink salmon statewide, which was 55% of the total salmon harvest. The exvessel value of the pink salmon harvest was only $31.6 million. Chum harvests represented only 12% of the total Alaska harvest, which is up from 8% in 1995, while coho catches contributed 3% and chinook less than 1% to the total statewide harvest.

Southeast and Yakutat

The 1996 Southeast Alaska commercial salmon harvest, including hatchery cost recovery, totaled 85.9 million fish, the largest harvest in the history of the region's commercial salmon fishery, which extends back to 1878. With few exceptions, Southeast Alaska salmon stocks are in excellent condition. When all salmon species are combined, eight of the eleven largest harvests in the 119-year history of the Southeast Alaska salmon fisheries have occurred since 1985, four of the largest occurring during this decade.

The chinook catch of 208 thousand was the lowest in the last 10 years and the third lowest in the 119-year history of the fishery. In fact, chinook harvests in the last 3 years have all been within the lowest five catches since 1911. The chinook harvest was constrained by U.S./Canada Pacific Salmon Treaty obligations. The current Southeast Alaska chinook escapement index goal is just shy of 84 thousand and the index achieved this year was a record 104.6 thousand. Most index systems were near or above their escapement goal levels, such as the Taku River, which reached a record 54.12 thousand or 48% above its goal level.

The 1996 sockeye harvest of 2.8 million was the second highest since statehood, but only the tenth highest in history. The sockeye catch was constrained early in the season by restrictions on fishing time allowed in District 104 under the U.S./Canada Pacific Salmon Treaty. An estimated 41 thousand hatchery sockeye salmon were harvested in terminal areas and during common property fisheries. Sockeye escapements in Southeast Alaska were mixed: in the Ketchikan area, McDonald and Hugh Smith Lakes were both below goal levels; in the Petersburg area the island systems were average, while the Stikine River continued its trend of being well above goal levels; and in northern Southeast the Chilkat and Taku Rivers were both well above goal levels, while the Chilkoot River just reached the lower end of its escapement goal range. Escapements to sockeye rivers in the Yakutat area were all within their escapement goal ranges, with the exception of the Alsek River, which was below the lower end of its goal range.

A total of 3.1 million coho salmon were harvested in 1996, well below the 1994 record harvest of 5.7 million but still among the top ten harvests in history. Nine of the ten highest harvests in the history of the fishery have occurred since 1985. Hatchery contributions were significant, over 123 thousand coho salmon were harvested in hatchery terminal areas in 1996, and over 460 thousand hatchery coho salmon were harvested during common property fisheries. Northern Southeast inside area coho escapements were within target goal ranges. Escapements to Sitka area index streams were near or above average. The Ketchikan area coho escapement index of 9.87 thousand was the third highest since the index program began in 1987.

The 1996 pink salmon harvest of 64.5 million was the largest in history. Hatcheries were a relatively minor component of the total, with the hatchery harvest estimated at less than 2 million. Approximately 500 thousand pink salmon were reported discarded or disposed of, indicated by a value of $0.00 on fish tickets. The preseason forecast indicated that the harvest would be EXCELLENT, which is the largest of five possible forecast categories in the Southeast management area. Prior to statehood, the highest 5-year average pink salmon harvest was 39.3 million, which occurred in 1938. That record was not broken again until 1992, when the most recent 5-year average reached 40 million. The 5-year average pink salmon harvest has remained above the old 1938 record every year since 1992 and is now at 52.4 million. The harvest of an average 13 million more pink salmon per

year than any other 5-year period in the first 114-year history of the fishery is reflective of generally favorable environmental conditions and escapements that are well distributed geographically and temporally and at levels that are apparently maximizing annual returns. The high harvests in the late 1930s and early 1940s occurred when individual runs or run-timing segments were being overfished. Current management strategies severely restrict harvesting whenever escapements lag behind desired levels.

The pink salmon escapement index goal range for southern Southeast is 6–9 million; the escapement index achieved in 1996 was 13.8 million. The upper end of the escapement goal range was greatly exceeded because processor capacities were inadequate to handle the harvest rate. The escapement index in northern Southeast was 7.1 million. Although this exceeded the goal of 4.8 million, the distribution of the escapement was uneven. Districts 109, 111, 112, and 113 all had escapements in excess of goal levels, while the escapements to Districts 110 and 114 were <50% of goal levels.

The 1995 all-time record chum salmon harvest of 11.1 million was broken with a harvest of 15.2 million in 1996. The three highest chum salmon harvests in the 119-year history of the fishery have occurred during the last 3 years. In excess of 2 million chum salmon were reported discarded or disposed of, indicated by a value of $0.00 on fish tickets. Hatchery contributions were significant: over 8.8 million chum salmon were harvested in hatchery terminal areas in 1996, and an additional 1 million hatchery chum salmon were estimated to have been harvested during the common property fisheries. Although formal escapement goals have not been set for Southeast Alaska chum salmon, an annual index has been calculated by selecting a set of index streams. An index stream is defined as any stream in which chum salmon escapement estimates were made at least ten times in the last 30 years. This definition has resulted in 209 chum salmon index streams in Southeast Alaska. Escapements were estimated in years when index streams were not surveyed by assuming that the expected escapement is determined by the individual year and the individual stream in a multiplicative way (i.e., that counts across years for a stream are multiples of counts in other streams, and that counts across streams for a year are multiples of counts in other years). The estimated escapement for a given stream in a given year is then equal to the sum of all escapements for the stream times the sum of all escapements for the year divided by the sum of all escapements over all streams and years. An iterative procedure is used since the sums change as missing values are filled in at each step. This year's chum salmon escapement index of 2.1 million was nearly twice the old record of 1.2 million set in 1967. The only two weak areas in this year's chum salmon run were a summer chum population in Fish Creek near Hyder and a fall chum population in the Chilkat River near Haines.

Yakutat area harvests are included in the Southeast Alaska harvest numbers reported above. Yakutat commercial setnet fishermen harvested 474.7 thousand salmon, which was below the 10-year average setnet harvest of 524.4 thousand. The harvests by species were 4.8 thousand chinook, 209.0 thousand sockeye, 227.7 thousand coho, 31.3 thousand pink, and 1.8 thousand chum salmon.

A total of 2,103 permits (370 purse seine, 445 driftnet, 140 setnet, 410 hand troll, and 738 power troll) were fished in the 1996 Southeast Alaska salmon fisheries. Compared to last year, there were 23 fewer purse seiners, 15 fewer drift gillnetters, 8 fewer set gillnetters, 52 fewer hand trollers, and 81 fewer power trollers. Fish traps were not fished on the Annette Island Fishery Reserve for the third consecutive year.

Prince William Sound

The 1996 Prince William Sound area commercial salmon harvest of 31.64 million fish is the fifth highest on record. The harvest was composed of 26.04 million pink, 3.0 million sockeye, 2.1 million chum, 459.25 thousand coho, and 56.46 thousand chinook salmon. The majority of the catch, 22.16 million salmon were harvested in the common property fisheries and 9.48 million were sold for hatchery cost recovery (exclusive of roe/meal sales).

The estimated value of the combined commercial salmon harvest is $40.5 million, which includes hatchery sales. During the 1996 season, 509 drift gillnet permit holders fished. The drift gillnet catch is valued at $27.99 million, setting the average earnings at $54.99 thousand. The set gillnet catch is valued at $712.02 thousand, setting the average earnings of the 27 participating permits at $26.37 thousand. The seine fishery was worth $5.26 million for an average exvessel value of $58.43 thousand for the 90 permit holders that participated in 1996. Revenues generated for hatchery operations (exclusive of roe/meal sales) amounted to approximately $6.57 million.

In the Copper River District the 1996 commercial fishing season began on May 16 with a 24-h fishing period. The sockeye harvest of 109.94 thousand was more than four times the projected harvest of 24.10 thousand, while the chinook harvest of 12.82 thousand was over three times the projected harvest of 3.69 thousand. The coho salmon harvest of 193.0 thousand, however, was 44% below the projected harvest of 344.0 thousand. Considering the low coho harvest, escapement counts were actually less than expected.

The final sockeye escapement estimate for the Bering River District was slightly less than expected. Escapement into Bering Lake was within the projected range as was escapement into Kushtaka and Clear Creeks. Visibility in the Shepherd Creek systems was marginal for 1996 and it is believed that sockeye escapements were below average. The strike over coho salmon prices also affected the Bering River District fisheries. The aerial index goal of 22.1 thousand was surpassed with an observed index of 26.8 thousand. Escapement was distributed uniformly throughout all systems.

In the Coghill District the management strategy prior to July 21 (gillnet-only fishery) is concerned primarily with the return of sockeye salmon to Coghill Lake and the return of chum salmon to the W. H. Noerenberg Hatchery. Beginning in 1993 the Prince William Sound Aquaculture Corporation (PWSAC) released hatchery-reared sockeye smolts at the mouth of Coghill River. If not harvested in a fishery, the returning adults (30 thousand–40 thousand sockeye salmon annually) have the characteristic of milling in the saltwater lagoon or spawning in the lower portion of the river. They do not appear to contribute significantly to the escapement. Based on coded wire tag recoveries in Prince William Sound, Coghill Lake produced nearly 250 thousand sockeye salmon, of which 110 thousand were hatchery-produced, remote-released fish. Coghill Lake sockeye salmon were harvested in the Coghill, Eshamy, Eastern and Southwestern Districts. The commercial harvest of Coghill wild stock sockeye salmon was 95 thousand and escapement was 39 thousand. This provided a total Coghill wild stock return of slightly <135 thousand, or 39% below the preseason forecast.

The total of both the common property harvest and the corporate escapement for chum salmon was 1.87 million, slightly more than the preseason forecast. The common property harvest of early chum salmon was 613 thousand. The hatchery harvested 1.05 million chum salmon for cost recovery and the broodstock goal of 217 thousand chum salmon was achieved. Of the hatchery's harvest of slightly over 1 million chum salmon, some 270 thousand were processed primarily for roe salvage and/or meal production. The total commercial harvest of sockeye salmon in the district was 180.2 thousand. The escapement into Coghill Lake was 38.7 thousand sockeye salmon, which exceeded the goal by 13.7 thousand.

Management of the Esther Subdistrict for the past three years has relied upon restricting the drift fleet to the terminal harvest area, as needed, in order to promote the escapement of Coghill Lake wild stocks. PWSAC's corporate harvest through June 10 was approximately 60.2 thousand chum salmon. Tender capacity shortages and a continuing strong return to the Copper River limited commercial effort in the chum fishery. Since 1990 there has not been a directed fishery on Coghill Lake wild sockeye salmon.

The 1996 Unakwik District salmon harvest was composed of 6.06 thousand sockeye salmon with minor numbers of chum and pink salmon. The sockeye harvest was below the 10-year average harvest of 8.80 thousand.

The Unakwik District opened June 20 on a schedule of two 24-h periods per week to target sockeye salmon. No changes were made to the fishing schedule until July 24, when the district closed until further notice. Sockeye harvests peaked during the first week of July. The peak aerial survey estimate for Miners Lake was 3.5 thousand sockeye salmon; no sockeye salmon were observed at Cowpen Lake. The district remained closed for the duration of the 1996 season following the July 24 closure.

The common property harvest of sockeye salmon from all Eshamy District stocks was 311.3 thousand sockeye salmon, slightly below the preseason forecast of 325.0 thousand. The entire Eshamy District, excluding Eshamy Lagoon and the Alternating Gear Zone in the Main Bay Subdistrict, opened on July 1 for 24 h. Based on the projected available harvest of almost 200 thousand Coghill Lake wild stock sockeye salmon, commercial fishing was not restricted to the Main Bay Subdistrict during the Coghill run. The harvest of 68.25 thousand sockeye and 13.7 thousand chum salmon included an estimated 20.2 thousand wild stock sockeye salmon.

The Eshamy District, excluding Eshamy Lagoon, opened for two periods per week through July 20. After July 21 the Coghill stock sockeye return was complete and management priorities switched to the Eshamy stock sockeye return to Main Bay Hatchery. Escapement past the Eshamy weir through July 20 was only 0.46 thousand sockeye salmon versus the anticipated 4.13 thousand. With less than 10% of the desired escapement into Eshamy Lake and catches in the Eshamy District dropping, the Crafton Island Subdistrict closed for the season following the 24-h period on July 18. The Main Bay Subdistrict opened for two periods per week through August 6, after which it became apparent the hatchery run was weak; all remaining sockeye salmon would be needed for broodstock at the Main Bay Hatchery. The Eshamy District did not reopen and closed for the 1996 season on August 31.

Escapement of sockeye salmon at Eshamy Lake fell short of the goal of 35 thousand–45 thousand fish, with only 5.27 thousand sockeye salmon counted past the weir. Actual sockeye escapement was below the anticipated escapement for the entire season. It remains unclear if the remote-released sockeye salmon that mill in the lagoon for long periods ever contribute successfully to the spawning population of Eshamy Lake.

Cook Inlet

Upper Cook Inlet

The 1996 Upper Cook Inlet harvest of 4.6 million salmon in 1996 represents a modest increase over 1995 and was just slightly above the long-term average. A significant improvement in the sockeye salmon harvest, coupled with stable sockeye prices, produced an overall exvessel value of $30 million, up $8 million from 1995.

The 1996 harvest of 15.16 thousand chinook salmon was below the long-term average by approximately 5 thousand fish and was valued at $417 thousand. Consistent with the management strategy outlined for the Board of Fisheries, the directed chinook fishery in the Northern District was limited to a single period to aid in rebuilding a number of stocks where escapement levels had been below desired levels in recent years. The resulting catch of 1.68 thousand fish was by far the lowest in the fishery's 11-year history. Freshwater abundance in most Northern District streams improved over 1995 levels.

The Central District eastside setnet fishery catch of 12.42 thousand chinook salmon was similar to harvest levels of recent years. A very low exploitation (6.11 thousand fish) in the recreational fishery, largely attributable to persistent turbid water, resulted in an estimated spawning escapement of 49.46 thousand, well in excess of the optimum goal of 22.3 thousand.

The harvest of nearly 3.9 million sockeye salmon represents the ninth highest catch on record and is approximately 1.5 million fish higher than the long-term average. The catch easily exceeded the forecasted harvest of 3.3 million and was valued at $28.6 million, or 95% of the total fishery. Prices paid for sockeye salmon were very low early in the season ($0.75 per pound), but eventually reached the 1995 price of $1.15 per pound, generally paid retroactively to the beginning of the season. The distribution of the harvest between drift (57.4%) and setnet gear (42.6%) was virtually identical to the long-term average.

The basic management strategy employed in the sockeye fishery was similar to that used successfully in prior years — a restricted drift fishery to permit adequate passage of fish northward, and use of the eastside setnets and drift gear confined to the eastern 3-mi corridor to deal with resulting surpluses of Kenai and Kasilof River stocks. The additional restriction proved to be insufficient to adequately bolster escapement, with the final count of 92 thousand falling short of the 100 thousand–150 thousand goal range. Considerable additional fishing time was needed along the Central District eastside to control escapement into both the Kenai and Kasilof, where final sonar counts matched the upper ends of both goals. The Russian River component of the Kenai River return was quite weak, requiring closure of that popular sport fishery in early August in order to meet the 30 thousand-fish escapement goal.

Despite implementation of the same severe restrictions utilized successfully in 1995, the Crescent River sockeye return failed to produce sufficient escapement to achieve the goal. The final count of 28.5 thousand was well short of the 50 thousand-fish minimum escapement goal. The return of sockeye salmon to Fish Creek in Knik Arm was very successful, producing an excellent catch in the localized commercial fishery (36 thousand), supporting a much more liberal personal use dip net fishery, and still exceeding the 50 thousand-fish escapement goal by 10 thousand. Another good return of sockeye salmon to Packers Creek on Kalgin Island contributed significantly to Kalgin Island setnet catches, satisfied escapement objectives, and provided a record 32 thousand fish for cost recovery by the Cook Inlet Aquaculture Association (CIAA). Consistent with observations elsewhere in the state, Upper Cook Inlet sockeye salmon were considerably larger in body size for all age classes than in any previous year.

The harvest of 321 thousand coho salmon was equal to the long-term average and the $834 thousand value of the catch represented 2.8% of the overall value of the fishery. As with the other species, management actions aimed primarily at reducing the harvest of Susitna-bound sockeye salmon significantly reduced the incidental harvest of north-bound coho salmon. Susitna coho stocks appeared to be somewhat early, making the July 12 drift restriction very effective in allowing substantial numbers of coho salmon to pass through the fishery. The Board of Fisheries-mandated restriction of the July 26 drift period was somewhat less effective, but produced results similar to those envisioned by the Board based on staff analysis. The Yentna River coho index was excellent. The lack of any additional fishing time in early August in the eastside setnet fishery helped reduce that fishery's coho catch and coho salmon were present in good numbers in the lower Kenai River by August 1. In general, most coho returns appeared early and were about average in strength.

Normally numerous in even-numbered years, the 1996 pink salmon harvest totaled just 242.77 thousand, the weakest even-year catch on record. Susitna-bound pink salmon were very weak and the escapement index at Yentna River was one of the poorest on record. The Kenai River pink return appeared somewhat stronger, but low prices and an early end to the Kenai sockeye return resulted in very limited effort on this stock. Escapement is not measured. The price per pound of $.05 resulted in an exvessel value of $43.7 thousand.

The 1996 harvest of 158.07 thousand chum salmon was the third poorest on record and continues the trend of substandard returns of this species. The management measures taken to produce greater escapement of Yentna River sockeye salmon also greatly benefited chum salmon with good numbers of fish moving through the fishing area during closed periods. The escapement index at Yentna, while not strong, was considerably better than commercial catches might have indicated.

The chum salmon return to Chinitna Bay was fairly strong and essentially unexploited as the local setnet fishery was inactive due to poor prices. The area was opened to seining beginning August 26, when escapement reached desired levels. Fishermen were paid only $.12 per pound for chum salmon, producing an exvessel value of $140 thousand, or just 0.5% of the overall fishery value.

Lower Cook Inlet

The total 1996 Lower Cook Inlet commercial salmon harvest of 919.7 thousand fish was the sixth lowest in the last 20 years. While the sockeye harvest exceeded the preseason forecast and set a new all-time record, the pink salmon catch ranked as one of the lowest due to a combination of weak returns and low prices. Despite the low number of landings, the total harvest of all species resulted in a preliminary exvessel value of $2.29 million, approaching the 1995 level of $2.76 million. The following table shows the actual catch compared to the forecast and long-term average:

Species	Projected Harvest	Actual Harvest[a]	1976–1995 Average
Chinook	No forecast[b]	1,181	1,250
Sockeye	415,000	449,685	185,302
Coho	No forecast[b]	13,572	13,390
Pink	1,673,100	451,506	1,161,777
Chum	98,400	3,764	103,183
Total	2,203,000	919,708	1,464,901

[a] Final fish ticket data.

[b] Enhanced returns intended for recreational fisheries.

Once again hatchery cost recovery played a dominant role in the Lower Cook Inlet fishery. Nearly 51% of the total salmon harvest was taken by CIAA to support their sockeye salmon lake stocking program and Tutka Hatchery operations. This equated to approximately 11.6% of the total exvessel value of the Lower Cook Inlet fishery. Cost recovery harvests of sockeye salmon occurred on hatchery production from Leisure Lake, Hazel Lake, Kirschner Lake, and Bear Lake. Hatchery harvests at these four locations composed 9% of the total Lower Cook Inlet sockeye landings, while cost recovery for pink salmon in the Tutka Bay Subdistrict made up 95% of the total Lower Cook Inlet pink harvest.

The chinook salmon harvest, a nontargeted species for Lower Cook Inlet commercial fishermen, was very near the 20-year average, totaling 1.18 thousand fish. Over 90% of the landings came from set gillnets, again due to enhanced production in Halibut Cove Lagoon and Seldovia Bay.

The total sockeye catch of 450 thousand surpassed the preseason projection of 415 thousand fish and was nearly double the 1986–1995 average. Sockeye salmon only accounted for 49% of the landings in 1996, but due to the price differential, still composed 92% of the total value of the Lower Cook Inlet fishery. Once again, most of this year's sockeye catch came from enhancement projects. Sockeye returns to the English Bay Lakes system, now supplemented by the Nanwalek salmon enhancement project, were strong enough to support a commercial harvest for the second consecutive year after nearly a decade of continuous closures. Natural sockeye returns were about what was expected. The early run to Mikfik Creek in the Kamishak Bay District attracted very little commercial fishing effort and once again the entire run, estimated at 10 thousand fish, entered the system to spawn.

