



Regional Information Report No. 5J00-04

**Run Forecasts and Harvest Projections
for 2000 Alaska Salmon Fisheries and Review of the 1999 Season**

Edited by

Ryan Scott

and

Harold J. Geiger

May 2000

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EXECUTIVE SUMMARY

The Alaska Department of Fish and Game is expecting a drop in commercial salmon catch in 2000. This is because the pink salmon harvest is expected to return to more average levels - far below the 1999 statewide record catch for this species. The 2000 commercial catch all-species projection of 153 million is distributed as 470¹ thousand chinook, 41.0 million sockeye, 5.2 million coho, 84.9¹ million pink, and 21.1 million chum salmon. Table 1 shows specific projection numbers by species and fishing area. In some cases the projections are based on formal run forecasts, using information on previous spawning level, the environment, and other factors. In other cases, the catch projections are simply recent average catch levels. With two or three exceptions, such as the Southeast chinook troll fishery and South Peninsula June fishery, Alaskan salmon management will be based on actual observed salmon run strength. Alaska managers have the primary goal of maintaining spawning population sizes - not of reaching preseason catch projections.

At this time last year, department biologists were expecting an all-species commercial catch of 148 million for the 1999 season. As it turned out, the all-species catch reached 216 million – barely missing the all-time catch record of 218 million from 1995. In 1999, the overall catch of sockeye salmon was considerably higher than expected (an actual catch of 44.2 million compared to the preseason projection of 23.58 million). Notably, the statewide pink salmon catch of 146¹ million was far above expectations - setting a new statewide record - with pink salmon catch records set in Southeast Alaska and in Prince William Sound. Although statewide chum salmon catches were above expectation, runs of Western Alaska chum salmon were well below expectations once again. We suspect that poor ocean survivals were to blame. Table 2 shows 1999 harvest numbers by species and fishing area, in units of fish harvested, and Table 3 provides this information in units of pounds harvested.

The exvessel value of the commercial harvest reversed its long downward trend. The preliminary estimate for the total value of Alaska's 1999 harvest is \$370 million – up from the estimates of \$261 million for 1998, \$297 million for 1997, \$378 million for 1996, \$487 million for 1995, and \$489 million for 1994.

In recent years, news stories about unusual climatic and oceanographic conditions have become increasingly common. Because our forecasts are based on statistical relationships that have been observed in the recent past, we are always nervously looking for reasons to think that past conditions have changed. Global warming, strong El Niño events followed by ocean cooling, exceptional temperatures in the Bering Sea, large forecast errors in the Bristol Bay sockeye returns, and an unexplained spectacular drop in Western Alaska chum salmon production are just some of the things that worry salmon forecasters. This year we are puzzled by the age distribution of salmon in a number of last year's fisheries. We usually assume that a large return of younger fish predicts a larger return of their older siblings in the following year. We observed large proportions of younger fish in several fisheries, from Bristol Bay and Chignik sockeye salmon to Southeast hatchery chum salmon. We don't know if these younger fish indicated a change in the year of ocean return, or if they indicate a coming increase in production.

Look for inseason harvest information, postseason statistics, and other information about salmon in Alaska on the World Wide Web at <http://www.cf.adfg.state.ak.us/>.

¹ Corrects errors in Regional Information Report 5J00-03, "salmon short forecast," published February 2000.

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; Geiger et. al. 1997; Hart et. al. 1998; Geiger and Hart 1999). 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 2000 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 2–8 provide detailed information on the 1999 harvest.

This report contains a detailed review of Alaska's 1999 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.