The coho salmon harvest of 13.6 thousand fish was nearly equal to the long-term average of 13.4 thousand. Without any late-season fishing effort in Kamishak District, virtually all coho salmon

were taken from the Southern District, as very little cost recovery harvest occurred at the Bear Creek weir in Resurrection Bay. Coho run strength appeared to be above average throughout Lower Cook Inlet, but weak prices also resulted in a lack of interest in this species.

Pink salmon returns, normally the dominant species in numbers of fish, composed only 49% of the Lower Cook Inlet harvest. The catch of 452 thousand pink salmon was only one-fourth the preseason forecast and considerably less than the recent 20-year average of 1.16 million. Nearly the entire harvest came from Tutka Bay Hatchery cost recovery operations, with an additional 138 thousand fish taken for broodstock. Only 22 thousand pink salmon were harvested by the commercial fleet and virtually all of these were caught incidentally while targeting sockeye salmon in the Southern District. The price ($.05/lb.) discouraged any directed effort for pink salmon in 1996.

The chum salmon harvest of 3.8 thousand fish was the lowest on record in Lower Cook Inlet. The catch was only 4% of the long-term average and can be partially attributed to the weak market demand and poor prices for chum salmon experienced throughout the state. With the poor prices, fishermen altogether ignored chum salmon and focused on the relatively strong sockeye returns. The resulting low catches continued a declining trend in Lower Cook Inlet chum landings for the eighth year in a row.

While several Lower Cook Inlet chum salmon runs were strong enough to meet escapement goals and could have sustained limited harvests, many other systems again fell below desired levels, such as McNeil River, where the estimated escapement of 16.1 thousand was significantly less than the goal of 20 thousand–40 thousand fish. Northern streams in the Kamishak Bay District generally produced stronger chum runs compared to recent years, actually exceeding escapement goals in several streams.

Bristol Bay

The inshore run of sockeye salmon totaled approximately 37 million fish and was the fifteenth largest inshore return on record. It was approximately 15% less than the preseason forecast of 43.4 million fish. Most of the eastside systems, including Kvichak, Egegik, and Ugashik, sustained runs that were less than forecasted while all of the westside systems and Naknek achieved runs that were greater than forecasted. The commercial harvest of 29.6 million sockeye salmon was the seventh largest on record for the Bay. A total escapement of approximately 7.4 million sockeye salmon was achieved.

The commercial chinook salmon harvest of approximately 87.6 thousand fish was 26% below the recent 20-year (1976–1995) average harvest of 117.6 thousand; however, it was the third largest catch recorded in the last ten years. The chum salmon harvest totaled approximately 842 thousand fish and was well below the 1976–1995 average harvest of 1.2 million. The pink salmon harvest of about 38,000 fish was also well below the recent 20-year average of 1.6 million, while the coho salmon harvest of approximately 124 thousand fish was slightly better than half the 20-year average of 203 thousand fish.

Chinook harvests in all of the Bristol Bay districts were below average. Total runs, with the exception of the Naknek/Kvichak District, which was about average, were also below average. Chinook escapement indices were above average in the Naknek-Kvichak District and below average in the Egegik and Ugashik Districts. Escapement counts in the Nushagak and Togiak Districts were below goal levels.

Given the very large preseason forecast for sockeye salmon in the Egegik District, most of the fishing fleet spent the season there. However, with many fishermen looking to avoid the anticipated crowding of the Egegik District, the Ugashik and Nushagak fleets were larger than normal. Inshore run abundance developed steadily from about June 17 through July 17, with the peak harvest days occurring from June 29 through July 2. Over 2 million sockeye salmon were delivered on each of those days. Daily catches in excess of 1 million sockeye salmon occurred 12 times between June 28

and July 9. The timing of this year's inshore run appears to have been at least a couple of days earlier than usual. Baywide, sockeye size was larger than normal with an average weight of 6.26 pounds. This was the largest average weight in 14 years. Because of the strength of the Naknek run, several "Naknek Section-only" openings were employed at the start of the emergency order period to direct harvests toward Naknek River-bound fish. On July 4, with escapement levels to the Kvichak falling behind schedule, the drift fleet in the Naknek Section fishery was pulled into the Naknek River. On July 8, with the Kvichak sockeye escapement still lagging, the setnet fishery was also brought into the Naknek River. This precipitated moving the Egegik District western boundary line inward toward the shore, from Loran C Line 9990-Z-45135 to Loran C Line 9990-Z-45110, which in turn precipitated a fair amount of complaints from the Egegik fleet. The unmitigated effect of the Egegik boundary change on Kvichak sockeye escapement is not known, but on July 8 the Kvichak tower count and inriver estimate totaled only about 650 thousand sockeye salmon.

Coho returns to all of the districts in Bristol Bay were strong in 1996; however, the coho harvest of approximately 124.1 thousand fish was 39% below the 1976–1995 (20-year) average of 203.5 thousand fish. Part of the reason for the lower-than-average harvest was price. The Nushagak fishery was closed early because of a lack of interest in purchasing pink salmon and the resultant waste of this species. The Togiak District was also closed early due to a lack of processor interest. The largest coho harvest in the bay occurred in the Togiak District, with 59.4 thousand fish reported. Egegik was next with 39.3 thousand coho salmon harvested, followed by Nushagak with 12.5 thousand, Ugashik with 9.2 thousand, and Naknek/Kvichak with 3.8 thousand. The Nushagak River sonar count totaled 189 thousand coho salmon, which was nearly twice its escapement goal of 100 thousand. The Egegik counting tower was operated until September 11 and a coho count of approximately 25 thousand was achieved there. Aerial surveys in other districts revealed 8.3 thousand coho salmon in Ugashik, 5.9 thousand in the Naknek drainage, 0.85 thousand in the Branch River, and 2.7 thousand in the Kvichak drainage.

Pink salmon return in strength to Bristol Bay during even-numbered years. The 1996 run produced a commercial harvest of only 38 thousand, but was influenced by a lack of processor interest. Pink salmon escapements ranged from below average in the Ugashik District to above average in the Egegik District. The Nushagak River count of 821 thousand was about average.

The total Bristol Bay chum salmon harvest of 842 thousand fish was well below the recent 20-year average of 1.25 million. The Ugashik District had an above-average catch with 103.4 thousand fish, while all of the other districts produced harvests below their 1976–1995 averages. Chum escapement into the Branch River was the largest on record with an estimated 147 thousand fish, but escapements into all of the other districts were below average.

Kuskokwim

The total 1996 commercial salmon catch for the Kuskokwim area was 1.5 million fish. Fishing time during the season was below average, primarily due to weak salmon markets. The chinook catch of 23 thousand was 61% below the recent 10-year average, and a below average sockeye harvest of 122 thousand was recorded. Fishermen caught 293 thousand chum salmon, half the recent 10-year average. The pink salmon catch of 1.66 thousand fish was well below average for an even year, while the coho salmon catch was a record at 1.1 million. Additionally, 388 pounds of chinook salmon roe, 5,267 pounds of chum salmon roe, and 798 pounds of coho salmon roe were sold.

In the Kuskokwim River, fishing time in June and July was limited by weak salmon markets and a below-average chum salmon run. The chum salmon catch was 61% below the recent 10-year average. Chinook and sockeye catches, taken incidentally during the chum fishery, were below average because of reduced fishing time and early run timing. The coho harvest was a record for the Kuskokwim River.

The Quinhagak District opened later than normal due to a lack of processor interest in chinook salmon and then on an irregular schedule due to limited tendering capacity. The chinook salmon catch was 30% below the recent 10-year average. Sockeye, chum, and coho catches were above average, indicating strong runs. The incidental chum catch was the highest on record.

The Goodnews Bay District opened in late June for directed harvest of sockeye salmon and to protect early-run chinook salmon, whose weak runs continue to be a concern. Due to lack of tendering capacity, commercial fishing time was well below average in this district. The chinook catch was below average and the escapement was 18% below the goal of 3.5 thousand fish. The sockeye catch was 21% below the recent 10-year average, but escapement was excellent and exceeded the objective. The incidental chum catch was 40% below the recent 10-year average and the escapement goal was met. The coho catch was 85% above the recent 10-year average.

Only 713 of the 832 Kuskokwim area permit holders participated in the commercial fisheries in 1996. The exvessel value of the catch was $2.9 million, $2.7 million less than the recent 10-year average exvessel value of $5.6 million. Average exvessel earnings for each permit holder was $4.1 thousand, well below the most recent 10-year average value of $7.0 thousand.

Yukon Area

The 1996 Yukon area commercial salmon harvest was 930 thousand. Sales were composed of 90 thousand chinook, 146 thousand summer chum, 88 thousand fall chum, and 53 thousand coho salmon sold in the round. Additionally, 1.5 thousand pounds of chinook roe, 314.8 thousand pounds of summer chum roe, 14.7 thousand pounds of fall chum roe, and 4.8 thousand pounds of coho salmon roe were sold. The total estimated commercial harvest, including the estimated number of fish harvested to produce the roe sold, was 90 thousand chinook, 676 thousand summer chum, 108 thousand fall chum, and 56 thousand coho salmon. The 1996 estimated chinook harvest was 19% below the recent 5-year average (1991–1995) of 112 thousand fish. The 1996 estimated summer chum harvest was 40% above the recent 5-year average of 484 thousand fish. The 1996 estimated fall chum harvest was 5% below the recent 5-year average of 113 thousand fish. The 1996 estimated coho salmon harvest was 67% above the recent 5-year average of 33 thousand fish. The exvessel value of the Yukon area commercial salmon fishery was an estimated $4.8 million, 37% below the recent 5-year average of $7.6 million.

Lower Yukon area fishermen harvested 87 thousand chinook, 123 thousand summer chum, 63 thousand fall chum, and 49 thousand coho salmon in the round. Because of declining salmon flesh markets, 935 pounds of summer chum salmon roe were sold in District 3 for an estimated harvest of 1.5 thousand summer chum salmon. The estimated average price paid per pound in the Lower Yukon was $1.95 for chinook, $0.09 for summer chum, $0.10 for fall chum, and $0.26 for coho salmon. These values indicate the price paid at the time of the sale and do not include any retroactive payments. The exvessel value of the Lower Yukon area commercial fishery was $3.7 million. The average income for the 628 Lower Yukon area fishermen that participated in the 1996 commercial fishery was $5.9 thousand.

Upper Yukon area fishermen harvested 3 thousand chinook, 22 thousand summer chum, 25 thousand fall chum, and 4 thousand coho salmon in the round. The estimated average price paid per pound in the Upper Yukon for fish in the round was $0.95 for chinook, $0.07 for summer chum, $0.13 for fall chum, and $0.09 for coho salmon. Additionally, 1.5 thousand pounds of chinook salmon roe, 313.8 thousand pounds of summer chum salmon roe, 14.7 thousand pounds of fall chum salmon roe, and 4.8 thousand pounds of coho salmon roe were sold by Upper Yukon area fishermen. The estimated average price paid per pound was $2.57 for chinook salmon roe, $3.05 for summer chum salmon roe, $1.71 for fall chum salmon roe, and $2.16 for coho salmon roe. These values indicate the price paid at the time of the sale and do not include any retroactive payments. The exvessel value of

the Upper Yukon area commercial fishery was $1.1 million, and the average income for the 135 Upper Yukon area fishermen that participated in the 1996 commercial fishery was $7.9 thousand.

The 1996 chinook run was slightly below average in abundance with the 6-year-old component much lower than normal. Chinook escapement goals were achieved in the Tanana River drainage and Canada. However, chinook escapements were below goals in the lower portion of the drainage. All summer chum and fall chum escapement goals were met in 1996, except for the Toklat River fall chum escapement. The overall fall chum salmon run exceeded the preseason projection and the coho salmon run appeared to be average in abundance. Declining salmon markets, particularly for chum salmon flesh, had a major impact on the fishery, resulting in limited harvests in some districts and lower exvessel values.

Norton Sound

The 1996 Norton Sound commercial salmon harvest of 571 thousand fish was composed of 5 thousand chinook salmon, 68 thousand coho salmon, 487 thousand pink salmon, and 11 thousand chum salmon. The chinook harvest was 26% below the previous 5-year average (1991–1995) and 24% below the previous 10-year average (1986–1995). The coho harvest was 6% below the previous 5-year average and 21% above the previous 10-year average. Historically, Norton Sound has had very limited markets for pink salmon. In 1994 a pink salmon market developed to take advantage of the strong even-year pink return: 982 thousand fish were harvested, and the catch was limited by processing capacity. In 1996 the market was present again, but the harvest was much less than in 1994 due to the weaker pink salmon return. The 1996 harvest of 487 thousand pink salmon was the second highest on record, but only about half that harvested during the 1994 season. The chum salmon commercial harvest was the lowest on record, which was primarily due to poor markets. The Norton Sound chum salmon commercial harvest was 81% below the 5-year average and 86% below the 10-year average catch.

The Norton Sound District has 201 limited entry salmon permits, of which 86 actually fished during the 1996 season. The number of participating fishermen in 1996 was 30% below the previous 5-year average and 42% below the previous 10-year average. This was the second year in a row that fishing participation has set a record low and can be primarily attributable to poor market conditions. Commercial fishermen received approximately $340 thousand for their catch in 1996, 30% below the previous 5-year average.

Kotzebue

The 1996 commercial salmon harvest in the Kotzebue District consisted of 80 thousand chum salmon. This commercial chum harvest was substantially below the projected harvest of 250 thousand–350 thousand salmon due to poor market conditions. It was also well below the 17-year average (1979–1996) of 272 thousand. There were 55 permits that fished in 1996. This is the lowest number of participants since 1969, when only 52 permits were fished. The low fishing effort is attributed to construction-related employment opportunities available in the region and the lowest prices for salmon since 1965.

The Kotzebue Sound commercial salmon season was opened 8 July by emergency order as established by regulation. The buyer purchased a total of 639.6 thousand pounds of chum salmon at $0.09 per pound. The total exvessel value was approximately $56 thousand to Kotzebue area fishermen with an average of approximately $1 thousand for each participating permit holder. The final opening was on August 23. Aerial survey escapement index counts were some of the highest on record, about four times the aerial survey goal in all but one tributary, which was double its goal.

A total of 19 openings were fished in 1996 for a total of 132 h. This is the fewest number of hours fished since the inception of the commercial fishery, and less than one-third of the historical average of 421 h. Commercial fishing periods varied from 4 h to 24 h in length during the 1996 season. Generally, the first openings are scheduled to be 24 h in length. With limited markets for chum salmon and only one buyer, these openings were reduced at the onset of the season. On July 22, the lone buyer reduced the price from $1.00 per fish ($0.125/lb) to $0.60 per fish ($0.075/lb).

Kodiak

The 1996 Kodiak commercial salmon fishery occurred over a 100-day period beginning with the initial opening on June 9 and ending when the last delivery was made on September 16. Of the 611 eligible permit holders, only 439 participated. By gear type, a total of 6 beach seine, 172 set gillnet, and 261 purse seine permit holders fished. The 1996 purse seine effort was the lowest on record since limited entry has been in effect. Throughout the season 9 different buyers operated 11 processing plants, all of which were shorebased.

Listed below are 1996 harvests by species (in numbers of fish) and average weights compared to 1996 preseason harvest expectations:

1996 Actual Harvests and Average Weights

Chinook	Sockeye	Coho	Pink	Chum	Total
13,000	4,970,000	202,000	3,500,000	544,000	9,229,000
13.7 lbs.	5.7 lbs.	8.2 lbs.	3.5 lbs.	8.2 lbs.	

1996 Preseason Harvest Projections

Chinook	Sockeye	Coho	Pink	Chum	Total
20,000	3,600,000	280,000	3,700,000	900,000	8,500,000

The estimated exvessel value of the 1996 fishery is approximately $24.3 million. This is the lowest value since 1985 ($20.4 million) and well below the recent 10-year average of $44.1 million. Average earnings by gear type for each permit fished were estimated at $63 thousand for purse seine, $46 thousand for set gillnet, and $2.6 thousand for beach seine.

The 1996 chinook harvest of 13 thousand fish was the lowest since 1987, when 5 thousand fish were caught, and well below the recent 10-year average (1985–1995, excluding 1989) of 19 thousand fish. The largest chinook salmon harvest on record 42 thousand, occurred in 1992.

The 1996 sockeye salmon harvest of 4.97 million fish is the third highest on record, falling behind the 5.7 million fish harvested in 1990 and the 5.2 million fish harvested in 1991. The recent 10-year average is 3.64 million. The 1996 sockeye harvest includes an estimated 450 thousand fish produced by supplemental and enhancement projects sponsored by the Kodiak Regional Aquaculture Association.

The coho salmon harvest of 202 thousand fish was below the recent 10-year average of 278 thousand fish. The highest harvest on record occurred in 1982 when 344 thousand fish were caught. Approximately 57 thousand coho salmon were harvested near Kitoi Bay Hatchery in 1996.

The pink salmon harvest of 3.5 million was well below the recent 10-year average of 9.0 million fish and represented less than 10% of the all-time record harvest of 42.8 million fish caught in 1995.

Included in the 1996 harvest were approximately 975 thousand pink salmon that were caught near the Kitoi Bay Hatchery.

The 1996 chum salmon harvest of 544 thousand was the lowest since 1985, when 430 thousand fish were caught, and well below the recent 10-year average harvest of 880 thousand fish. Approximately 14 thousand chum salmon were caught near Kitoi Bay Hatchery. The highest chum harvest on record occurred in 1970 when 1.54 million fish were caught.

Escapement counts for all major sockeye and chinook salmon systems were enumerated through the use of salmon counting weirs. Overall, sockeye salmon escapements were excellent with 1.81 million fish counted, 1.63 million of which (90% of the total escapement estimate) were counted with fish weirs. The overall biological escapement goal for sockeye salmon ranges from 1.4 million to 2.1 million fish. Pink salmon escapements varied considerably depending on the geographic location. Overall, the indexed pink salmon escapement totaled 3.35 million fish and the areawide biological escapement goal for even-year pink salmon returns ranges from 2.4 million to 6.0 million fish. A total of 395 thousand chum salmon were counted as an indexed escapement and the areawide biological escapement goal ranges from 510 thousand to 530 thousand fish. Coho salmon escapements were excellent with 87 thousand out of the total indexed escapement of 190 thousand being counted into systems with fish counting weirs. The overall biological escapement goal for coho salmon ranges from 90.47 thousand to 150 thousand fish. A total of 21 thousand chinook salmon were counted through fish weirs as escapement into the Ayakulik, Karluk, and Dog Salmon Rivers; 10 thousand entered the Ayakulik and Karluk Rivers and an additional 0.68 thousand chinook salmon entered the Dog Salmon River. The overall biological escapement goal for chinook salmon ranges from 11.1 thousand to 19.3 thousand fish.

Chignik

Escapements to the Chignik management area in 1996 are considered to have been met for all species, and in the case of sockeye salmon, exceeded. Escapements to the Chignik Lakes system through September 4 were as follows: (1) chinook salmon — 3.44 thousand, (2) sockeye salmon — 734.39 thousand with inseason analysis apportioning 419.18 thousand to the Black Lake run and 314.20 thousand to the Chignik Lake run, (3) coho salmon — 16.84 thousand, (4) pink salmon — 6.03 thousand, and (5) chum salmon — 0.14 thousand. Areawide escapements for sockeye salmon were 739.89 thousand, for coho salmon 42.49 thousand, for pink salmon 1.951 thousand (second largest since 1960), and for chum salmon 352.67 thousand.

The 1996 harvests for all salmon species, except sockeye, were smaller than that forecasted primarily because of market conditions. Although the sockeye forecast approximated the overall harvest, preliminary inseason analysis indicates the Black Lake harvest was larger and the Chignik Lake harvest was smaller than expected. Over 51% of the sockeye salmon were caught in the lagoon and the combined sockeye harvest for the lagoon and the Central Districts totaled 89% of the total sockeye catch. The pink harvest was the smallest since the mid 1970s (except 1989, the year of the oil spill) and the smallest for chum salmon since 1984. Coho catches were less than the 1996 forecast and less than the 10-year average (1987–1996).

Harvests were below allocations at both Cape Igvak (allocation 15%) and Southeastern District Mainland (allocation 6%) through July 25. Of the total Chignik-bound sockeye salmon, 14.34% were caught at Igvak and 5.92% were caught at Southeastern District Mainland. Harvests of Chignik-bound sockeye salmon through July 25 were as follows: 1.71 million (79.7%) for the Chignik area, 308.3 thousand (14.34%) for Cape Igvak, and 127.2 thousand (5.92%) for the Southeastern District Mainland.

Average weights of sockeye salmon were higher this season than in recent years. The average weights by day from fish tickets in the lagoon were higher at the beginning of the season (8.2 lbs) as compared to the season's middle and end (6.0 lbs).

The 1996 fishery was worth roughly $13.17 million, approximately $3.825 million below the 1987–1996 average. To the 100 permit holders that fished in 1996, the fishery was worth about $131.7 thousand per permit holder.

Alaska Peninsula — Aleutian Islands

For South Unimak (False Pass) and Shumagin Islands, sockeye harvests were extremely disappointing. Fishing was allowed each day after the initial openings, but neither fishery was able to come close to reaching its guideline harvest level. At South Unimak, despite continuous fishing time from 6:00 AM June 15 through midnight June 30, only 572.5 thousand sockeye salmon (22.3% of the guideline harvest level) were harvested. In the Shumagin Islands, a total of 456.47 thousand sockeye salmon (80.6% of the guideline harvest level) were harvested. The purse seine effort in the Shumagin Islands was unusually intense because poor fishing at South Unimak caused many seiners to move east. The total South Unimak-Shumagin Islands June chum salmon harvest was 359.82 thousand (129.89 thousand at South Unimak and 229.93 thousand in the Shumagin Islands). The preliminary South Unimak-Shumagin Islands June fisheries exvessel value for all species combined is an estimated $4.5 million. Most of this value, $4.2 million, is attributed to sockeye sales.

Through July 25 an estimated 126.97 thousand Chignik-destined sockeye salmon were caught in the Southeastern District Mainland fishery, 6% of the total harvest of Chignik-destined sockeye salmon. A total of 10.28 thousand Chignik-destined sockeye salmon were harvested in the Northwest Stepovak Section during June.

In the South Peninsula the season total harvest for all species was below the previous 10-year (1986–1995) average. The chinook catch of 5.08 thousand was 47% of the 1986–1995 average of 10.73 thousand. The sockeye catch of 1.52 million was 64% of the 1986–1995 average of 2.38 million. The coho harvest of 278.94 thousand was 87% of the previous 10-year average of 319.33 thousand. The pink harvest of 2.189 million was only 28% of the previous 10-year average catch of 7.825 million, while the chum catch of 775.87 thousand was 51% of the 1986–1995 average. The harvest of pink and chum salmon was impacted substantially by low prices offered by processors on the South Peninsula.

The South Peninsula indexed total sockeye salmon escapement of 73 thousand was in the goal range of 68 thousand–136 thousand, but was below the 91 thousand average for the previous 10 years. The sockeye systems in the Southwestern District generally produced below-average runs. However, Orzinski Bay in the Southeastern District produced a strong run and had an escapement of 30 thousand. The South Peninsula indexed total pink salmon escapement of 3.65 million was the third highest on record and was at the upper end of the even-year escapement goal range. The South Peninsula indexed total chum salmon escapement of 610 thousand was near the upper end of the escapement goal range of 350 thousand–690 thousand.

In 1996 no salmon were commercially harvested in the Aleutian Islands area. Very little escapement monitoring was done; however, what survey work that was accomplished indicated pink salmon escapements were poor. Also, no salmon were commercially harvested in the Atka-Amlia Islands management area. Escapement surveys on Atka and Amlia Islands were not conducted.

As was the case with the South Peninsula, the North Peninsula harvest of all species during 1996 was below the previous 10-year average. The chinook harvest of 4.94 thousand was 36% of the 1986–1995 average of 13.83 thousand. The sockeye harvest of 1.91 million was 76% of the 1986–1995 average of 2.52 million fish. The coho catch of 157.31 thousand was 85% of the previous 10-year average of 185.67 thousand. The 1996 North Peninsula pink salmon harvest of 53.84 thousand was 26% of the average even-year catch during 1986–1995. The chum salmon harvest of 67.96 thousand was 31% of the previous 10-year average of 217 thousand fish. Low prices and little interest by processors had a large impact on the harvest of all species, except sockeye salmon, on the North Peninsula.

The chinook indexed total escapement on the North Peninsula was estimated to be 25.7 thousand. However, this figure includes estimates for Port Heiden and Cinder River, where no data was available for 1996. The estimates were based on past escapements and took into account Port Heiden having no commercial exploitation.

The North Peninsula sockeye escapement (systems with weir counts plus indexed totals for other systems) was 968 thousand. The weired systems accounted for 77% of the North Peninsula sockeye escapement. The total North Peninsula sockeye escapement goal range is 480 thousand–730 thousand.

The 1996 coho salmon run was both early and strong on the North Peninsula. The harvest would have been much larger than the 157 thousand harvested if more markets had been available and higher prices had been paid. Processors and fishermen abandoned Cinder River early and Port Heiden had no buyer (for chinook or coho salmon). The escapements of coho salmon were very strong at both Port Heiden and Cinder River, especially at Port Heiden where 120 thousand coho salmon were observed in the Meshik River near the end of August. The Nelson Lagoon Section accounted for 77 thousand coho salmon (almost half the total North Peninsula coho catch). The Sapsuk River coho salmon escapement was estimated at 22 thousand, slightly more than the 20 thousand goal.

The North Peninsula indexed total pink salmon escapement was at least 395 thousand. Locations with the strongest runs were Bechevin Bay and Lawrence Valley Creek in Herendeen Bay. There was little interest in fishing for North Peninsula pink salmon and all of the harvest of 54 thousand fish was incidental to fishing for sockeye salmon.

The North Peninsula indexed chum salmon escapement was 822 thousand, well over the 349 thousand–698 thousand range. No fishing was directed at chum salmon, as processors did not want them. Most of the 68 thousand fish harvest was taken incidental to fishing for sockeye salmon in the Bear River and Nelson Lagoon Sections. The locations with the largest indexed total escapements were Herendeen-Moller Bay (353 thousand), Izembek-Moffet Bay (277 thousand), and Bechevin Bay (72 thousand).

Preliminary Forecasts of 1997 Salmon Runs to Selected Alaska Fisheries

ADF&G prepares forecasts for salmon runs that affect major fisheries around the state. Salmon runs to be forecasted are selected using several criteria, including economic importance, feasibility, compatibility with existing programs, and management needs. For the 1997 fishing year, forecast fisheries are as follows:

Southeast	—	pink salmon
Prince William Sound	—	pink, chum, sockeye, coho, and chinook salmon
Copper River	—	sockeye and chinook salmon
Copper and Bering Rivers	—	coho salmon
Upper Cook Inlet	—	sockeye salmon
Lower Cook Inlet	—	pink salmon
Kodiak	—	pink salmon

Upper Station Lakes	—	sockeye salmon
Frazer Lake	—	sockeye salmon
Ayakulik River (early and late)	—	sockeye salmon
Spiridon Lake	—	sockeye salmon
Karluk Lake	—	sockeye salmon
Chignik	—	sockeye salmon
Bristol Bay	—	sockeye and chinook salmon

A variety of information was used to make salmon run forecasts. In most cases the principal indicator of future abundance is the escapement magnitudes of parental stocks. Other information that might have been considered includes spawning stock distribution, egg deposition, survival to intermediate life stages, environmental conditions, and historical age composition. A range of run possibilities are predicted for each forecasted fishery. In general, based on past experience, the actual run can be expected to fall within the range (between the lower and upper limits) less than half the time. Please see the appendices for further details.

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Table 1. Preliminary projections of 1997 Alaska commercial salmon harvests, by fishing area and species, in thousands of fish.

Fishing Area	Species					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Southeast Region	233	2,570	3,900	37,000	11,200	54,900
Prince William Sound						
Common Property	60	2,160	612	20,500	1,320	24,700
Cost Recovery	3	188	24	9,700	460	10,400
Upper Cook Inlet	15	5,300	300	50	200	5,900
Lower Cook Inlet	2	228	13	3,110	65	3,400
Bristol Bay	81	24,800	100	0	900	25,900
Central Region Total	161	32,700	1,000	33,400	2,900	70,300
Kodiak Area	20	3,500	320	21,600	700	26,100
Chignik	7	1,550	220	1,000	230	3,000
South Peninsula	10	2,750	300	7,200	1,500	11,800
North Peninsula	15	2,300	180	5	200	2,700
Aleutian Islands	0	0	0	0	0	0
Westward Region Total	52	10,100	1,020	29,800	2,630	43,600
AYK Region Total	133	118	818	51	1,100	2,220
Statewide Total	579	45,500	6,740	100,000	17,800	171,000

Columns and rows do not total exactly due to rounding.

Modified January 29, 1997

Table 2. Preliminary 1996 Alaska commercial salmon harvests, by fishing area and species, in thousands of fish.

Fishing Area	Species					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Southeast Region Total	208	2,800	3,100	64,500	15,300	85,900
Prince William Sound	57	3,010	459	26,000	2,110	31,600
Upper Cook Inlet	14	3,880	321	243	157	4,620
Lower Cook Inlet	1	443	11	450	3	910
Bristol Bay	88	29,600	123	40	841	30,700
Central Region Total	160	36,900	910	26,700	3,110	67,800
Kodiak Area	13	4,970	202	3,500	544	9,230
Chignik	3	1,960	193	184	100	2,440
South Peninsula	5	1,540	279	2,190	776	4,790
North Peninsula	5	1,910	157	54	68	2,190
Aleutian Islands	—	—	—	—	—	—
Westward Region Total	26	10,400	831	5,920	1,490	18,700
AYK Region Total	118	122	1,220	489	1,170	3,120
Total Alaska	512	50,200	6,060	97,600	21,100	176,000

Missing data indicates no harvest and zeros indicate harvest activity but <1,000.
Columns and rows do not total exactly due to rounding.

Modified January 27, 1997

Table 3. Preliminary 1996 Alaska commercial salmon harvests, by fishing area and species, in thousands of pounds.

Fishing Area	Species					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Southeast Region Total	3,430	17,900	23,900	226,000	142,000	413,000
Prince William Sound	1,410	19,300	3,700	93,600	18,360	136,000
Upper Cook Inlet	308	24,100	2,090	680	1,570	28,700
Lower Cook Inlet	22	2,750	72	1,260	30	4,100
Bristol Bay	1,580	186,000	836	140	6,140	195,000
Central Region Total	3,320	232,000	6,700	95,700	26,100	364,000
Kodiak Area	178	28,300	1,700	12,000	4,500	47,000
Chignik	54	13,500	1,380	700	770	16,400
South Peninsula	104	9,400	1,790	5,500	6,000	22,800
North Peninsula	104	11,700	1,005	135	480	13,400
Aleutian Islands	—	—	—	—	—	—
Westward Region Total	440	62,900	5,880	18,000	11,800	100,000
AYK Region Total	2,100	950	9,390	1,516	9,000	23,000
Total Alaska	9,300	314,000	45,900	341,000	189,000	900,000

Missing data indicates no harvest and zeros indicate harvest activity but <1,000.

Columns and rows do not total exactly due to rounding.

Modified January 27, 1997

Table 4. Preliminary 1996 Southeastern Region commercial salmon harvests, by fishing area and species, in thousands of fish.

Fishing Area	Species					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Tree Point Drift Gillnet	1	212	33	371	602	1,220
Prince of Wales Gillnet	1	311	224	188	283	1,010
Stikine River Gillnet	2	154	19	38	136	349
Southern Districts Seine	0	1,400	303	52,100	2,213	56,000
Annette Island Fisheries	0	30	42	868	126	1,070
Southern Southeast Total	4	2,110	621	53,570	3,360	59,700
Taku-Snettisham Gillnet	3	199	34	13	354	603
Lynn Canal Gillnet	1	147	53	2	342	545
Yakutat Set Net	5	209	228	31	2	475
Northern Districts Seine	0	102	132	9,130	1,800	11,200
Northern Southeast Total	9	660	447	9,180	2,500	12,820
Southeast Troll [a]	141	11	1,900	813	406	3,270
Hatchery Terminal Area Fisheries						
Gillnet	3	4	7	4	314	332
Seine	22	10	7	437	4,880	5,360
Private Hatchery Fishery	28	0	114	481	3,760	4,380
Miscellaneous [b]	1	2	0	44	32	79
Southeast Region Total	208	2,800	3,100	64,500	15,300	85,900

[a] Includes chinook salmon caught by troll gear from October 11, 1995 to September 30, 1996.

[b] Includes salmon that were confiscated or taken in sport fish derbies or commercial test fisheries.

Missing data indicates no harvest and zeros indicate harvest activity but <1,000.

Columns and rows do not total exactly due to rounding.

Revised January 27, 1997

Table 5. Preliminary 1996 Central Region commercial salmon harvests, by fishing area and species, in thousands of fish.

Fishing Area	Species					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Purse Seine						
Eastern [a]	0	4	88	6,080	340	6,510
Northern [b]	0	5	7	5,040	11	5,060
Coghill	0	3	5	1,480	0	1,490
Southwestern	0	12	11	5,050	13	5,090
Drift Gillnet						
Bering River [b]	0	38	94		0	130
Copper River [b]	56	2,360	193	6	26	2,640
Unakwik	0	6		0	1	7
Coghill	1	178	21	59	613	872
Eshamy	0	179	1	19	24	223
Set Gillnet						
Eshamy	0	132	0	17	9	158
Hatchery [c]	0	87	39	8,290	1,070	9,490
Miscellaneous PWS [d]	0	1			0	1
Prince William Sound Total	57	3,010	459	26,000	2,110	31,600
Southern District	1	357	8	443	3	812
Kamishak District	0	27	0	0	0	27
Outer District		15	0	7	0	22
Eastern District		44	3	0	0	47
Lower Cook Inlet Total	1	443	11	450	3	910
Central District	12	3,780	243	222	145	4,400
Northern District	2	104	78	21	12	217
Upper Cook Inlet Total	14	3,880	321	243	157	4,620
Naknek-Kvichak	4	8,190	4	5	124	8,330
Nushagak District	73	5,750	12	2	324	6,160
Egegik District	1	10,800	39	0	83	10,900
Ugashik District	1	4,410	9	0	103	4,520
Togiak District	9	461	59	31	207	770
Bristol Bay Total	88	29,600	123	40	841	30,700
Central Region Total	160	36,900	910	26,700	3,110	67,800

[a] Totals include discarded pink and chum salmon.

[b] Does not include salmon taken for home use as reported on fish tickets.

[c] Hatchery sales for operating expenses. Includes meal production/roe salvage sales, processor discards. Excludes post egg-take roe sales at hatcheries.

[d] Some of these fish were donations landed by Coghill District and Copper River District drift gillnet permit holders.

Missing data indicates no harvest and zeros indicate harvest activity but <1,000.

Columns and rows do not total exactly due to rounding.

Revised January 27, 1997

Table 6. Preliminary 1996 Westward Region commercial salmon harvests, by fishing area and species, in thousands of fish.

Fishing Area	Species					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Kodiak Area	13	4,970	202	3,500	544	9,230
Chignik Area	3	1,960	193	184	100	2,440
South Peninsula	5	1,540	279	2,190	776	4,790
North Peninsula	5	1,910	157	54	68	2,190
Alaska Peninsula Total	10	3,450	436	2,240	844	6,980
Aleutian Islands						
Westward Region Total	26	10,400	831	5,920	1,490	18,700

Missing data indicates no harvest and zeros indicate harvest activity but <1,000.

Columns and rows do not total exactly due to rounding.

Revised January 27, 1997

Table 7. Preliminary 1996 Arctic-Yukon-Kuskokwim Region commercial salmon harvests, by fishing area and species, in thousands of fish.

	Species					
Fishing Area	Chinook	Sockeye	Coho	Pink	Chum	Total
Kuskokwim River	7	34	936	2	200	1,180
Kuskokwim Bay	16	88	163		93	360
Kuskokwim Area Total	23	122	1,100	2	293	1,540
Lower Yukon River	87		49		188	324
Upper Yukon River [a]	3		7		596	606
Yukon River Total	90	0	56	0	784	930
Norton Sound	5		68	487	11	571
Kotzebue Area	0				80	80
AYK Region Total	118	122	1,220	489	1,170	3,120

[a] The Upper Yukon River catch includes the estimated harvest to produce roe sold.

Missing data indicates no harvest and zeros indicate harvest activity but <1,000.
Columns and rows do not total exactly due to rounding.

Revised January 27, 1997

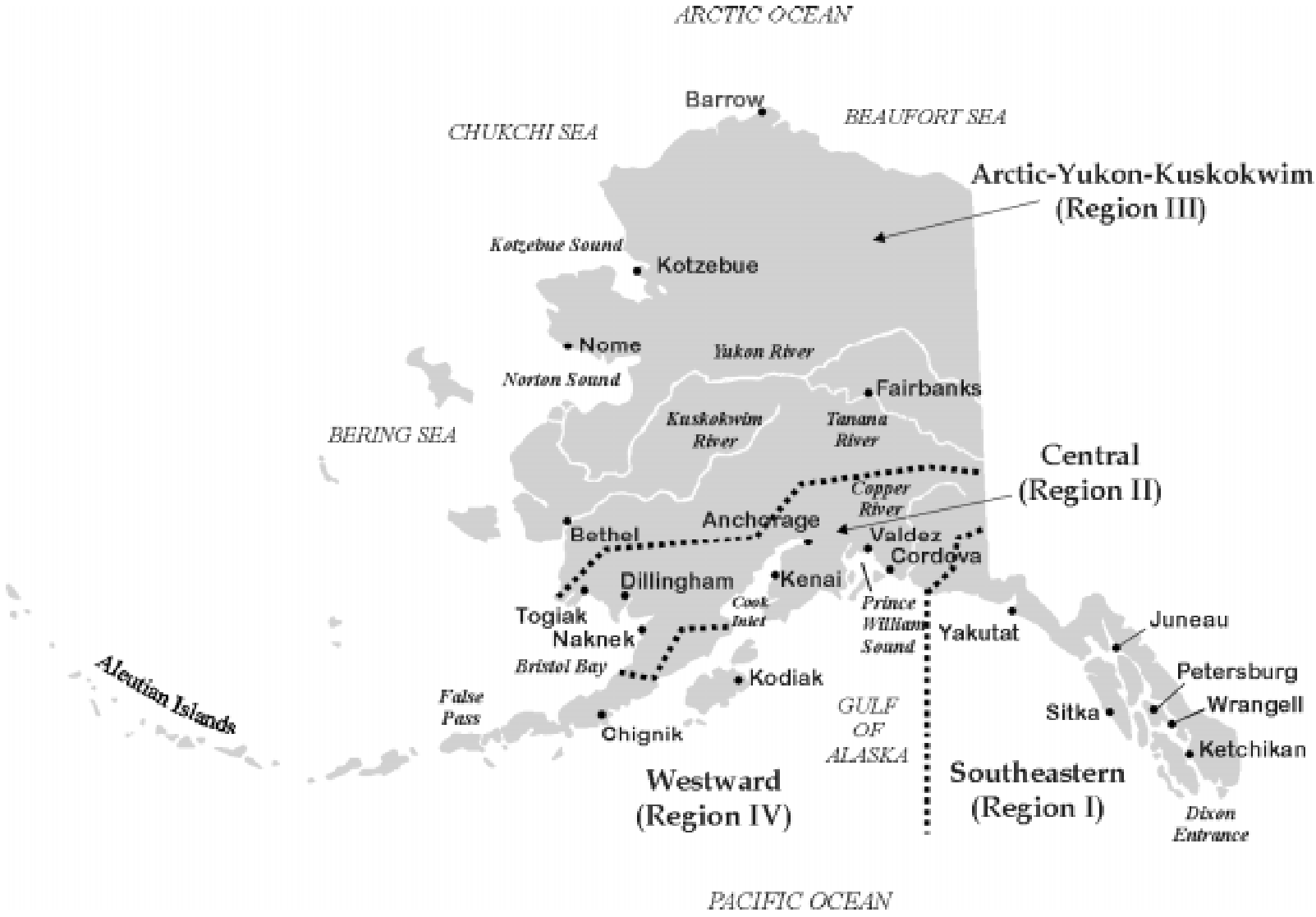

Figure 1. The four fishery management regions (Southeastern, Central, Arctic-Yukon-Kuskokwim, and Westward) of the Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division.