Predominant ages and brood years for 1999 salmon runs, by species, are as follows:

Species	Age of Returning Salmon in Years				
	2	3	4	5	6
Pink	1998				
Chum		1997	1996	1995	
Coho		1997	1996		
Sockeye			1996	1995	1994
Chinook			1996	1995	1994

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

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

DEFINITIONS OF TERMS

<i>Biological escapement goal</i>	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 (human use). This determination is based on biological information about the fish stock in question. (Also see <i>optimum escapement goal</i> .)
<i>Commercial harvest</i>	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.
<i>Commercial common property harvest</i>	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.
<i>Common property harvest</i>	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.
<i>Cost recovery harvest</i>	Harvests of salmon by hatchery operators in specially designated areas to fund the operation of hatcheries and other enhancement activities.
<i>Enhancement of runs</i>	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.
<i>Escapement, spawning population, or broodstock</i>	The portion of a salmon run that is not harvested and survives to reach the spawning grounds or hatchery.
<i>Harvest projections or harvest outlooks</i>	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.
<i>Optimum escapement goal</i>	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 consideration of social and allocative needs.

Run forecast

Forecasts of a run (harvest + escapement) are estimates of the fish that will return in a given year based on such information as parent-year escapements, subsequent fry abundance, and spring seawater temperatures. 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 1999 ALASKA COMMERCIAL SALMON FISHERIES

Southeast and Yakutat

The 1999 Southeast Alaska commercial salmon harvest, including hatchery cost recovery, totaled 97.5 million fish. This was the largest harvest in the history of the region's commercial salmon fishery that extends back to 1878. The five largest harvests in the history of the fishery have all occurred during the 1990s.

The exvessel value of this year's salmon harvest was \$85.8 million, which is below the 10-year average of \$90.8 million despite the high pink, chum, and coho salmon harvests. The exvessel values by species were: chinook salmon — \$4.5 million, sockeye salmon — \$8.6 million, coho salmon — \$15.4 million, pink salmon — \$31.8 million, chum salmon — \$25.6 million.

A record pink salmon return, harvest and escapement highlighted the 1999 season. The 77.7 million pink salmon harvest was higher than the preseason forecast of 31 to 51 million fish. Pink salmon harvests in southern Southeast Alaska were close to the preseason forecast midpoint of 32.5 million fish, but the 35.8 million harvested in northern Southeast (33.8 million in net fisheries and 2.0 million in hatchery and troll fisheries) was twice the 17 million-prediction midpoint. Pink salmon escapements by stock group were above the 1990s average in all management areas — Sitka (+296%), Petersburg (+221%), Juneau (+124%), and Ketchikan (+18.4%). Twenty-four of 45 stock groups received the highest counts since the indexing program began in 1960. Only two southern Southeast Alaska stock groups had escapement counts below the 1990s average. Southeast pink salmon escapements for the three main stock groups (Southern, Northern Inside, and Northern Outside) appear to be in an upward trend.

The 14.9 million chum salmon harvest was the third highest on record. The top six chum salmon harvests have all occurred in the past six years when hatchery-origin fish have dominated the harvests. Chum salmon escapements were variable but generally good in all areas except Portland Canal. The total escapement of chum salmon was above the 1990s average.

Sockeye salmon harvests were below average in most fisheries. The Southeast Region harvest totaled 1.2 million fish compared to the 10-year, 1989–1998, average of 2.3 million. Sockeye salmon escapements varied by location. Transboundary river escapements of sockeye salmon were above the goal in the Taku River, but below goals in the Alsek and Stikine Rivers. In the Ketchikan area, sockeye salmon escapements were relatively good in McDonald and Salmon (Karta) Lakes, but poor in Hugh Smith Lake. Marine survivals appear to be improving over the past few years. The entire Sitka area had strong returns with Necker, Redoubt, and Sitkoh Bays having excellent returns. Chilkat Lake in the Juneau area also had a strong return.

The 3.6 million coho salmon harvest was the fourth highest on record. The run timing was unusually late in most areas. Escapements were at or above goals in the four wild indicator stocks. Surveys throughout the region indicated that escapements were above the 10-year average in most systems.

Prince William Sound

The 1999 Prince William Sound Area commercial salmon harvest of 50.3 million fish was the highest on record. The harvest was comprised of 45.0 million pink salmon, 2.0 million sockeye salmon, 2.99 million chum salmon, 245,000 coho salmon, and 63,000 chinook salmon. The majority of the catch, 36.4 million, was common property harvest and 13.9 million fish were sold for hatchery cost recovery (exclusive of roe/meal sales). All hatchery broodstock and cost recovery goals were met.