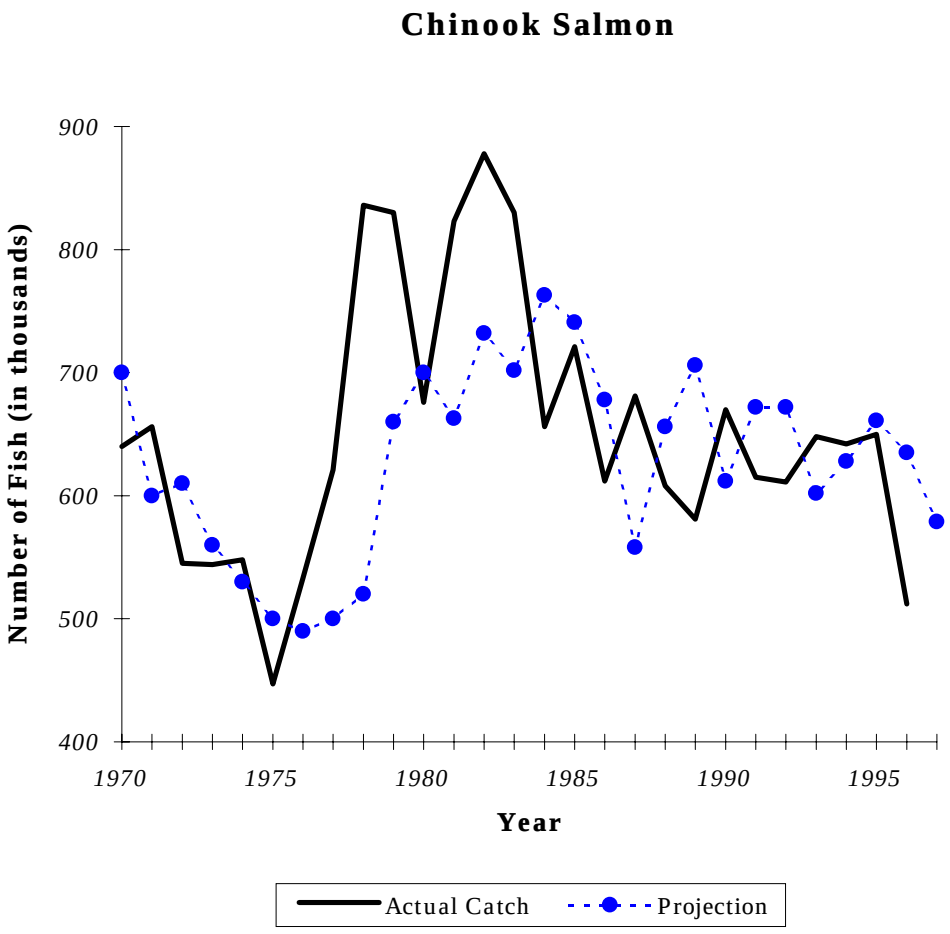

Figure 2. Relationship between actual catch and projected catch, in thousands, for Alaska chinook salmon from 1970 to 1996, with the 1997 projection.

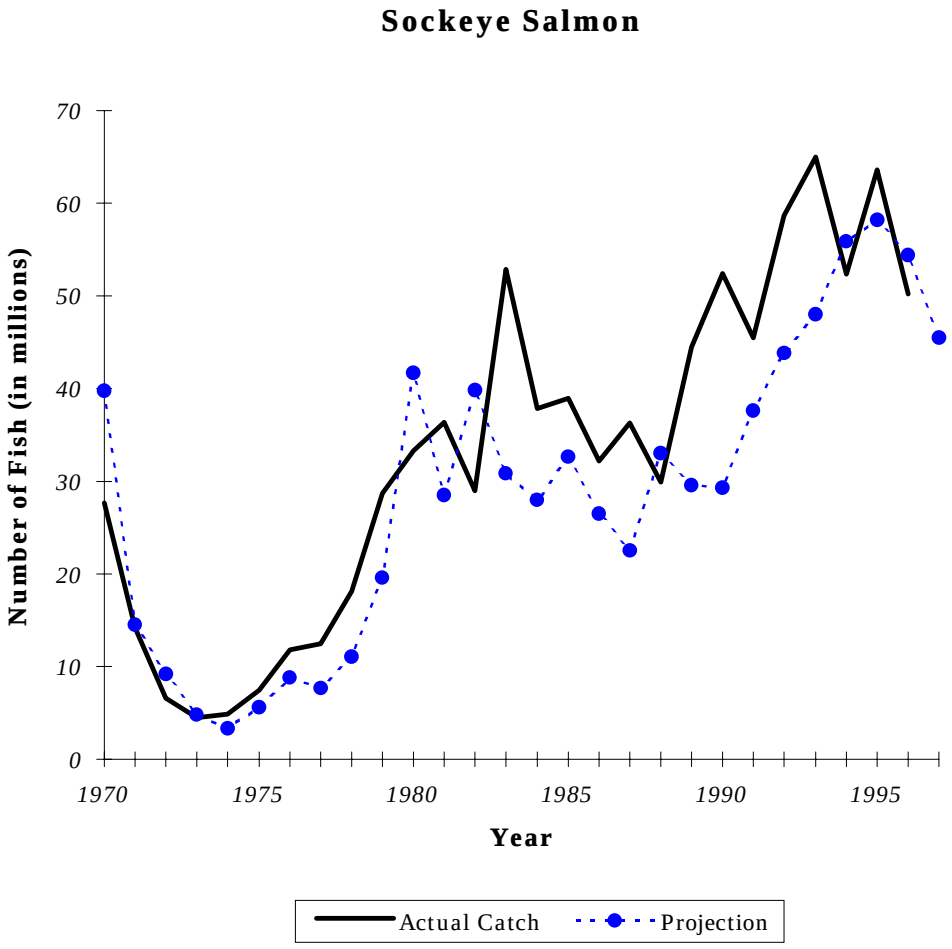

Figure 3. Relationship between actual catch and projected catch, in millions, for Alaska sockeye salmon from 1970 to 1996, with the 1997 projection.

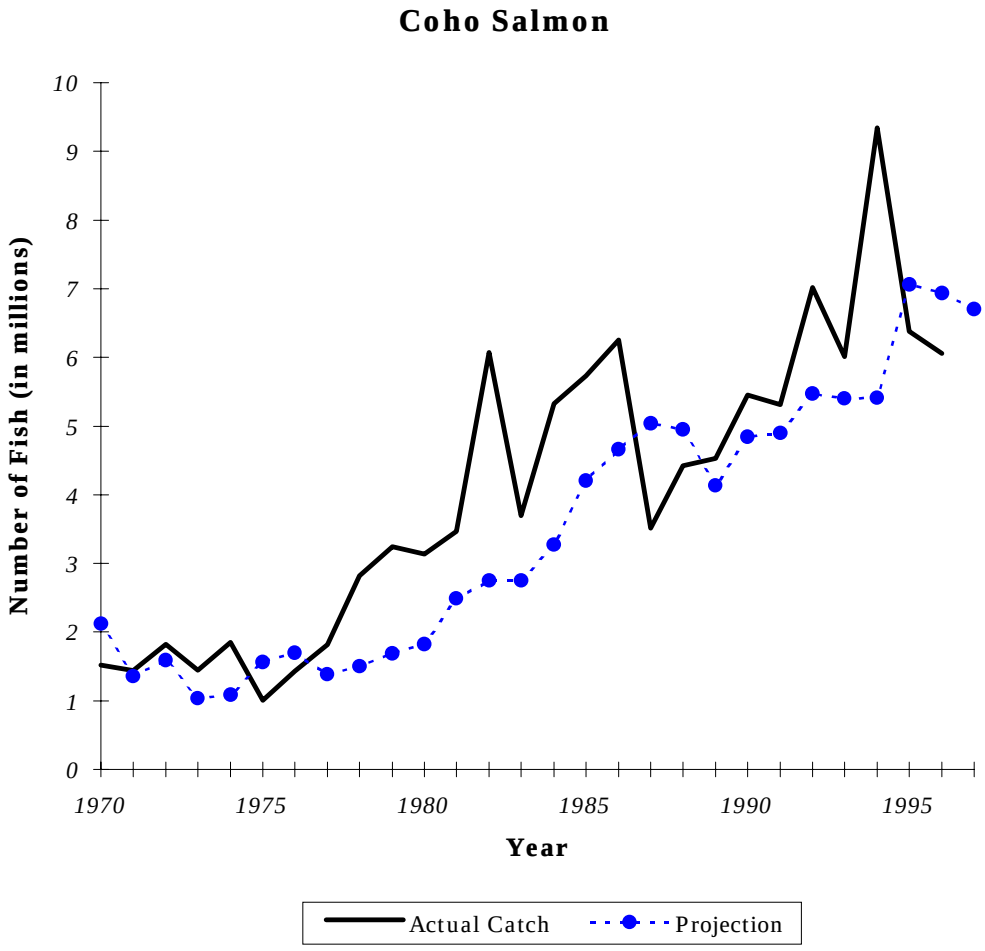

Figure 4. Relationship between actual catch and projected catch, in millions, for Alaska coho salmon from 1970 to 1996, with the 1997 projection.

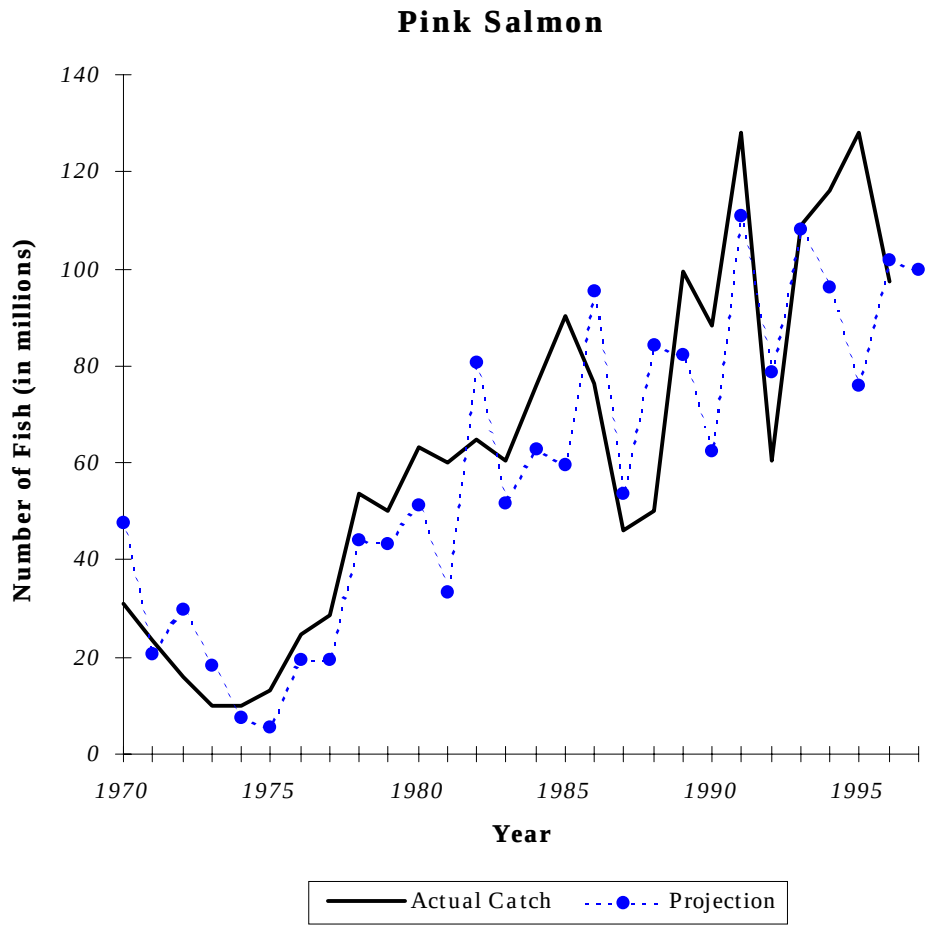

Figure 5. Relationship between actual catch and projected catch, in millions, for Alaska pink salmon from 1970 to 1996, with the 1997 projection.

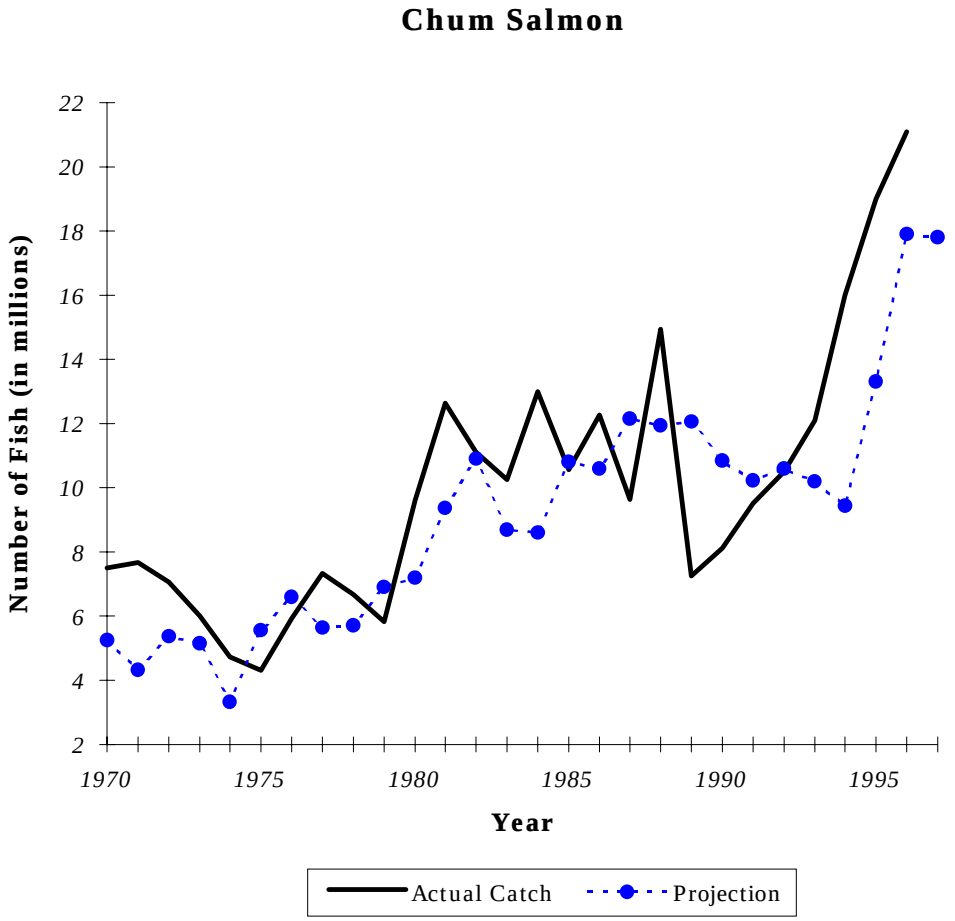

Figure 6. Relationship between actual catch and projected catch, in millions, for Alaska chum salmon from 1970 to 1996, with the 1997 projection.

Appendix

Forecast Area: Southeast Alaska

Species: Pink Salmon

Preliminary Forecast of 1997 Run	Forecast Estimate (millions)
• Natural Production	
Natural Run	66.3
Escapement Goal	31.0 [a]
Commercial Common Property Harvest	35.3
• Hatchery and Supplemental Production	
Hatchery Run	1.9
Broodstock Needs	0.2
Commercial Common Property Harvest [b]	1.7
• Total Production	
Total Run	68.2
Escapement Goal	31.2
Commercial Common Property Harvest [b]	37.0

[a] An expansion factor of 2.5 was applied to the escapement index to convert the index to an estimate of total escapement. In addition the escapement index goal for southern Southeast was changed from a point goal of 6.0 million to a range of 6.0 million–9.0 million.

[b] Includes commercial common property and hatchery cost recovery harvests.

Introduction

Programs designed specifically for collecting data relevant to estimating the magnitude of Southeast Alaska pink salmon returns have been eliminated. Consequently, we have deemed it inappropriate to make predictions based solely on formal statistical models. However, information available from other sources (NOAA [National Oceanic and Atmospheric Administration] temperature and precipitation data, management escapement data, management and fleet field observations) allows us to provide an estimate that we feel is more informative than a simple historic average. As a result, predictions made since 1992 have been a subjective combination of statistical forecast models, historic average harvests, and expert opinion.

Forecast Methods

The 1997 prediction is based on selecting one of five different harvest magnitude categories. The categories were obtained by calculating the 20th, 40th, 60th, and 80th percentiles of Southeast Alaska's pink salmon harvest during the 1967–1996 time period. The categories are:

Category	Range	Percentile
DISASTER	8 million or less	< 20th
WEAK	9 to 13 million	21st to 40th
AVERAGE	14 to 25 million	41st to 60th
STRONG	26 to 48 million	61st to 80th
EXCELLENT	49 million or more	> 80th

Category selection was made by subjective weighting of the following information:

1. Our standard multiple linear regression model predicts a harvest in all of Southeast of 58 million pink salmon, with a 95% prediction interval of 42 to 73 million. The model has an adjusted R^2 value of 0.89 with 25 degrees of freedom. This model includes return years 1967 through 1996, with 1987 and 1988 omitted as outliers. Independent variables used in the regression include: (1) brood year escapement index, (2) sum of the previous two brood year escapement indices, and (3) average daily minimum winter (November 1 through February 29) air temperatures from nine NOAA weather stations throughout Southeast Alaska.

2. The brood year escapement in Southeast of 37 million was the fourth highest since statehood. In southern Southeast, escapements were well distributed with all districts, except District 107, being at or above goal levels. The brood year escapement index in northern Southeast was the third largest since statehood; however, it was not well distributed. Districts 109, 112, 113, and 114 all received adequate escapements, while Districts 110 and 111 were well below optimal escapement levels. The escapement in District 110 was only 36% of the desired level, and District 111's escapement was only 74% of the desired level.

3. Winter temperatures are positively correlated with harvest. The average winter temperature during the 31-year study period is 27.9°F, and the average temperature during the winter of 1995–1996 was 26.0°F, which is in the lower 25th percentile of the study period. In addition to being below average, the winter of 1995–1996 was unusual because a cold spell occurred in mid November, which was earlier than normal. It is probable that a cold spell early in the winter has a greater negative impact on survival than one later in the season because the pink salmon are still in the egg or newly hatched alevin developmental stage and unable to move deeper into the substrate to escape freezing temperatures. A second concern is that the cold spell occurred at a time when no snow was present; snow helps insulate the eggs and alevins from freezing.

4. Very high pink salmon fry abundance was noted in west Behm Canal during a study designed to evaluate the use of side-scan sonar to index the abundance of pink salmon fry during their early marine residence. This was only the second year of the study and, consequently, the data cannot be incorporated into a statistical model. Visual observations, however, indicated higher abundance in the spring of 1996 than in the spring of 1995. Observations from commercial fishermen and biologists participating in spring herring fisheries indicated that fry concentrations in 1996 were lower than in 1995 in areas other than west Behm Canal. The National Marine Fisheries Service has conducted trawl surveys in Southeast Alaska to collect salmon fry for scale measurements annually since 1993 (J. Orsi, National Marine Fisheries Service, Juneau, personal communication). The pink salmon catch-per-haul in 1996 was the lowest observed in both northern and southern Southeast.

5. Odd-year pink salmon harvests in southern Southeast have tended to be larger than even-year harvests since the low returns of 1987 and 1988. During the last 8 years the average even-year harvest has been 30 million and the average odd-year harvest has been 43 million. This trend was broken in 1996 with an all-time record harvest of 53 million pink salmon.

Forecast Discussion

Based on a subjective evaluation of the above information, we believe the 1996 harvest will be STRONG. The midpoint of the prediction model is indicating an EXCELLENT harvest. However, we have downgraded the prediction by one category to STRONG. The prediction was downgraded in part

because we believe the low winter temperature will have a greater negative impact than is being accounted for in the model. Consequently, we expect the return to come in near the lower end of the 95% prediction interval. The harvest forecast number of 37 million reported in Table 1 is the mid-point of the STRONG category.

A second reason for downgrading the prediction is that management biologists conducting herring surveys noted far fewer pink salmon fry in the estuaries of Southeast Alaska in 1996 than were present in 1995, and National Marine Fisheries Service trawling studies indicated lower abundance of pink salmon fry in 1996 than in any year since 1993. The one bright spot was in West Behm Canal, which should have another strong return in 1997.

The number of fry released from pink salmon hatcheries in Southeast Alaska was not available at the time this report was prepared. Hatchery production was estimated by assuming a 90% survival from eyed eggs to fry, and a 2% survival from release to return (104,079,280 eyed eggs x 0.90 survival to fry stage x 0.02 survival to return = 1.9 million adults returning).

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Forecast Area: Prince William Sound
Species: Pink Salmon

Preliminary Forecast of 1997 Run	Forecast Estimate (millions)	Forecast Range (millions)
• Natural Production		
Prince William Sound General Districts		
Total Run	5.2	2.3–11.3
Escapement Goal	1.4	
Harvest Estimate	3.8	0.9–9.9
• Hatchery and Supplemental Production		
VFDA [a] *— Solomon Gulch Hatchery*		
Hatchery Run	10.0	6.1–13.2
Broodstock Needs	0.5	
Cost Recovery Needs [b]	3.0	2.6–3.6
Limited Entry Harvest	6.5	3.0–9.1
Historical Survival for Odd Years: Range = 1.3%–9.9%; Mean = 4.3%		
PWSAC [c] *— Cannery Creek Hatchery*		
Hatchery Run	7.5	5.2–8.5
Broodstock Needs	0.3	
Cost Recovery Needs	3.7	2.6–4.4
Limited Entry Harvest	3.8	2.3–3.8
Historical Survival for Odd Years: Range = 0.5%–8.3%; Mean = 4.9%		
PWSAC [c] *— A. F. Koernig Hatchery*		
Hatchery Run	3.9	3.9–6.5
Broodstock Needs	0.0	
Cost Recovery Needs	0.0	
Limited Entry Harvest	3.9	3.9–6.5
Historical Survival for Odd Years: Range = 0.9%–10.3%; Mean = 4.7%		
PWSAC [c] *— W. H. Noerenberg Hatchery*		
Hatchery Run	6.3	2.6–10.1
Broodstock Needs	0.5	
Cost Recovery Needs	3.0	1.3–4.8
Limited Entry Harvest	2.8	0.8–4.8
Historical Survival for Odd Years: Range = 0.9%–8.7%; Mean = 3.7%		
• Total Production		
Run Estimate	32.9	20.1–49.6
Natural Escapement Goal	1.4	
Broodstock Needs	1.3	
Cost Recovery Needs	9.7	6.5–12.8
Limited Entry Harvest	20.5	10.9–34.1

[a] VFDA is an abbreviation for Valdez Fisheries Development Association.

[b] VFDA sales are based upon fixed revenue needs. The lower and upper bounds are based upon variations in salmon weight and price per pound.

[c] PWSAC is an abbreviation for Prince William Sound Aquaculture Corporation.

Forecast Methods

Natural runs of pink salmon are predicted from a linear regression of adult production from brood year escapement for indicator spawning streams. The total parent escapement is calculated using an area- under-the-curve analysis of 208 aerial survey indicator streams representative of all pink salmon spawning streams in Prince William Sound. The 80% confidence interval for the natural run forecast was estimated using cross validation.

The forecast for the total hatchery run is the sum of individual hatchery forecasts. The forecast for each hatchery is the product of the number of fry released and their historical mean marine survival rate at each hatchery subjectively adjusted for plankton abundance, degree days, and hatchery manager observations of site-specific parameters (e.g., predator abundance, fry growth rates, fry condition at time of release). The 80% confidence interval around the forecast is derived from the confidence interval around the mean of the marine survival data.

All cost recovery harvest estimates are preliminary, and projected broodstock needs will not change unless state-permitted changes occur in hatchery programs. Projected broodstock needs for each facility are based on the expected number of eggs retrievable from each female and the expected percentage of females in the broodstock. Cost recovery harvests for the Prince William Sound Aquaculture Corporation (PWSAC) are based on 40% of the actual total hatchery run. The range is calculated as 40% of the upper and lower bounds of the run forecast minus the broodstock goal. Actual PWSAC cost recovery harvests will depend on the actual run realized by each facility. The ultimate goal is a total PWSAC cost recovery harvest for all of Prince William Sound that is 40% of the total PWSAC hatchery return. The Valdez Fisheries Development Association (VFDA) projected cost recovery harvest is based on a revenue goal using assumptions about pink salmon weight and price. The upper and lower bounds of the VFDA cost recovery harvest are based on possible variations of these two parameters.

Forecast Discussion

The 1995 pink salmon spawning escapement into Prince William Sound was approximately 19% below the desired goal. In addition, heavy rains in the fall of 1995 resulted in widespread flooding throughout southcentral Alaska. It is believed that mortality of pink salmon eggs was high, though no alevin survival data were collected to confirm this. The 1997 natural pink salmon forecast was calculated using methods different from those used in recent years because the long-standing alevin index project, which formed the basis for most previous pink salmon forecasts, was not done in 1996 due to budget constraints. The regression of the logarithm of return per spawner on parent-year escapements for odd-year forecasts was chosen, although the R^2 value of 0.0002 was very low. Future projections may incorporate ocean temperatures, plankton abundance, and growth rate to improve predictions.

The release of 643 million pink salmon from hatcheries in Prince William Sound in 1996 was the largest release on record, and the 1997 forecast is correspondingly high. Marine survival estimates for each hatchery have been calculated since 1987 using coded wire tag recoveries and are considered reliable. Mean odd-year survival was used to initially calculate the estimated run, but these estimates were often adjusted to account for subjective observations on growing conditions and fry health. In the case of the W. H. Noerenberg Hatchery, observations on growth and abundance of pink salmon juveniles captured up to one month after release by ADF&G employees working on the *Exxon Valdez* Trustee Council Sound Ecosystem Assessment Project were used to adjust estimates. The effects of predators are extremely hard to quantify and can greatly affect the survival of pink salmon juveniles. Our forecast will not account for changes in predation rates, so if predation rates are greater now than in past years, our predictions will be high.

The pink salmon return to Solomon Gulch Hatchery is expected to reach at least the initial forecast. Weather problems during early rearing caused some delay in ponding emergent fry that may have decreased survival. However, no obvious predator concentrations were noted during release and plankton levels were average, though water temperatures were warmer than in the previous year. The initial forecast was adjusted slightly upward.

Cannery Creek Hatchery is also expected to provide above-average returns from pink salmon fry releases. Fry were released from rearing pens in good condition. Plankton levels were also above average and no obvious predation occurred at the time of release. The trend of above-average survivals of pink salmon within the eastern portion of Prince William Sound is expected to continue, and the initial forecast was therefore adjusted upward from the calculated midpoint.

The W. H. Noerenberg Hatchery again released good-quality pink salmon fry in 1996 into better-than-average plankton conditions without obvious predators present. Similar conditions occurred in 1995, and the 1996 return was similar to the unadjusted forecast. Unlike previous years nearly all fry were released on one night in 1997 instead of over several nights. This strategy was used because it was believed that the abundance of fry would exceed the consumption capacity of predators and increase survival. The effectiveness of this strategy cannot be judged at this time. Warm water conditions, better plankton conditions, and a novel release strategy have the potential for a return larger than predicted. However, an outbreak of *Vibriosis* sp. in the rearing pens, coupled with poor quality of food used by the hatchery, may have negated some of the good marine conditions. Consequently, no adjustment was made to the predicted return.

The A. F. Koernig Hatchery is again expected to provide a below-average contribution to the fishery in 1997. Plankton levels in the Southwest District were better than in the past several years, but the same problems occurred here as at the W. H. Noerenberg Hatchery with poor quality food and an outbreak of *Vibriosis* sp. The predicted run was adjusted to be equivalent to the lower bound of the 80% confidence intervals to reflect poor pen-rearing conditions, abundant fish predators, and a recent trend of very low returns in the southwestern area of the Sound, although improvement is expected over the run of 1996.

The total adjusted forecast hatchery return is 27.7 million pink salmon, possibly the fourth largest hatchery return to Prince William Sound. Most are expected to return to the Solomon Gulch and Cannery Creek Hatcheries. Based on degree-day ocean temperatures, the spring of 1996 was the warmest since 1990. The 1993 spring produced a near record return of pink salmon to Prince William Sound, and the 1994 and 1995 springs produced returns near average. Based on total degree days for the spring of 1996, the pink salmon return in 1997 should have greater survival than the returns of 1995 or 1996. Total fry releases in 1996 were 5% above the 1995 release, so there should be a considerable increase in the return. The 1997 forecast reflects this increase with an adjusted midpoint forecast that is 6.4 million fish larger than that of 1996.

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Forecast Area: Prince William Sound
Species: Chum Salmon

Preliminary Forecast of 1997 Run	Forecast Estimate (millions)	Forecast Range (millions)
• Natural Production		
Prince William Sound General Districts		
Total Run	0.39	0.13–0.82
Escapement Goal	0.23	
Harvest Estimate	0.16	0.00–0.59
• Hatchery and Supplemental Production		
VFDA [a] *— Solomon Gulch Hatchery*		
Hatchery Run	0.22	0.16–0.26
Broodstock Needs	0.00	
Cost Recovery Needs	0.00	
Limited Entry Harvest	0.22	0.16–0.26
PWSAC [b] *— W. H. Noerenberg Hatchery (Onsite Returns)*		
Hatchery Run	1.40	1.30–2.10
Broodstock Needs	0.14	
Cost Recovery Needs [c]	0.46	0.50–0.80
Limited Entry Harvest	0.84	0.80–1.30
PWSAC [b] *— W. H. Noerenberg Hatchery (Port Chalmers Remote Returns)*		
Hatchery Run	0.14	0.14–2.30
Broodstock Needs	0.00	
Cost Recovery Needs [c]	0.00	
Limited Entry Harvest	0.14	0.14–0.23
• Total Production		
Run Estimate	2.15	1.73–3.41
Natural Escapement Goal	0.23	
Broodstock Needs	0.14	
Cost Recovery Needs	0.46	0.50–0.80
Limited Entry Harvest	1.32	1.10–2.24

[a] VFDA is an abbreviation for Valdez Fisheries Development Association.

[b] PWSAC is an abbreviation for Prince William Sound Aquaculture Corporation.

[c] Chum salmon cost recovery is pooled with the sockeye salmon cost recovery at Main Bay Hatchery to provide a 40% corporate escapement of equal value plus the costs of operating the Gulkana Hatchery. Forty percent of the return to Port Chalmers is added to the cost recovery goal at W. H. Noerenberg Hatchery.

Forecast Methods

The natural chum salmon forecast is the pooled results of four separate regressions. Returns of 3-year-old chum salmon are predicted from pink salmon returns from the same brood year, while returns of 4-, 5-, and 6-year-old chum salmon are predicted from returns in prior years of chum salmon from the same brood year. Cross validation was used to estimate 80% confidence intervals.

The predicted total run and its associated 80% confidence interval were calculated as sums of the predictions and 80% confidence intervals for individual ages.

The forecast for the total hatchery run is the sum of individual hatchery forecasts. The forecast for each hatchery is the product of the number of fry released and their historical mean marine survival rate subjectively adjusted for past sibling returns. Hatchery runs for 1997 are projected from fry releases made during 1991–1995 and multiplied by a mean marine survival of 1.82% (range: 1.41–2.23%). Mean survival was based on six years of fry releases and resulting adult return data from Main Bay Hatchery when it was operated by the State of Alaska. This is the only data set for Prince William Sound hatchery-produced chum salmon in which coded wire tag recoveries were available to estimate the proportion of returning adults intercepted in the commercial fishery. The average age composition of returning adults from 1991–1995 hatchery releases is assumed to be the same as the average age composition observed for natural chum returns from brood years 1978–1986. The 80% confidence interval around the forecast is derived from the confidence interval around the mean of the marine survival data. The adjustment to the total forecast, based on sibling information, was made within the bounds of the 80% confidence interval. For example, if sibling predictions for major age classes were much less than mean survival predictions, the point estimate was shifted toward the lower end of the overall 80% confidence interval.

Projected broodstock needs for each facility are based on the expected number of eggs produced from each female and the expected percentage of females in the broodstock. Broodstock needs do not change unless hatchery program changes occur. The projected sales harvest for PWSAC is 40% of the run returning to W. H. Noerenberg Hatchery, less broodstock needs. This sales harvest is pooled with the sockeye salmon run to Main Bay Hatchery, which is of comparable value. In addition, the cost of Gulkana Hatchery operations is recovered from these pooled sales harvests and the corporate share of the Port Chalmers return. Consequently, the corporation could harvest more than 40% of the chum salmon return and remain within its policy guidelines, but for simplicity, 40% of the W. H. Noerenberg Hatchery and Port Chalmers returns were used in these calculations. Additional sales harvests will be needed for the Gulkana Hatchery, but the number of fish sold will depend on price, and the cost recovery figures, which do not include the Gulkana portion, are probably low. Returns to the Port Chalmers remote release site will be composed of 2-, 3-, and 4-year-old chum salmon. The 3-year-old return in 1996 was estimated from aerial surveys of fish on the spawning grounds and was slightly below the expected number of adults predicted. Since survival data do not exist for this remote release site, the forecast and confidence intervals are based on hatchery onsite release survivals and may not apply to this situation. The forecast for the 1997 return to Port Chalmers has been adjusted down, close to the lower confidence level based on the low return of 3-year-old chum salmon in 1996. VFDA does not operate a cost recovery fishery for their chum salmon run.

Forecast Discussion

The accuracy of chum salmon forecasts is probably not great since the database available to calculate survivals and examine sibling relationships is quite small. In addition, estimates of wild stock contributions to harvests are not available for recent years due to elimination of coded wire tag recovery studies for this species. This is reflected in the wide 80% confidence interval for the natural chum salmon forecast. Natural chum salmon runs in 1997 are not expected to be as large as runs in 1996, but are still expected to be above the 1966–1996 average. The predicted total run is largely driven by 4-year-old chum salmon returns. The predicted abundance of 4-year-old chum salmon in 1997 accords with both the observed abundance of 3-year-old siblings in 1996 as well as the good survival of pink salmon from the 1993 brood year that migrated to sea at the same time. Forecasts of chum salmon runs using pink salmon survival, similar to methods used in previous years, produced predictions similar to those based on regressions of chum salmon sibling age groups but with lower average errors.

The forecast for W. H. Noerenberg Hatchery chum salmon is quite large based on the survival data used in the calculations. The sibling relationship used to produce the 6-year-old chum salmon forecast indicated a much weaker return (50%) for that year class than calculation based on average survivals. The age-5 component contributes quite heavily to the return (43%), and age-3 and -4 siblings of that age group produced strong returns in previous years. The 4-year-old component also contributes heavily to the return (53.4%), and low returns are expected based on the number of 3-year-old chum salmon returning in 1996. Further justification for reducing the 4- and 6-year-old components and increasing the 5-year-old component comes from the relationship of chum salmon survivals to sibling pink salmon survivals. The age-4 and -6 chum salmon migrated out under the same conditions as the pink salmon in 1992 and 1994, respectively, and the hatchery pink salmon returns for those years were weak. However, the 1993 release of pink salmon, the same year of the 5-year-old chum salmon releases, produced near-record returns of pink salmon. The adjusted forecast reflects these slight reductions, but still projects the second largest chum salmon return on record to W. H. Noerenberg Hatchery will occur in 1997.

The Solomon Gulch facility is expected to have a large chum salmon return as the year classes of their largest releases are returning in 1997. Again, sibling relationships between pink salmon survivals were used to adjust the forecast downward based on average survivals.

The confidence in chum salmon forecasting is low as the database used to calculate survivals is quite small. The adjusted forecast is probably realistic for both facilities and still falls within the calculated 80% confidence intervals. It also predicts the second highest hatchery chum salmon return to Prince William Sound.

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Forecast Area: Prince William Sound
Species: Sockeye Salmon

Preliminary Forecast of 1997 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
• Natural Production		
Prince William Sound — Coghill Lake		
Total Run	96.5	33.2–290.3
Escapement Goal	25.0	
Harvest Estimate	71.5	8.2–265.3
Prince William Sound — Eshamy Lake		
Total Run	58.0	12.6–176.1
Escapement Goal	40.0	
Harvest Estimate	18.0	0.0–136.1
Prince William Sound — Unakwik District		
Harvest Estimate	11.0	8.3–13.7
• Hatchery and Supplemental Production		
PWSAC [a] — Main Bay Hatchery (Eyak Stock Onsite Returns)		
Hatchery Run	3.8	3.2–4.3
Broodstock Needs	3.8	
Cost Recovery Needs	0.0	
Limited Entry Harvest	0.0	
PWSAC [a] — Main Bay Hatchery (Coghill Stock Onsite Returns)		
Hatchery Run	334.1	315.2–353.1
Broodstock Needs	0.0	
Cost Recovery Needs	180.0	176.1–191.2
Limited Entry Harvest	154.1	139.1–161.9
PWSAC [a] — Main Bay Hatchery (Coghill Stock Coghill Lake Remote Returns)		
Hatchery Run	23.9	20.9–26.9
Broodstock Needs	0.0	
Cost Recovery Needs [b]	0.0	
Limited Entry Harvest	23.9	20.9–26.9
PWSAC [a] — Main Bay Hatchery (Coghill Stock Marsha Bay Lake Remote Returns) [c]		
Hatchery Run	0.0	0.0–0.1
Broodstock Needs	0.0	
Cost Recovery Needs [b]	0.0	0.0–0.1
Limited Entry Harvest	0.0	
PWSAC [a] — Main Bay Hatchery (Eshamy Stock Onsite Returns)		
Hatchery Run	171.0	166.1–178.2
Broodstock Needs	6.0	
Cost Recovery Needs [b]	62.4	60.4–65.3
Limited Entry Harvest	102.6	99.7–106.9
PWSAC [a] — Main Bay Hatchery (Eshamy Stock Eshamy Bay Remote Returns)		
Hatchery Run	0.6	0.0–2.9
Broodstock Needs	0.0	
Cost Recovery Needs	0.0	
Limited Entry Harvest	0.6	0.0–2.9

– continued –

Preliminary Forecast of 1997 Run (continued)	Forecast Estimate (thousands)	Forecast Range (thousands)
• Total Production		
Run Estimate	730.6	460.8–1,430.6
Natural Escapement Goal	65.0	
Broodstock Needs	1.7	
Cost Recovery Needs [b]	187.7	180.2–195.2
Limited Entry Harvest	475.3	286.4–1,168.8

[a] PWSAC is an abbreviation for Prince William Sound Aquaculture Corporation.

[b] Sockeye salmon returning from brood year 1991 releases of presmolts into Marsha Bay Lake on Knight Island.

[c] Cost recovery figures include the corporation's 40% escapement, which is pooled with the W. H. Noerenberg Hatchery chum salmon for equal value plus additional sockeye salmon from the mid-run Coghill stock returning to Main Bay Hatchery, to partially pay for operation of the Gulkana Hatchery on the Copper River.

Forecast Methods

The forecast for the natural sockeye salmon run to Coghill Lake is the total of estimates for five age classes. Returns of age-1.2 and -1.3 sockeye salmon are predicted from a sibling regression model using the return of sockeye salmon from the previous year that were one ocean year younger than the predicted age. Sibling regression models are also used to predict returns of age-2.2 sockeye salmon from returns of age-1.2 sockeye salmon, and returns of age-2.3 sockeye salmon from returns of age-2.2 sockeye salmon. Finally, returns of age-1.1 sockeye salmon are predicted from the mean return of that age class. Although catch and escapement numbers as well as age-composition data are available for Coghill sockeye salmon runs since 1962, escapement numbers prior to the installation of the full weir in 1974 are considered unreliable. Therefore, only data collected since 1974 were used to calculate individual age-class forecasts and 80% confidence intervals, which were estimated using cross validation. The predicted total run to Coghill Lake and the associated 80% confidence interval is the sum of the predictions and 80% confidence intervals for all individual ages.