The estimated value of the combined commercial salmon harvest, including hatchery sales, was \$56.9 million. During the 1999 season, 523 drift gillnet permit holders fished. The drift gillnet catch was valued at \$30.3 million, setting the average earnings per permit at \$58,000. The set gillnet catch was valued at \$690,000 setting the average earnings of the 21 participating permits at \$32,900. The seine fishery was worth \$17.1 million for an average exvessel value of \$123,000 for the 139 permit holders that participated this year. Revenue generated for hatchery operations (exclusive of roe/meal sales) was approximately \$8.84 million.

The Copper and Bering River District's sockeye salmon harvest of 1.69 million was the third largest on record. The harvest of 62,400 chinook salmon was also the third largest harvest for this species. The Copper and Bering River District's coho salmon harvest of 163,000 was less than half of the preseason forecast. The inriver goal at Miles Lake sonar for all salmon of 750,000 was exceeded with an estimated 851,000 salmon passing the sonar site. The sockeye salmon aerial escapement survey for the Copper River delta systems was 101,000 fish, approximately 12% above the 90,000 fish goal. The coho salmon aerial escapement survey was 76,000 fish, which was close to the 75,000 fish goal.

Gillnet fisheries in Prince William Sound primarily targeted enhanced and wild sockeye and chum salmon. In the Coghill District, the gillnet harvest was 689,000 chum, 106,000 sockeye and 32,000 pink salmon. In the Eshamy District, the gillnet harvest was 24,000 chum, 160,000 sockeye and 170,000 pink salmon. In the Unakwik District, 8,540 sockeye salmon were harvested. The wild stock sockeye salmon return to Coghill Lake was more than twice the preseason projection. The escapement goal of 25,000 sockeye salmon was met in a single day and eventually exceeded by 34,300 additional sockeye salmon. The Eshamy weir was in place for only the latter half of the wild stock return to Eshamy Lake; 27,000 sockeye salmon were counted through the weir. It is unknown how close the actual escapement was to the goal of 40,000.

The total pink salmon harvest of 45.0 million fish in 1999 was the largest in Prince William Sound history. The common property pink harvest, taken primarily with seine gear, was 31.5 million fish with a majority of the remainder being taken for hatchery cost recovery and broodstock needs. The seine harvest of 1.47 million chum salmon included approximately 639,000 enhanced fish that had been released at Montague Island and 621,000 enhanced fish taken in the Noerenberg Hatchery terminal area. The wild pink and chum salmon escapements were very strong in 1999 for all districts.

Cook Inlet

Upper Cook Inlet

The preliminary 1999 Upper Cook Inlet salmon harvest of 3.0 million fish was below the 10-year average of 4.8 million fish. The Upper Cook Inlet salmon harvest produced an estimated \$23.5 million in exvessel revenue.

There were many regulation changes as a result of the Board of Fisheries meeting in February 1999, with significant changes to management plans used to conduct the Upper Cook Inlet commercial fishery. The commercial salmon season for most areas of Upper Cook Inlet opens for Monday and Thursday regular periods beginning June 25. The exceptions to this June 25 general opening are set gillnetting in the Kenai, Kasilof and East Forelands sections.

The preseason forecast for a return to the Kenai River of 1.7 million sockeye salmon initially resulted in an escapement goal of 600,000 to 850,000 fish. The Upper Cook Inlet harvest of 2.7 million sockeye salmon was 700,000 fish over the preseason forecast. Much of this additional harvest is likely attributable to Kasilof River stocks which were much stronger than forecast. Kenai stocks are also likely stronger than forecast. Sockeye salmon prices at the beginning of the season were \$0.90 to \$1.10 per pound, but by the end of the season most processors were paying \$1.30 to \$1.40 per pound, paid retroactively to the beginning of the season. This resulted in an exvessel value for sockeye salmon of \$22.8 million, which was 96% of the total Upper Cook Inlet exvessel value.