The forecast for the natural run to Eshamy Lake is also the total of estimates for five age classes. Returns of age-1.2 sockeye salmon are predicted from the number of spawners in parent-year escapements. Age-1.3 sockeye salmon returns are predicted from a sibling regression model using the return of age-1.2 sockeye salmon from the previous year. Sibling regression models are also used to predict returns of age-2.2 sockeye salmon from returns of age-1.2 sockeye salmon, and returns of age-2.3 sockeye salmon from returns of age-2.2 sockeye salmon. Finally, returns of age-1.1 sockeye salmon are predicted from the mean return of that age class. Eshamy Lake escapements have been enumerated since 1950, except 1987, when the weir was not operated. Commercial catches are available for the same periods, but age-composition data for Eshamy sockeye salmon are only available for some years since 1962. Escapement numbers and age-composition data were not collected in 1987. Only available data collected since 1974, excluding 1987, were used to calculate individual age-class forecasts and the 80% confidence intervals, which were estimated using cross validation. The predicted total run to Eshamy Lake and the associated 80% confidence interval is the sum of the predictions and 80% confidence intervals for all individual ages. Forecast methods differed from previous predictions that used the mean of runs achieved since 1965.

Only a harvest projection for wild stocks is made for the Unakwik District. This projection is the mean of purse seine and gillnet catches made in that district since 1968. The 80% confidence interval is the 80% confidence interval around the mean harvest.

Main Bay hatchery, operated by PWSAC, is the only facility producing sockeye salmon in Prince William Sound. Three sockeye salmon stocks are used: Coghill, Eshamy, and Eyak Lakes stocks. Forecasts are made for each stock returning to the facility (onsite returns) as well as to remote release sites (remote returns). The predicted total run for each hatchery stock and the associated 80% confidence interval is the sum of the predictions and 80% confidence intervals for all individual ages.

The forecast of the Eyak Lake sockeye salmon onsite run is based on age-specific marine survivals (0.31% for 3-year-old and 3.9% for 4-year-old sockeye salmon) obtained from brood years 1990, 1991, and 1993 hatchery releases. These are the first series of brood year survival data available since this stock has just been recently introduced into the hatchery. Survival estimates are based on fry releases, catch contribution estimates from coded wire tag recoveries, and broodstock data. No survival data from multiple brood years of this stock exist. Therefore, coefficients of variation for age-specific survival estimates based on Coghill Lake hatchery stock returns from brood years 1987 through 1991 were used to approximate 80% confidence intervals around Eyak Lake age-specific forecasts.

The forecast of the Coghill sockeye salmon stock onsite run is based on age-specific mean marine survival rates from brood year 1987 through 1992 hatchery returns (0.73% for 3-year-old, 7.35% for 4-year-old, and 2.44% for 5-year-old sockeye salmon). These rates are based on fry releases, catch contribution estimates from coded wire tag recoveries, and broodstock data. To compensate for the limited amount of data available from multiple brood years, age-specific survival estimates were calculated separately for 24 separate release groups within four complete brood years. The means of these estimates were used to forecast 3-, 4-, and 5-year-old returns, and the variance of each mean was used to estimate associated 80% confidence intervals.

The forecast of the Coghill stock return to the Coghill River remote release site is based on age-specific mean marine survival rates from three complete brood cycles (0.01% for 3-year-old, 3.05% for 4-year-old, and 2.69% for 5-year-old sockeye salmon). The coefficients of variation of age-specific survival estimates from Coghill stock hatchery returns were used to approximate 80% confidence intervals about the forecasts of 3-, 4-, and 5-year-old Coghill remote returns.

The forecast of the Coghill stock return to Marsha Bay Lake, Knight Island, remote release is based on an estimated proportion of 3-year-old sockeye salmon from previous returns of a 1991 stocking. This is the only age class that will be returning from a stocking in 1995; all returns of the 1991 stocking are essentially complete. The entire return to Marsha Bay Lake is expected to be harvested for cost recovery needs by PWSAC.

The forecast of the late-run Eshamy sockeye salmon onsite run is based on age-specific marine survival rates from three complete brood year cycles of hatchery returns (0.25% for 3-year-old, 11.01% for 4-year-old, and 0.05% for 5-year-old sockeye salmon). Coefficients of variation for age-specific survival estimates from Coghill stock hatchery returns were used to estimate 80% confidence intervals about the forecasts of late-run Eshamy stock hatchery returns.

The forecast of the Eshamy late-run stock return to the Eshamy River remote release site is based on marine survivals from two complete brood cycles (0.13% for 3-year-old, 5.64% for 4-year-old, and 0.09% for 5-year-old sockeye salmon). The coefficients of variation of age-specific survival estimates from Coghill stock hatchery returns were used to approximate 80% confidence intervals about the forecasts of 3-, 4-, and 5-year-old Eshamy remote returns.

Projected broodstock needs for each facility are based on the expected number of eggs produced from each female and the expected percentage of females in the broodstock. Broodstock needs do not change unless hatchery program changes occur. PWSAC cost recovery needs for sockeye salmon are pooled with early chum salmon returns to W. H. Noerenberg Hatchery and will vary depending upon numbers of returning salmon and revenues needed for operating Gulkana Hatchery in the Copper River drainage. The 80% confidence interval about projected cost recovery harvest needs for each stock is estimated to be 40% of the upper and lower bounds of the 80% confidence limit calculated for the total return of that stock minus broodstock needs. In the case of the Coghill stock onsite return, additional sockeye salmon were added to each bound to provide for Gulkana Hatchery operating costs.

Forecast Discussion

Biological escapement goals for the Coghill Lake natural return were met in 1997 for the third time since 1990. The forecast for the natural run to Coghill Lake in 1997 of approximately 96.5 thousand sockeye salmon is an improvement over the very low runs of recent years, but is still only half of the 1962-1996 average run of 190.0 thousand for this system. Poor runs of natural Coghill sockeye salmon in recent years appear to be due, in part, to limnological conditions in Coghill Lake. In fact, the biological escapement goal for this system has been temporarily lowered to allow plankton populations to recover. In addition, a cooperative project with the U.S. Forest Service is underway to improve the forage base for rearing sockeye salmon juveniles through the addition of fertilizers to Coghill Lake. Returns in 1996 marked the beginning of a return to previous higher production levels and are expected to continue in 1997.

The Eshamy Lake natural stock is the largest natural stock contributor to commercial harvests of sockeye salmon outside the Coghill District. The Eshamy Lake natural run has historically contributed substantially to the incidental harvest of the purse seine fishery in the Southwest District. Although weir counts of escapement into Eshamy River have been made for 50 years, it has been only recently that age, sex, and size data have been collected from the escapement, the Eshamy District directed harvest, and the Southwest District incidental harvest. These data were used to construct brood tables for this run and were used for the first time to calculate the 1997 forecasts. Age-composition data and weir counts were not collected in 1987, however, due to budget shortfalls. This data gap will continue to complicate predictions for several years. Contributions to commercial harvests in western Prince William Sound of sockeye salmon produced by the Main Bay Hatchery were estimated through the recovery of coded wire tags, but not all harvests could be adequately estimated. Future funding for this project is uncertain.

Onsite returns of the Eyak hatchery stock will be small in 1997. The return will consist entirely of returning 4-year-old sockeye salmon from 90 thousand zero-check smolts that were released in 1993. The remainder of the production from the 1992 brood year was destroyed after stricken by infectious hematopoietic necrosis virus (IHNV) in the hatchery.

The onsite hatchery return of Coghill stock sockeye salmon in 1997 is expected to be greater than the 1996 return. The forecast of 3-year-old sockeye salmon has been reduced based on an emergency release of that year class in January because of a pipeline failure. The 4-year-old age class dominates the hatchery return of this stock and very few coded-wire-tagged 3-year-old sockeye salmon were recovered in 1996. However, few 3-year-old sockeye salmon are typically found in the return and modification of the forecast based on sibling relationships is difficult. This stock will not be used for broodstock in 1997 since PWSAC will be trying to develop an early and late sockeye salmon run rather than continuing the production of a mid-run stock.

A remote release of Coghill hatchery stock back into the Coghill system to supplement natural production ended with a stocking of presmolts in 1995. This decision was based on the late run timing and delayed entry into fresh water of returning adults produced by stocking. The presence of these milling sockeye salmon made it difficult to manage the commercial harvest, and they may not have made a significant contribution to the spawning population. The 1997 Coghill system remote release return will be composed of adults released as smolts (brood year 1992) in Coghill River and as presmolts (brood years 1993 and 1994) in Coghill Lake. Presmolt-to-adult survival data are not available because these are the first returns from that stocking strategy and the hatchery forecast only encompasses the smolt stocking of 1992. The stocked presmolts are included in the natural production forecast because they were mixed with naturally produced fry at the time of release. Enhanced and natural smolts were counted at a weir on the Coghill River during emigration and contribution estimates, by stock, of emigrating smolts are not available. The midpoint forecast for the return of sockeye salmon stocked as smolts is probably low. The 1996 return had extremely high survivals of 4-year-old fish that could indicate a larger-than-expected return of 5-year-olds. However, it is possible

that smolts released from Main Bay Hatchery would mature at ages similar to onsite hatchery returns, which primarily return as more 4-year-olds and fewer 5-year-olds than the naturally produced Coghill stock.

Remote release of Coghill hatchery stock presmolts in 1992 into Marsha Bay Lake were harvested for cost recovery needs by PWSAC in 1995 and 1996. The 1997 forecast return is composed entirely of 3-year-old sockeye salmon stocked into the lake as presmolts in November 1995. The forecast is based entirely on the predicted return of jacks from a model of wild Coghill Lake returns.

The onsite hatchery return of the Eshamy stock is expected to be composed almost entirely of late-run 4-year-old sockeye salmon. The forecast is based on the expected survival of smolts released in 1995 is an improvement over the 1996 return, which was adversely affected by outbreaks of IHNV. All presmolts from the 1991 brood year were destroyed after stricken by IHNV in the hatchery, and sockeye salmon from the 1992 brood year were exposed during release. Coded wire tag recoveries in 1996 indicated a very high number of 3-year-old sockeye salmon in the return, which could indicate a large number of 4-year-olds in 1997. If the 3-year-old component is accurate and a strong sibling relationship exists, the return could be twice the current forecast. Since only two complete brood year returns for this hatchery stock exist, the model is weak and has no past history that can be used for modifying the forecast.

Remote release of Eshamy hatchery stock into the Eshamy system ended with a stocking of smolts in 1994 from the 1992 brood year. Since returns consist almost exclusively of 4-year-old sockeye salmon, 1997 will be the last year that hatchery stocking will significantly supplement natural production in this system. The decision to terminate this remote release was based on reasons similar to those noted for the Coghill system: late run timing and delayed freshwater entry of supplemented sockeye salmon.

All supplemental production of sockeye salmon at Coghill River and Eshamy Bay remote release sites were assigned to the limited entry commercial harvest. However, no fishing will occur at these sites until biological escapement goals are attained in the Coghill and Eshamy systems. If the large chum salmon forecast for W. H. Noerenberg Hatchery is realized, a portion of the Coghill Lake sockeye salmon run would probably be taken during cost recovery and during commercial harvests directed at the chum salmon run. If this incidental harvest takes a large proportion of the Coghill run, there may be no surplus available for a directed harvest.

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Forecast Area: Prince William Sound
Species: Coho Salmon

Preliminary Forecast of 1997 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
• Hatchery and Supplemental Production		
VFDA [a] *— Solomon Gulch Hatchery*		
Hatchery Run	140.5	108.8–172.2
Broodstock Needs	1.5	
Cost Recovery Needs	16.0	
Common Property Harvest [b]	123.0	91.3–154.7
Historical Survival for Odd Years: Range = 0.9%–14.5%; Mean = 7.6%		
PWSAC [c] *— W. H. Noerenberg Hatchery (Onsite Releases)*		
Hatchery Run	13.2	9.8–16.7
Broodstock Needs	0.2	
Cost Recovery Needs	8.0	5.8–10.1
Common Property Harvest	5.0	3.8–6.4
Historical Survival for Odd Years: Range = 3.0%–14.3%; Mean = 7.5%		
PWSAC [c] *— W. H. Noerenberg Hatchery (Remote Releases)* [d]		
Hatchery Run	7.4	5.4–9.3
Broodstock Needs	0.0	
Cost Recovery Needs	0.0	
Common Property Harvest [b]	7.4	5.4–9.3
• Total Hatchery Production		
Run Estimate	161.1	124.0–198.2
Broodstock Needs	1.7	
Cost Recovery Needs	24.0	21.8–26.1
Limited Entry Harvest	135.4	100.5–170.4

[a] VFDA is an abbreviation for Valdez Fisheries Development Association.

[b] Includes recreational fishing harvest.

[c] PWSAC is an abbreviation for Prince William Sound Aquaculture Corporation.

[d] Includes remote releases at Whittier, Chenega, and Cordova.

Forecast Methods

Harvest projections for natural coho salmon in Prince William Sound have typically been estimated from the mean of historical annual harvests of this species. In recent years commercial harvests have primarily targeted hatchery returns, so no stock contribution estimates are available to assess natural production. Estimates of sport harvests, which do target natural coho salmon, are not available until the following summer. For these reasons, no projection is estimated for natural production of this species for 1997.

The forecast for each hatchery return is the product of the number of smolts released from each facility in 1996 and the mean marine survival achieved for each facility (7.6% for Solomon Gulch Hatchery and 7.5% for W. H. Noerenberg Hatchery). Forecast ranges are based on 80% confidence intervals about mean survivals.

Forecast Discussion

The coho smolt release from the Solomon Gulch Hatchery in 1996 was the largest ever attained for that facility, while the release from W. H. Noerenberg Hatchery was greatly reduced. Recent improvements in fish culture practices at W. H. Noerenberg Hatchery have resulted in the production of larger, more vigorous smolts. This could produce an actual return greater than the midpoint forecast. Marine survival estimates for coho salmon hatchery stocks were not based on tagging data, but were based on the assumption that all harvest taken in the vicinity of a hatchery is composed of production from that hatchery. Survival estimates could be overly optimistic if hatchery and natural runs mix in harvest areas. The PWSAC corporate harvest includes 40% of the production from remote releases at Cordova and Whittier.

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Forecast Area: Prince William Sound
Species: Chinook Salmon

Preliminary Forecast of 1997 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
• Hatchery and Supplemental Production		
PWSAC [a] — W. H. Noerenberg Hatchery (Onsite Releases)		
Hatchery Run	8.00	6.0–10.8
Broodstock Needs	0.02	
Cost Recovery Needs	3.20	2.4–4.3
Common Property Harvest	4.80	3.6–6.5
Historical Survival for Odd Years: Range = 0.45%–3.56%; Mean = 2.33%		
PWSAC [a] — W. H. Noerenberg Hatchery (Remote Releases)		
Hatchery Run	7.70	5.8–9.5
Broodstock Needs	0.00	
Cost Recovery Needs	0.00	
Common Property Harvest	7.70	5.8–9.5
Historical Survival for Odd Years: Range = 0.31%–8.16%; Mean = 4.24%		
• Total Hatchery Production		
Run Estimate	15.70	11.8–20.3
Broodstock Needs	0.02	
Cost Recovery Needs	3.20	2.4–4.3
Common Property Harvest	12.50	9.4–16.0

[a] PWSAC is an abbreviation for Prince William Sound Aquaculture Corporation.

Forecast Methods

The forecast of the chinook salmon hatchery return includes predictions for onsite returns to the hatchery as well as returns to remote release sites near Whittier, Cordova, and Chenega. Harvest estimates include recreational harvests. Returns are predicted as the product of the number of smolts released at each site and the estimated average marine survival for releases from 1993 through 1996. Marine survival is based on coded wire tag recoveries from harvests in the Coghill District, broodstock, and the estimated sport catch at all the release sites for two brood years. The 80% confidence intervals were based on the 80% confidence interval about the mean of the survivals.

Forecast Discussion

W. H. Noerenberg Hatchery is the only facility that releases chinook salmon in Prince William Sound. In 1994 PWSAC reduced the scope of this program to maintaining a chinook salmon broodstock at the hatchery. This has resulted in decreased egg takes and smolt releases as well as reduced remote releases of smolts, which contribute mostly to recreational fisheries.

Tim Joyce
Area Resource Development Biologist
Cordova

Forecast Area: Copper River
Species: Sockeye Salmon

Preliminary Forecast of 1997 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
• Natural Production		
Total Run	1,985.6	1,093.8–3,604.7
Escapement Goal	480.0	
Common Property Harvest	1,504.2	998.6–2,009.7
• Hatchery and Supplemental Production		
PWSAC [a] — Gulkana Hatchery		
Hatchery Run	250.3	172.8–327.8
Broodstock Needs	20.0	
Supplemental Escapement [b]	58.6	
Common Property Harvest	171.7	114.0–229.5
• Total Production		
Run Estimate	2,235.9	1,266.6–3,932.5
Natural Escapement Goal	480.0	
Broodstock Needs	20.0	
Supplemental Escapement [b]	58.6	
Common Property Harvest	1,675.6	1,112.6–2,239.2

[a] PWSAC is an abbreviation for Prince William Sound Aquaculture Corporation.

[b] Hatchery production that will not be harvested to ensure natural escapement into the Upper Copper River is achieved, since natural stocks cannot sustain the higher exploitation levels of hatchery stocks.

Forecast Methods

The total forecast of natural sockeye salmon production is the sum of run estimates for the Copper River Delta and upper Copper River. These estimates were calculated as the product of historical mean return-per-spawner values and parent-year escapements weighted by age class (4-, 5-, and 6-year-old sockeye salmon). Mean return-per-spawner values were based on a linear regression of adult production on brood year escapements. The 80% confidence interval for the total forecast of natural production was estimated from cross validation. Past forecast methods differed slightly from this forecast in that return-per-spawner estimates were based either on the most similar 5 or 6 years of age-5 parent-year return data or on the average return-per-spawner value for the most recent 5-year period.

Supplemental production from Gulkana Hatchery was predicted using survival estimates based on coded wire tag recoveries from harvests and enumerated escapements to Crosswind and Summit Lakes. Survival of juveniles released into Paxson Lake was assumed to be intermediate between these estimates. The average total harvest rate for 1966–1996 (68.6%) was used to calculate the total projected harvest of Gulkana Hatchery stocks. The 80% confidence interval for the forecast of supplemental production was calculated using mean square error estimates calculated for natural runs.

Forecast Discussion

Previous forecasts have relied on the rather poorly defined relationship between number of spawners and subsequent returns, using return-per-spawner values for parent-year abundance similar to that of the dominant age class of the forecast year. Visual inspection of return-per-spawner values for the period 1966–1996 suggests they may cycle, possibly in response to cyclic environmental conditions, although a Durbin-Watson Test indicated that autocorrelation among years was not statistically significant. Rather than use the average return-per-spawner value from the most recent 5 or 6 years, as was done for the 1995 forecasts to capture the apparent trend, the 1997 forecast employed a linear regression of the logarithm of return-per-spawner values for the 1961–1992 brood years on age-weighted parent-year escapements. Previous forecasts used return-per-spawner values selected from 5 or 6 past brood years, for which 5-year-old spawner abundance was similar, and the net effect is similar to using the regression. Even if a weak cycle is present, current trends generally seem to favor average return-per-spawner values with moderate variability. Therefore, there is little difference between mean return-per-spawner values calculated for the most recent 5 or 6 years and values calculated for past brood years for which 5-year-old spawner abundance was similar to those for the brood years in the forecast. Pooled results of linear regressions of sibling returns produced an estimate similar to the projection, but age-composition data for some escapements in recent years are not yet available and the return-per-spawner relationship was used to predict natural runs.

The 1997 run will be composed primarily of returns from the 1992 and 1993 brood years, with 5-year-old sockeye salmon of the 1992 brood year expected to dominate Copper River Delta and upper Copper River runs.

John Wilcock
PWS Research Project Leader
Cordova

Forecast Area: Copper River
Species: Chinook Salmon

Preliminary Forecast of 1997 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
• Natural Production		
Total Run	37.4	10.8–63.9
Escapement Goal	15.0	
Harvest Estimate	22.4	4.2–40.5

Forecast Methods

The 1997 chinook salmon forecast was based on historical aerial survey indices, estimated contributions of age-4, -5, -6, and -7 spawners to each annual escapement index, and total annual harvests. First, an age-specific annual spawner index was calculated by multiplying each annual aerial survey index by the proportion of each age class in samples obtained that same year. Next, an age-specific spawning population index for the return year was calculated by summing appropriate annual spawner indices. For example, the spawning population index for the 1997 return was the sum of indices for 1993 age-4, 1992 age-5, 1991 age-6, and 1990 age-7 spawners. Finally, the spawning population index was multiplied by the ratio of the average annual escapement index to the average annual total harvest. The 80% confidence interval of the forecast was calculated from the mean square error of forecasts made for the previous 13 years using this same method.

Forecast Discussion

During the past 14 years, chinook salmon runs to the Copper River have tended to be above average, and several catch records have been set. For example, the 1995 run exceeded the 1966–1994 average run by 115%. Escapements appear to have been maintained at high levels, and environmental conditions generally appear to favor continued good production. However, aerial surveys were not conducted on the upper Copper River in 1993 and surveys in 1995 were not considered reliable. It will not be possible to continue to forecast chinook total run abundance using this same method until spawning escapements are indexed or enumerated for a period of several years. In addition, because chinook salmon appear to be continuing through a period of generally increasing productivity, all but two of the predictions for the previous 13 years have been below actual runs.

John Wilcock
PWS Research Project Leader
Cordova

Forecast Area: Copper and Bering Rivers
Species: Coho Salmon

Preliminary Forecast of 1997 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
• Harvest Projection for Natural Run		
Copper River District	337.2	133.8–540.5
Bering River District	139.0	2.2–275.8

Forecast Method

The harvest projection for the 1997 run of coho salmon to the Copper and Bering Rivers is the average limited entry commercial fishery harvest for 1980–1996. The range is the 80% confidence interval about the mean harvest.

Forecast Discussion

Temperature, snow cover, water level, and general weather conditions were generally within normal ranges during the freshwater residency of the two brood years (1993 and 1994) expected to predominate the 1997 run. Freshwater survival was probably good as well. Improvements in forecast accuracy may be realized by using environmental data for freshwater residency years in conjunction with overwinter survival data for coho salmon rearing in U.S. Forest Service spawning channels and estimates of returning adults at U.S. Forest Service weirs. Collection of climatological and coho salmon data in cooperation with the U.S. Forest Service began in 1994.

John Wilcock
PWS Research Project Leader
Cordova

Forecast Area: Upper Cook Inlet
Species: Sockeye Salmon

Preliminary Forecast of 1997 Run	Forecast Estimate (millions)	Forecast Range (millions)
• Natural Production		
Total Run	6.8	2.9–10.7
Escapement Goal		1.5
Harvest Estimate		5.3

Forecast Methods

The major sockeye salmon systems in Upper Cook Inlet are the Kenai, Kasilof, Susitna, and Crescent Rivers, Packers Creek, and Fish Creek. Spawner, sibling, and smolt data, if available, were examined for each system. Forecasts for all systems, except Kenai River age 1.3, were made from two models: one using the relationship between adult returns and spawner data and the other the relationship between adult returns and sibling data. Forecasts for age-1.3 Kenai River sockeye salmon were made by averaging results from the relationship between adult returns and fall fry estimates and the relationship between adult returns and sibling data. An approximate 80% confidence interval was calculated using the squared deviation between past forecasts and actual returns as the forecast variance (mean square error).

Forecast Discussion

The actual total run of sockeye salmon to Upper Cook Inlet in 1996 was 5.6 million fish, while the preseason forecast was 4.8 million. Individual forecasts for most systems are within recent historical trends, so there is no reason to suspect an individual forecast is in error. However, the Kenai River forecast has great uncertainty associated with it. The sibling model used to predict the age-1.3 (5-year-old) component of the run estimated an adult return of 1.48 million sockeye salmon. However, estimates of the number of fry rearing in Kenai and Skilak Lakes suggest the age-1.3 return could be 4.97 million sockeye salmon. Since we have no way to determine which data set would provide a more accurate prediction, we used the average of these two estimates for the 1997 forecast. If the lower estimate is correct, the harvest would be reduced by 1.7 million sockeye salmon. Conversely, if the higher estimate is correct, the harvest would be increased by 1.7 million sockeye salmon.

Forecasted runs to individual freshwater systems are as follows:

System	Run
Crescent River	194,000
Fish Creek	302,000
Kasilof River	741,000
Kenai River	4,032,000
Packers Creek	85,000
Susitna River	576,000
Minor System	889,000

Kenneth E. Tarbox
Research Project Leader
Upper Cook Inlet

Forecast Area: Lower Cook Inlet

Species: Pink Salmon

Preliminary Forecast of 1997 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
• Natural Production		
Total Run	1,011	214–4,975
Escapement [a]	375	183–478
Commercial Harvest [b]	636	
• Supplemental Production		
Total Run	2,625	1,050–4,200
Broodstock	150	
Commercial Harvest [b]	2,475	
• Total Production		
Total Run	3,636	1,264–9,176
Broodstock and Escapement [a]	525	
Commercial Harvest [b]	3,111	

[a] Escapement values include an escapement goal shortfall of 7,107 fish for systems with a forecast in 1997.

[b] Commercial Harvest = Total Run – Escapement/Broodstock. Commercial harvests of supplemental production include both common property and cost recovery harvests. Additional harvests may be expected in systems not included within the forecast.

Forecast Methods

The forecast of wild pink salmon runs to 11 harvest areas in the lower Cook Inlet management area was based on log-log regression and Ricker Curve analysis using 22 to 34 years of escapement observations. A forecast range of natural production was developed from cross-validation errors. The projected harvest from natural production was obtained by subtracting both escapement goals and escapement shortfalls from the forecast. A forecast range of supplemental production in Tutka Bay was based on ocean survival rates of 1% to 4%. The projected harvest from supplemental production was obtained by subtracting broodstock goals from the supplemental production forecast.

Forecast Discussion

The natural production model was tested with cross-validation methods. During simulation tests the model correctly predicted 30 out of 34 directions of change in annual run size. Accordingly, we have some confidence that the 1997 total return will continue the cycle of more fish returning in odd-numbered years. In contrast, Resurrection Bay system runs are unusual in that they exhibit a strong even-year cycle. We have been less successful in correctly predicting the actual size of runs, although forecasts have usually fallen within the 80% confidence interval. For example, in 1995, the last odd-numbered year, 10 of the 11 systems for which a forecast was made had runs within the forecast range. The 1997 forecast of 1.01 million pink salmon has an 80% confidence interval of 214.49 thousand to 4.97 million pink salmon. If realized, a natural run of 1.01 million pink salmon would exceed the median run size of 671.70 thousand fish for odd years between 1963 and 1995. The pink salmon escapement goal is 382.50 thousand for systems with a forecast and 489.0 thousand for all

lower Cook Inlet systems, including those without a forecast. An escapement goal shortfall of 7.11 thousand fish is anticipated for systems with a forecast in 1997.

In the Southern District, projected pink salmon harvests are 34.0 thousand fish in Seldovia and more than 78.0 thousand fish in Humpy Creek. No harvest is expected in Port Graham, which also failed to achieve its escapement goal during 1993–1995. Additional harvests are expected in China Poot Bay and the Barabara Creek area. Supplemental production of pink salmon in the Southern District has contributed from 24% to 90% of the total lower Cook Inlet commercial harvest in recent years. However, declining pink salmon prices concurrent with recent hatchery cost recovery requirements have reduced the harvest available for the common property fishery; only about 7% of the pink salmon returning to Tutka Bay and Tutka Lagoon were harvested in the common property fishery in 1996. Short-term-rearing enhancement projects are expected to produce harvests of 2.6 million pink salmon in Tutka Bay and Tutka Lagoon in 1997. Because cost recovery requirements are dependent upon inseason fish prices, the allocation of supplemental production between common property and cost recovery fisheries cannot be determined at this time. The Halibut Cove Lagoon enhancement project has been discontinued for several years and no harvest is expected in that area.

In the Outer District, harvests are projected to be 15.0 thousand pink salmon in Port Chatham, 24.0 thousand in Port Dick, 23.0 thousand in Windy Bay, and 39.0 thousand for Nuka Island. No harvests are anticipated for Rocky Bay.

In the Eastern District, a harvestable surplus of 65.0 thousand pink salmon is projected for Resurrection Bay. This would be the largest odd-year harvest in the Eastern District since 1986.

In the Kamishak Bay District, harvests are forecasted to be 302.0 thousand fish in Bruin Bay and 52.0 thousand fish in Ursus and Rocky Coves. If realized, these harvests, combined, will be the second highest on record for Kamishak Bay District fisheries.

Edward O. Otis
Lower Cook Inlet Research Biologist
Homer

Nick Dudiak
Area Resource Development Biologist
Homer

Forecast Area: Kodiak
Species: Pink Salmon

Preliminary Forecast of 1997 Run	Forecast Estimate (millions)	Forecast Range (millions)
• Natural Production		
Natural Run	16.8	6.3–16.8
Escapement Goal [a]	2.0	2.0
Commercial Common Property Harvest	14.8	4.3–14.8
• Hatchery Production [b]		
Hatchery Run	7.1	2.1–13.7
Broodstock Needs	0.3	0.3
Commercial Common Property Harvest	6.8	1.8–13.4
• Total Production		
Total Run	23.9	8.4–30.5
Broodstock and Escapement	2.3	2.3
Commercial Common Property Harvest	21.6	6.1–28.2

[a] Midpoint indexed escapement goal.

[b] Hatchery forecast was prepared by the Kitoi Bay Hatchery Manager. See Afognak District on next page for details.

Forecast Methods

The forecast for the 1997 natural pink salmon run to the Kodiak management area was calculated from a stepwise multiple regression analysis of preemergent pink salmon sampling data from the past 31 years. Variables used in the analysis were the indexed live fry densities for Kodiak and Afognak Islands, the March and April ambient air temperatures in Kodiak, and temperature departures from the average. Eight combinations of variables were tested, and the model with the lowest error and highest R^2 value was chosen. A point estimate for the total return to the Kodiak management area was determined, with the upper and lower ranges being 80% prediction intervals. The model utilizing the unweighted live fry index for Kodiak and Afognak Islands and April temperatures was chosen as the best model for the 1997 forecast. Confidence in this forecast is fair. The forecast for the 1997 Kitoi Bay Hatchery pink salmon run was developed using survival rates from the 1978–1995 brood years. The range estimates were calculated by using the average survival rate of the two lowest and two highest odd-year returns.

Forecast Discussion

Preemergent pink salmon fry sampling of the Kodiak management area index streams conducted during March and April of 1996 indicated only fair overwinter survival of the eggs and sac fry. These fry were from a near-record brood year escapement in 1995; the indexed escapement estimate was 10.5 million pink salmon. Sampling resulted in an unweighted live fry index of 164.2 live fry/m^2 of spawning area. This live fry index ranks as the ninth highest of the past 16 odd-year indices on record.

Fall weather conditions in the Kodiak management area were poor, with heavy rain and flooding of streams. It is suspected that eggs from much of the early pink salmon escapements were washed out; however, there were significant numbers of pink salmon still entering the streams in the late fall. Conditions were cold in mid winter but with good snow cover. During the sampling period most of the index streams were open. There were record high temperatures in early March, so preemergent sampling was completed earlier than in past years. Large numbers of recently hatched fry and live eggs were found in many systems. All lakes, including Karluk Lake, were breaking up near the end of March, and the water level in most streams was high. Signs of heavy flooding from fall rains and some ice scouring from spring breakup were seen on most streams. Because of budget concerns there was no attempt to sample Mainland District streams.

Early spring conditions in 1996 were good to excellent for outmigration and rearing in the nearshore ocean environment. Ambient air temperatures, as measured in Kodiak, were well above average in March and above average in April. The Kitoi Bay Hatchery Manager reported that spring plankton production was very good at the time of outmigration of wild pink salmon fry and release of hatchery-produced fry. Late spring and summer weather conditions were also excellent. Prior to 1989 Kodiak management area pink salmon returns were considered even-year dominant, with the large returns occurring in even years followed by small returns in odd years. Since 1989 dominance has switched, possibly due to extremely differential environmental conditions; odd-year returns of pink salmon have become larger than even-year returns. The 1993 and 1995 pink salmon returns broke all previous production records. Also, in three of the past four odd-year cycles, the Kodiak management area pink salmon forecast has underpredicted the number of returning pink salmon.

Regression of past fry indices and subsequent returns predicts a point estimate of 11.6 million natural run pink salmon returning in 1997, with a range of 6.8 million–16.8 million. Because of the favorable conditions for pink salmon fry outmigration and spring and summer survival, and the recent trend for large odd-year returns, it is suspected there will be better-than-average returns in 1997. Therefore, the actual 1997 wild stock return will likely exceed the point estimate of 11.6 million and should approach the high end of the forecast at 16.8 million pink salmon. The 1997 forecast, broken down by district, follows:

- Afognak District: All index streams showed signs of flooding and freezing. Large numbers of live eggs were found in several systems and up to half of all fry found were only recently hatched. The overall preemergent live fry index is lower than the past three odd-year cycles. Sampling results were mixed, with two systems (Danger and Paramanof) having much lower indices than in past years, while in all other systems live fry survival was above recent odd-year indices. Due to good early marine conditions a total return of 2.0 million pink salmon is expected. The mid-point escapement goal is 166.0 thousand, so the harvestable surplus is expected to be 1.83 million pink salmon.

- Afognak District Supplemental Production: Favorable early marine conditions are expected to produce good survival. Fry condition upon release was above average, and the Hatchery Manager reported significant plankton production at the time of release. In 1995 the hatchery released 139.04 million reared fry and 5.0 million emergent fry. It is felt that the 1997 return will achieve at least the midpoint estimate of 7.06 million pink salmon. Only 250.0 thousand pink salmon are needed for stream escapement and broodstock requirements, leaving 6.81 million available for harvest.

- Alitak District: Live fry densities for this district were slightly below the recent odd-year average. Flooding was evident on most streams. Again, fry survival results were mixed. A smaller stream sampled, Narrows Creek, had very good survival, as did the lower portions of the Humpy and Deadman Rivers. A return of 3.8 million pink salmon is expected for this district. The

midpoint escapement goal is 424.0 thousand pink salmon, leaving about 3.38 million available for harvest.

- Eastside Districts: Heavy flooding was evident in most streams within these districts. The overall live fry index for these districts is lower than recent odd-year indices, but survival was very mixed. There were good fry densities in Kaiugnak, Barling, American, and Sheratin Rivers. The adult return in 1997 should be good. Approximately 5.0 million pink salmon are forecasted to return to these districts, and subtracting the midpoint escapement goal of 500.0 thousand pink salmon leaves 4.5 million available for harvest.

- Mainland District: No sampling was conducted due to budget constraints. Pink salmon escapements to the Mainland District were very good, though it is suspected that Mainland District streams also flooded in the fall of 1995. The pink salmon return in 1997 is expected to near 1.2 million fish. Midpoint escapement requirements are 430.0 thousand pink salmon, leaving a harvestable surplus of 770.0 thousand.

Kevin Brennan
Fishery Biologist
Kodiak

Ivan Vining
Westward Region Biometrician
Kodiak

Forecast Area: Kodiak, Upper Station (Early Run)
Species: Sockeye Salmon

Preliminary Forecast of 1997 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
• Total Production		
Total Run Estimate	129	81–513
Escapement Goal		50–75
Harvest Estimate	79	

Forecast Methods

The Upper Station 1997 early-run forecast was derived using simple linear regression models that employed recent brood year (1980–1992) sibling relationships. Selection of prediction models using sibling data encompassed analysis of outlier data points, residuals, and use of dependent variable transformations (log and square root) where applicable. Model selection for an age-class estimate was based upon identifying a model that had a reasonable biological interpretation, coupled with possessing low error and a high R^2 value. The forecast range was derived by combining the 80% prediction intervals for each individual age-class estimate. Minor age classes (ages 1.1 and 2.1) were not estimated. These minor age classes will invariably contribute to the run and therefore impart error.

Forecast Discussion

The 1997 forecast is about 15.0 thousand fish larger than the 1996 forecast and about 84.0 thousand fish less than the actual 1996 run of 213.0 thousand fish. Our confidence in this forecast is fair, largely due to the error experienced in the 1996 forecast. The 1997 run should be composed of 59% 5-year-old fish and 29% 6-year-old fish.

The projected harvest of 79.0 thousand is founded upon achievement of the lower end of the escapement goal range of 50.0 thousand. Age-2.2 fish should compose 49% of the 1997 run, followed by age 2.3 at 28% and age 1.2 at 14%.

The run reconstruction and commercial catch apportionment program for this sockeye salmon stock continues to be improved. Over time, these changes should be reflected in forecast accuracy.

Kevin Brennan
Fishery Biologist
Kodiak

Ivan Vining
Westward Region Biometrician
Kodiak

Forecast Area: Kodiak, Upper Station (Late Run)
Species: Sockeye Salmon

Preliminary Forecast of 1997 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
• Total Production		
Total Run Estimate	836	68–1,724
Escapement Goal		150–200
Harvest Estimate	636	

Forecast Methods

The Upper Station 1997 late-run forecast was derived using simple linear regression models that employed recent brood year (1980–1992) sibling relationships. Selection of prediction models using sibling data encompassed analysis of outlier data points, residuals, and use of dependent variable transformations (log and square root), where applicable. Model selection for an age-class estimate was based upon identifying a model that had a reasonable biological interpretation, coupled with possessing low error and a high R^2 value. The forecast range was derived by combining the 80% prediction intervals for each individual age-class estimate. Minor age classes (ages 1.1 and 2.1) were not estimated. These minor age classes will invariably contribute to the run and therefore impart error.

Forecast Discussion

The 1997 forecast is about 385.0 thousand fish greater than the 1996 forecast and about 68.0 thousand fish less than the actual 1996 run of 902.0 thousand fish. Our confidence in this forecast is fair, largely due to the observed error of the 1996 forecast. The 1997 run should be composed of 45% -5-year-old fish, 24% 4-year-old fish, and about 2% 6-year-old fish.

The projected harvest of 636.0 thousand is founded upon achievement of the upper end of the escapement goal range of 200.0 thousand. Age-2.2 fish should compose 45% of the 1997 run, followed by age 1.2 at 24% and age 2.3 at 2%.

The run reconstruction and commercial catch apportionment program for the Upper Station late-run stock continues to be improved. Over time, these advancements should be reflected in increased forecast accuracy.

Kevin Brennan
Fishery Biologist
Kodiak

Ivan Vining
Westward Region Biometrician
Kodiak

Forecast Area: Kodiak, Frazer Lake (Dog Salmon)
Species: Sockeye Salmon

Preliminary Forecast of 1997 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
• Total Production		
Total Run Estimate	913	457–1,859
Escapement Goal	140	140–200
Harvest Estimate	773	

Forecast Methods

The Frazer Lake (Dog Salmon) 1997 run forecast was derived using simple linear regression models that employed recent brood year (1981–1993) data. When constructing and evaluating each of the regression models, standard regression diagnostic procedures were considered and applied where appropriate (e.g., removal of outliers and examination of residual and normal probability plots to identify violations from assumptions). The total run forecast and range were calculated by summing individual age-class estimates along with upper and lower 80% prediction intervals over all ages. Results from the age-2.2 and -2.3 models were compared to estimates derived from models using smolt data; they were found to be in close agreement.

Forecast Discussion

The 1997 run should be approximately 200.0 thousand fish larger than the 1996 run of 700.0 thousand fish and composed of greater than 80% 2-ocean fish. The forecast and projected harvest are for the Alitak Bay District only; we assume that fishing time and effort within Kodiak's westside commercial fisheries will be similar to 1996, at least through July 6. If this assumption holds true than a harvest in excess of 500.0 thousand will be realized. Confidence in this forecast is good.

The projected harvest of 500.0 thousand is founded upon achievement of the minimum escapement goal of 140.0 thousand fish. Use of only recent-year data is based upon increased production trends (return per spawner) observed in this and other systems compared to pre-1980 production.

Kevin Brennan
Fishery Biologist
Kodiak

Ivan Vining
Westward Region Biometrician
Kodiak

Forecast Area: Kodiak, Ayakulik (Red River)
Species: Sockeye Salmon

Preliminary Forecast of 1997 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
• Total Production		
Total Run Estimate	835	385–1,691
Escapement Goal	300	200–300
Harvest Estimate	535	

Forecast Methods

The Ayakulik (Red River) 1997 forecast was derived using simple linear regression models that employed recent brood year (1980–1992) sibling relationships. Selection of prediction models using sibling data encompassed analysis of outlier data points, residuals, and use of dependent variable transformations (log and square root), where applicable. Model selection for an age-class estimate was based upon identifying a model that had a reasonable biological interpretation, coupled with possessing low error and a high R^2 value. The forecast range was derived by combining the 80% prediction intervals for each individual age-class estimate. Minor age classes (ages 1.1 and 2.1) were not estimated.