The Kasilof Section, targeting Kasilof River sockeye salmon stocks, opened for regular Monday and Thursday fishing periods on Thursday July 1. Because the Kenai River return was forecast to be fairly weak, a conservative fishing pattern was established, restricting additional fishing time in the Kasilof section and also eliminating drift gillnets. This lowered the exploitation rate of Kenai sockeye salmon stocks until the run strength could be evaluated. Escapements to both the Kenai and Kasilof Rivers increased substantially over the July 23–27 period with the Kasilof River escapement rapidly approaching the upper end of the escapement range. The escapement into the Kenai River was projected to be within the 600,000 to 850,000 range. A fairly aggressive fishing pattern was necessary in the Kasilof section to try to control escapement to the Kasilof River. From August 1 to August 5 the Kenai, Kasilof and East Forelands sections were open to maintain the escapement into the Kenai River within the targeted range, with a final escapement of 800,000 sockeye salmon.

Since 1990 the Crescent River on the west side of Cook Inlet has been producing at a lower level than is required to meet escapement goals without severe restrictions to the commercial fishery. Early season harvests and escapement to this system were good enough that no early season restrictions were implemented to either the drift or set gillnet fisheries in this area. On July 12 it became apparent that the lower end of the escapement goal was ensured and continuous fishing was allowed in the set gillnet fishery in the Western Subdistrict south of Redoubt Point until July 31.

Board of Fish action for the 1999–2001 seasons closed commercial fisheries targeting Fish Creek stocks in Knik Arm. The 1999 return to Packers Creek was fairly weak but allowed a modest harvest in the Kalgin Island Subdistrict and a modest amount for cost recovery by Cook Inlet Aquaculture Association.

The 1999 harvest of 174,000 chum salmon was a modest improvement from returns we have seen the last three years but below the 10-year average of 239,000 fish. Fishermen were paid \$0.15 to \$0.40 per

pound for chum salmon, producing an exvessel value of \$250,000 or just 1.1% of the overall fishery value. The 1999 chum salmon harvest would likely have been higher except for management actions restricting the drift fleet and Northern District fisheries for Yentna sockeye and Northern District coho salmon.

The 1999 harvest of 16,200 pink salmon is one of the lowest harvests for an odd year in Upper Cook Inlet and well below the 10-year average of 295,000 fish. As with chum salmon, management actions restricting the drift fleet and Northern District fisheries for Yentna sockeye and Northern District coho salmon are a contributing factor to the poor pink salmon harvest. Prices paid for pink salmon were \$0.03 to \$0.10 per pound resulting in an exvessel value of \$6,800 for pink salmon.

The 1999 coho salmon harvest of 125,000 fish was about half of the average long-term harvest in Upper Cook Inlet and the lowest harvest since 1973. The price paid for coho salmon was approximately \$0.40 per pound resulting in an average exvessel value of \$246,000. Commercial coho salmon harvests in Upper Cook Inlet during the 1980s and early 1990s were much higher than the long-term average due to good coho salmon production and strong sockeye salmon returns to Upper Cook Inlet, resulting in more fishing time in the Central District. However, wild stock coho salmon harvests statewide have declined by an average of approximately 40% during the last three years. In addition, regulations from the Board of Fish since 1996 reducing the fishing time of the drift fleet in the Central District and elimination of additional fishing time directed at coho and sockeye salmon surpluses in the Northern District and Kalgin Island subdistricts, have lowered the commercial exploitation rate dramatically.

The 1999 harvest of 14,200 chinook salmon was approximately equal to the recent 10-year average harvest and much improved over the 1998 harvest of 8,000 chinook salmon. The 1999 chinook salmon harvest was valued at \$400,000, approximately 1.5% of the total exvessel value. Fishermen were paid approximately \$1.10 per pound for chinook salmon. The resulting catch was 1,830 chinook salmon from the first period and 407 from the second period. The set gillnet harvest in the Kenai, Kasilof and East Forelands sections for 1999 was 9,340 chinook salmon. The sonar count into the Kenai River was 48,000 chinook salmon with an estimated 12,000 fish harvested in the recreational fishery leaving an escapement of 36,000.