Forecast Discussion

The 1997 forecast is about 100.0 thousand fish larger than the 1996 forecast and about 300.0 thousand fish less than the actual 1996 run of 1.24 million fish. Our confidence in this forecast is fair, largely due to the error experienced in the 1996 forecast. The 1997 run should be composed of 50% 5-year-old fish and 35% 6-year-old fish.

The projected harvest of 535.0 thousand is founded upon achievement of the upper end of the escapement goal range of 300.0 thousand. Age-2.2 and -2.3 fish should compose 35% of the 1997 run, followed by age 1.3 at 14%.

The run reconstruction and commercial catch apportionment program for the Ayakulik River sockeye salmon stock continues to be improved. Over time, improvements should be reflected in forecast accuracy.

Kevin Brennan
Fishery Biologist
Kodiak

Ivan Vining
Westward Region Biometrician
Kodiak

Forecast Area: Kodiak, Spiridon Lake
Species: Sockeye Salmon

Preliminary Forecast of 1997 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
• Total Production		
Total Run Estimate	164	98–230
Escapement Goal		
Harvest Estimate	164	98–230

Forecast Methods

The 1997 Spiridon Lake forecast is based on 1994 and 1995 smolt population estimates and 1994–1996 adult harvest age composition. In 1994, 625.0 thousand age-1 and 221.0 thousand age-2 smolts migrated from Spiridon Lake. In 1995, 362.0 thousand age-1 and 231.0 thousand age-2 smolts migrated from Spiridon Lake. Smolt-to-adult survival from fry stocking has averaged ~20%, ranging from 15% to 35%. The observed smolt-to-adult survival range was used for forecasting the 1997 run. The initial returns were composed of a large number of 2-ocean fish (>70%) with fewer 3-ocean fish. Therefore, about 75% of the returns are projected to be 2-ocean- and 25% 3-ocean-age fish.

Forecast Discussion

The run to Telrod Cove is a result of fry stocking in Spiridon Lake. The lake is devoid of anadromous salmon, thus sockeye salmon production is intended to provide a terminal harvest of all returns. The 1997 run is estimated to be ~40% smaller than the 1996 run (~292.0 thousand). The predominate age class is expected to be age-1.2 fish. The run timing should be similar to 1994–1996 returns, with the peak of the run occurring in mid August.

Kevin Brennan
Fishery Biologist
Kodiak

Ivan Vining
Westward Region Biometrician
Kodiak

Forecast Area: Kodiak, Karluk Lake (Early Run)
Species: Sockeye Salmon

Preliminary Forecast of 1997 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
• Total Production		
Total Run Estimate	489	181–1,114
Escapement Goal	200	150–250
Harvest Estimate	289	

Forecast Methods

The Karluk Lake 1997 early-run forecast was derived using simple linear regression models that employed recent brood year (1980–1992) sibling relationships. Selection of prediction models encompassed analysis of outlier data points, residuals, and use of dependent variable transformations (log and square root), where applicable. Model selection for an age-class estimate was based upon identifying a model that had a reasonable biological interpretation, coupled with possessing low error and a high R^2 value. The forecast range was derived by combining the 80% prediction intervals for each individual age-class estimate. Minor age classes (ages 1.1, 2.1, and 3.1) were not estimated and will invariably contribute error.

Forecast Discussion

The 1997 forecast is about 29.0 thousand fish larger than the 1996 forecast and about 300.0 thousand fish less than the actual 1996 run of 760.0 thousand fish. Our confidence in this forecast is fair, largely due to the error experienced in the 1996 forecast. The 1997 run should be composed of 42% 5-year-old fish and 49% 6-year-old fish.

The projected harvest of 289.0 thousand is founded upon achievement of the midpoint of the escapement goal range of 200.0 thousand. Age-2.2 fish should compose 37% of the run, followed by age-2.3 and -3.2 fish at 25%.

The run reconstruction and commercial catch apportionment program for the Karluk Lake sockeye salmon stock continues to be improved. Over time, improvements should be reflected in forecast accuracy.

Kevin Brennan
Fishery Biologist
Kodiak

Ivan Vining
Westward Region Biometrician
Kodiak

Forecast Area: Kodiak, Karluk Lake (Late Run)
Species: Sockeye Salmon

Preliminary Forecast of 1997 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
• Total Production		
Total Run Estimate	781	291–1,629
Escapement Goal	400	400–550
Harvest Estimate	381	

Forecast Methods

The Karluk Lake 1997 late-run forecast was derived using simple linear regression models that employed recent brood year (1980–1992) sibling relationships. Selection of prediction models using sibling data encompassed analysis of outlier data points, residuals, and use of dependent variable transformations (log and square root), where applicable. Model selection for an age-class estimate was based upon identifying a model that had a reasonable biological interpretation, coupled with possessing low error and a high R^2 value. The forecast range was derived by combining the 80% prediction intervals for each individual age-class estimate. Minor age classes (ages 1.1, 2.1, and 3.1) were not estimated and will therefore impart error.

Forecast Discussion

The 1997 forecast is for 160.0 thousand fish less than the 1996 forecast and about 275.0 thousand fish greater than the actual 1996 run of 506.0 thousand fish. Our confidence in this forecast is fair, largely due to the observed error of the 1996 forecast. The 1997 run should be composed of 42% 5-year-old fish and 49% 6-year-old fish.

The projected harvest of 381.0 thousand fish is founded upon achievement of the lower end of the escapement goal range of 400.0 thousand. Age-2.2 fish should compose 50% of the 1997 run, followed by age 3.2 at 26% and age 2.3 at 18%.

The run reconstruction and commercial catch apportionment program for the Karluk Lake sockeye salmon stock continues to improve. Over time, these advancements should be reflected in increased forecast accuracy.

Kevin Brennan
Fishery Biologist
Kodiak

Ivan Vining
Westward Region Biometrician
Kodiak

Forecast Area: Chignik
Species: Sockeye Salmon

Preliminary Forecast of 1997 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
• Total Production		
Early Run (Black Lake)		
Total Run	1,000	250–1,650
Escapement	400	
Commercial Common Property Harvest	600	
Late Run (Chignik Lake)		
Total Run	1,600	550–2,650
Escapement	250	
Commercial Common Property Harvest	1,350	
Total Chignik Area Run		
Total Run	2,600	800–4,300
Escapement	650	
Commercial Common Property Harvest	1,950	

Forecast Methods

The estimated run to Black Lake is based upon a regression estimate of the historical relationship of the number and length of prior year age-1.2 sockeye salmon (1966–1996) and the two major current year age classes (sum of ages 1.3 and 2.3); $R^2 = 0.73$. All other age-class estimates are predicted from the most recent 10-year average. The Chignik Lake forecast is based upon return-per-spawner relationships, recognizing that accuracy has historically been quite variable. Developing a model such as the one used for the Black Lake run has been unsuccessful. The 1997 Chignik Lake forecast was derived using post-1969 average return-per-spawner relationships for each year class.

Forecast Discussion

- Early Run: The 1997 Black Lake sockeye salmon run is expected to be 1.0 million fish, which is approximately 500.0 thousand fish less than the 1987–1996 average run of 1.5 million. Contributing factors for this low projection are the return of 51.0 thousand age-1.2 sockeye salmon during the 1996 season, the lowest return since 1989 (37.0 thousand) that anticipated the 1990 run of about 1.0 million. Only 11 times from 1966 to the present, and only once since 1989, has the return of age-1.2 sockeye salmon been between 30.0 thousand and 100.0 thousand. Only one of the returns within this range has resulted in an above-average run. Also, in recent years there is a trend for every other year to be either above or below the average run. Since the 1996 run of 2.1 million was 0.6 million above the average run from 1987–1996, we anticipate the 1997 run will be below average.

- Late Run: The estimated 1997 Chignik Lake sockeye salmon run is 1.6 million fish, 300.0 thousand more than the 1986–1996 average of 1.3 million fish. For the 6-year-olds (age 2.3), which typically dominate the run, the parent-year (1991) escapement is 382.59 thousand and the post-1969 recruit-per-spawner ratio is 4.2. In recent years the Chignik Lake run has been above average when the current year's run to Black Lake is below average and the Chignik Lake previous year's run was also below average.

Preliminary Forecast of 1997 Run	Forecast Estimate (thousands)
• Total Production	
Chinook Salmon [a]	7
Sockeye Salmon [b]	1,550
Coho Salmon [c]	220
Pink Salmon [d]	1,000
Chum Salmon [e]	230
Total Projected Harvest	3,007

[a] Chinook harvest is dependent upon the amount of fishing time allowed for sockeye salmon in July; the harvest projection approximates the 10-year average, 1987–1996.

[b] Estimate does not include the Cape Igvak and Southeastern District Mainland intercept fisheries (21% allocation), which equates to approximately 400.0 thousand Chignik-bound sockeye salmon through the season.

[c] Fishing time for the coho salmon harvest will be related to the strength of the Chignik Lake sockeye salmon run. Chignik Bay and outside district catches are based on a 10-year harvest average.

[d] The 1997 forecast is based on an underlying relationship between Kodiak and Chignik odd-year pink salmon total run, $R^2 = 0.75$. Variables that are used to predict the Kodiak pink salmon run were used to predict the run to Chignik. Kodiak fry dig indices and average April temperatures were regressed on Chignik odd-year runs from 1969. The point estimate is 1.7 million, with a prediction interval between 0.74 and 2.65 million. The Western and Perryville Districts should experience the largest proportion of the catch.

[e] The chum salmon forecast is based upon the average of the run strength since 1980 (excluding the oil spill year of 1989). The Western/Central Districts should experience the largest proportion of the catch.

David Owen
Area Management Biologist
Chignik Area

Ivan Vining
Westward Region Biometrician
Kodiak

Forecast Area: Bristol Bay

Species: Sockeye Salmon

Preliminary Forecast of 1997 Run	Forecast Estimate (millions)	Forecast Range (millions)
• Total Production		
Total Run Estimate	35.8	21.2–50.5
Escapement Goal	8.8	
South Peninsula Quota	2.2	
Commercial Common Property Harvest (Inshore) [a]	24.8	

[a] Forecasted sockeye salmon harvests for inshore Bristol Bay fishing districts are as follows: Naknek-Kvichak = 5.6 million; Egegik = 1.8 million; Ugashik = 3.1 million; Nushagak = 3.9 million; and Togiak = 0.3 million.

Forecast Methods

The 1997 Bristol Bay forecast is the sum of individual predictions for nine river systems (Kvichak, Branch, Naknek, Egegik, Ugashik, Wood, Igushik, Nushagak-Mulchatna, and Togiak) and four age classes (age-1.2, -1.3, -2.2, and -2.3 sockeye salmon). In addition to these four major age classes, a prediction was also made for age-0 sockeye salmon to Nushagak-Mulchatna River because of their relative importance to the total run of that system. Predictions for each age class returning to a river system were calculated by averaging results from simple linear regression models based on the relationship between returns and either spawners or siblings. Also, the relationships between returns and smolt outmigrants were examined with regression models for the Kvichak, Naknek, Egegik, and Ugashik Rivers. Spawner-return models were not used for the 1997 Ugashik River forecast because the number of spawners for age-4 and -5 sockeye salmon were the second highest number of spawners observed and we have very little information on the number of returns from those levels of escapements. In addition, hindcasting showed that forecast accuracies for the Ugashik River were similar if only smolt and sibling information were used. Results from each regression model were excluded from final forecast calculations if the slope of the line was not significantly different from zero ($P < 0.25$). The mean return of an age class to a specific river system was used to predict returns when none of the models could be used.

We used production data only since 1978 to predict returns to all systems in Bristol Bay. The number of returning adults produced from each spawner has shown a dramatic increase since 1978, and results from hindcasting have shown the use of recent data provides more accurate and less biased predictions of run size. Nushagak-Mulchatna predictions were based on all available production data (1980–1996).

Although using recent production data reduced prediction errors for most Bristol Bay rivers during 1984–1996, we still would have underforecasted eastside returns 10 out of 13 years. To further correct this tendency, we began in 1991 to adjust the predictions by their respective average prediction errors. We reviewed the adjustment procedure each year and tested whether the adjusted predictions performed more accurately and with less bias than the original predictions. Based on these reviews, we adjusted forecasts for Kvichak, Branch, Egegik, and Ugashik Rivers during 1991–1996. The only rivers we applied the 1984–1996 forecast error for the 1997 forecast were to the Branch and Ugashik Rivers. The 1984–1996 prediction errors used were 25% for the Branch River and 38% for the Ugashik River. The 1997 adjustment resulted in an overall increase of 4% for the total Bristol Bay forecast.

The mean squared error of the total run forecast was calculated from the deviations of actual runs from run predictions made for 1987–1996. Run predictions for 1987–1996 were based on the same methods used for the 1997 forecast (i.e., the use of recent-year production data corrected by the Branch and Ugashik Rivers' average error rate). The mean squared error was used to estimate the standard error and 80% confidence bounds of the total run forecast.

Forecast Discussion

Based on the methods described above, 35.8 million sockeye salmon are expected to return to Bristol Bay in 1997. The 1997 prediction is 11% less than the previous 20-year mean (40.1 million; range, 10.7 million–66.3 million), and 20% less than the previous 10-year mean (44.7 million; range, 24.0 million–62.8 million). Runs are expected to exceed spawning escapement goals for all systems.

The inshore harvest is expected to be 24.8 million sockeye salmon. A harvest of this size would be similar to the previous 20-year mean harvest of 25.1 million (range, 4.9 million–44.3 million) and 17% less than the previous 10-year mean of 30.0 million (range, 13.8 million–44.3 million). An additional 2.2 million Bristol Bay sockeye salmon can be harvested during June in the Shumagin Islands and South Unimak fisheries under the current Alaska Board of Fisheries management plan (8.3% of the total projected 27.1 million harvest).

Differences in projections from the three linear regression models (spawner return, sibling, and smolt) suggest possible deviations in the 1997 forecast. The run of age-2.2 and -1.3 sockeye salmon to the Kvichak River could be less than predicted because the sibling-return relationships predicted smaller runs than did spawner or smolt data. The Egegik River run of age-1.3 and -2.3 sockeye salmon could be less than predicted because sibling data predicted less returns of sockeye salmon than either the spawner-return or smolt-return models. Finally, Ugashik River runs of age-1.3 and -2.3 sockeye salmon could be less than predicted because sibling-return models predicted smaller runs than smolt models.

We do not formally forecast chum, coho, or pink salmon catches in Bristol Bay. Summarized below are outlooks for 1997 catches for those species. Outlooks are based on the most recent 5-year average harvests.

Preliminary Forecast of 1997 Run	Forecast Estimate (thousands)
• Total Production	
Coho Salmon	900
Pink Salmon [a]	100
Chum Salmon	

[a] Appreciable numbers of pink salmon are not harvested during odd years.

Beverly Cross
Research Project Leader
Anchorage

Forecast Area: Bristol Bay, Nushagak District
Species: Chinook Salmon

Preliminary Forecast of 1997 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
• Total Production		
Total Run Estimate	156	108–204
Inriver Run Escapement Goal [a]	75	
Commercial Common Property Harvest	81	

[a] The Nushagak inriver goal is 75.0 thousand chinook salmon, which provides for a biological escapement goal of 65.0 thousand spawners and an additional harvest of 10.0 thousand chinook salmon by upriver subsistence and sport fisheries.

Forecast Methods

The 1997 chinook salmon forecast for the Nushagak District is the sum of individual predictions for five age classes (ages 1.1, 1.2, 1.3, 1.4, and 1.5). The prediction for each age class was first calculated from a simple linear regression model based on the relationship between sibling returns in succeeding years (e.g., age-1.4 returns for 1997 based on age-1.3 returns in 1996). However, predictions from regression models were only used if the slope of the line was significantly different from zero ($P < 0.25$). If this criteria was not met, the mean return of an age class was used to predict 1997 returns.

Regression models were used to predict age-1.3, age-1.4, and age-1.5 returns. Mean returns were used to predict age-1.1 and age-1.2 returns. In addition, the 1997 forecast was adjusted to account for overforecasting errors that have occurred for 10 out of the past 13 years. The 1997 prediction was reduced by the 1984–1996 average forecast error (13.5%). The average forecast error from 1984 to 1996 was used because the trend of overforecasting began in 1984 and has continued through 1996. The mean squared error of the total run forecast was calculated from the deviations of actual runs from hindcasts for the years 1987–1996. Hindcasts were based on the same methods used for the 1997 forecast. The mean squared error was then used to estimate the standard error and 80% confidence bounds.

Forecast Discussion

The age composition of the 1997 forecasted run is 0.4% (0.7 thousand) age 1.1, 14.5% (22.6 thousand) age 1.2, 31.6% (49.3 thousand) age 1.3, 50.5% (78.7 thousand) age 1.4, and 3.0% (4.7 thousand) age 1.5. The 1997 forecasted run of 156.0 thousand chinook salmon is 18% less than the previous 20-year mean run of 189.6 thousand, and 11% greater than the most recent 10-year mean run of 140.8 thousand. The projected harvest of 81.0 thousand is 16% less than the previous 20-year mean harvest of 97.0 thousand and 19% greater than the most recent 10-year mean harvest of 67.8 thousand.

Beverly Cross
Research Project Leader
Anchorage

Forecast Area: Alaska Peninsula, Bear Lake (Late Run)
Species: Sockeye Salmon

Preliminary Forecast of 1997 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
• Total Production		
Total Run Estimate	600	198–1,130
Escapement Goal		80–115
Harvest Estimate	485	

Forecast Methods

The Bear Lake 1997 late-run forecast was derived using simple linear regression models employing recent brood year (1980–1992) sibling relationships. Selection of prediction models using sibling data encompassed analysis of outlier data points, residuals, and use of dependent variable transformations (log and square root), where applicable. Model selection for an age-class estimate was based upon identifying that model having a reasonable biological interpretation, coupled with possessing low error and a high R^2 value. The forecast range was derived by combining the 80% prediction intervals for each individual age-class estimate. Minor age classes (ages 1.1, 1.2, and 2.1) were not estimated. These minor age classes will invariably contribute to the run and therefore impart error.

Forecast Discussion

The 1997 forecast is about 245.0 thousand fish less than the 1996 forecast and about 9.0 thousand fish greater than the actual 1996 run of 476.0 thousand fish. Our confidence in this forecast is fair, largely due to the observed error of the 1996 forecast, coupled with this being only the second year that a formal forecast has been prepared for this system. The 1997 run should be composed of 70% 5-year-old fish and 30% 6-year-old fish.

The projected harvest of 485.0 thousand is founded upon achievement of the upper end of the escapement goal range of 115.0 thousand. Age-2.2 fish should compose 65% of the run, followed by age-2.3 fish at 30% and age-1.3 fish at 6%.

Kevin Brennan
Fishery Biologist
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Forecast Area: Arctic-Yukon-Kuskokwim

Commercial Harvest Outlook for the Arctic-Yukon-Kuskokwim Region in 1997

ADF&G does not produce formal run forecasts for any salmon runs in the Arctic-Yukon-Kuskokwim (AYK) Region. Salmon run outlooks in the region are mostly qualitative due to a lack of adequate information with which to develop more rigorous forecasts. While commercial catch outlooks provide a general level of expectation, the fisheries are managed based upon inseason assessments of the actual runs.

Declining salmon markets, particularly for chum salmon flesh, have had a major impact on the commercial fisheries in the AYK Region. A continuation of these market trends in 1997 could result in limited harvests, in some areas, and lower exvessel value. In addition, 4-year-old chum salmon in 1997 will be returning from the poor parent-year escapements observed in 1993.

For 1997 the commercial catch outlook by management area in the AYK Region consists of 16–43 thousand chinook, 80–155 thousand sockeye, 580–870 thousand coho, 0–2 thousand pink, and 160–410 thousand chum salmon for the Kuskokwim Area (Kuskokwim Bay and Kuskokwim River combined); 88–108 thousand chinook, 0–75 thousand coho, 200–600 thousand summer chum, and 0–150 thousand fall chum salmon for the Yukon River; 5 thousand chinook, 40–70 thousand coho, 0–100 thousand pink, and 40–80 thousand chum salmon for Norton Sound; and 250–300 thousand chum salmon for Kotzebue Sound.