Lower Cook Inlet

The preliminary 1999 Lower Cook Inlet salmon harvest of 1.64 million fish was the seventh highest on record, surpassing both the most recent 10- and 20-year averages. The catch yielded an estimated exvessel value of approximately \$3.18 million, nearly 60% greater than that of the 1998 season.

Once again, Lower Cook Inlet commercial salmon harvests relied heavily on the success of hatchery and enhanced fish production. Pink salmon production from Tutka Hatchery, operated by Cook Inlet Aquaculture Association, fell well below expectations, yet the harvest of this species returning to the facility comprised nearly three-fourths of the all-species catch. The overall return of pink salmon to Tutka Hatchery, estimated at around 1.39 million fish, was the fifth highest on record for the facility. Over three-fourths of the sockeye salmon harvest in both numbers of fish and exvessel value was attributed to joint Alaska Department of Fish and Game and Cook Inlet Aquaculture Association lake stocking and fertilization projects at Leisure and Hazel Lakes in the Southern District, Kirschner and Bruin Lakes in the Kamishak Bay District, and Bear and Grouse Lakes in the Eastern District. The Chugach Regional Resources Commission and Port Graham Hatchery Corporation jointly run a project at English Bay Lakes in the Southern District. Normally, this project provides a surplus harvest of

sockeye salmon for both subsistence and commercial set gillnet fishermen in Port Graham Subdistrict. Over 60% of the total salmon harvest, and 28% of the exvessel value of the Lower Cook Inlet salmon fishery was taken by Cook Inlet Aquaculture Association and Port Graham Hatchery Corporation to support the sockeye salmon lake stocking programs and Tutka Hatchery operations.

The 1999 sockeye salmon harvest of over 477,000 fish set a new record for Lower Cook Inlet and exceeded the preseason forecast by approximately 20%. Sockeye salmon accounted for less than 30% of the landings in numbers of fish, but due to the price differential, comprised over 80% of the exvessel value of the fishery in 1999.

Returns of pink salmon, the dominant species in numbers of fish in Lower Cook inlet, fell below preseason expectations in 1999, with an overall harvest of 1.14 million fish. Although the catch fell about 4% shy of the most recent 20-year average, it represents the ninth highest catch on record. The estimated hatchery return, including escapement, broodstock and commercially harvested fish, was 1.39 million pink salmon. This represents just over 40% of the preseason projection of 3.25 million fish.

Naturally produced pink salmon did not factor into this season's catches, with only incidental harvests occurring during other targeted fisheries. The entire management area experienced extremely weak pink salmon returns, and none of the major pink salmon systems achieved escapement goals. This seems unusual in light of the fact that pink salmon runs in Lower Cook Inlet are traditionally odd-year dominant. We cannot offer any good reasons for the low returns.

The 1999 commercial chum salmon harvest of 7,900 fish was the highest catch since 1995, still 24% short of the recent 10-year average. However, compared to the 20-year average, it was the eleventh successive substandard season in Lower Cook Inlet, representing less than 10% of that long-term average. The low numbers were anticipated based on the recent trend of weak returns coupled with a soft market and low prices.

The commercial harvest of 8,000 coho salmon in 1999 was the lowest for this species in Lower Cook Inlet since 1992, representing about half of the 20-year average. The majority of the harvest occurred in the Eastern District, primarily for Cook Inlet Aquaculture Association cost recovery at Bear Lake and the Seward Silver Salmon Derby. Although coho salmon run assessment in Lower Cook Inlet is limited, commercial, sport, and personal use harvests provide the best indicators of run strength. Returns during 1999 were considered average, with no commercial harvest surpluses identified, therefore no directed effort resulted.

The 1999 harvest of chinook salmon, not normally a commercially important species in Lower Cook Inlet, was the highest catch since 1995 at 1,770 fish. This was greater than the long-term average of 1,300, but well below the record high harvest of 2,300 fish taken in 1995. Set gillnetters accounted for 85% of the Southern District chinook salmon catch, with purse seiners taking the remaining 15%.

Bristol Bay

The 1999 harvest in Bristol Bay of all salmon species totaled approximately 26.0 million fish. The estimated exvessel value of the 1999 Bristol Bay salmon fisheries totaled \$107.9 million, which is the eighth lowest exvessel value in twenty years. The value was 20% below the 20-year average exvessel value of \$134 million. However, the total revenue paid to fishermen was more than the total value of the 1997 and 1998 harvests combined.

The inshore run of sockeye salmon totaled approximately 39.5 million fish and was the twelfth highest inshore return in the last twenty years. The run was approximately 59% (14.5 million) above the preseason forecast of 24.9 million fish. All systems exceeded the preseason forecast. The preliminary total sockeye salmon harvest for the 1999 season was 25.3 million. All escapement goals for sockeye salmon were met or exceeded for a combined escapement of 14.1 million sockeye salmon.

The Naknek-Kvichak District sockeye harvest of approximately 8.9 million fish was the tenth lowest harvest for that district in the last twenty years. The Ugashik District sockeye harvest of approximately 2.3 million was 20% less than the 20-year average. The Nushagak District harvest of 6.3 million sockeye salmon was the second highest catch on record for that district and well above the 20-year average catch of 3.7 million fish. The Togiak District sockeye salmon harvest was 18% below the 20-year average of 441,300 fish.

The Egegik District sockeye harvest of 7.4 million fish was only 0.5 million less than the 20-year average for this district. Fish passed the test fishery in the Egegik River but held up in the river and the lagoon. After several days of slow harvests, sockeye salmon began migrating into all systems except the later-timed Ugashik River system. The Ugashik District catch peaked on July 9. Peak harvests in Egegik, Naknek-Kvichak and Nushagak occurred on July 1 and July 2 with combined harvests of 3.1 and 3.9 million sockeye salmon, respectively. The timing of the 1999 inshore run appears to have been two days earlier than usual.

The commercial chinook harvest of approximately 28,000 fish was 78% below the recent 20-year (1979–1998) average harvest of 112,000 fish. It was the lowest recorded catch in the last twenty years. The 1999 forecast for chinook salmon into the Nushagak River of 214,000 fish did not materialize. The directed chinook salmon fishery in the Nushagak consisted of one opening and resulted in a harvest of 500 fish. The remaining catch of 10,500 was harvested incidentally in the sockeye salmon fishery. The chinook escapement into the Nushagak River was 62,300 fish.

The chum harvest of 716,000 fish was well below the 20-year average harvest of 1.1 million and the third lowest catch on record. All of the districts produced harvests below their 1979–1998 averages. Escapement counts for chum salmon were below average throughout the bay.

Pink salmon return in strength to Bristol Bay only during even-numbered years. The 1999 odd-year run had a harvest of only 100 fish, which was probably due to the lack of processor interest in purchasing pink salmon.

The coho harvest of approximately 19,600 fish was the lowest catch in the most recent twenty years and less than 10% of the 20-year average of 207,000 fish. In the Nushagak District, run strength did not provide a surplus for a directed commercial fishery. Togiak District catches were poor and fishing closed

after three 48-hour periods. Fishing time was reduced from the normal fall schedule in Egegik and Ugashik, when catches were below historic trends.

Kuskokwim Area

The total 1999 commercial salmon harvest for the Kuskokwim Area was 211,000 fish, the lowest since 1972. The areawide chinook salmon harvest of 25,000 fish was 51% below the recent 10-year (1989–1998) average of 51,000 fish. A below average sockeye salmon harvest of 81,000 fish was recorded. Fishers harvested 73,000 chum salmon, 82% below the recent 10-year average of 406,000 fish. The coho salmon harvest was 32,000 fish, the lowest harvest since 1972 and 95% below the recent 10-year average if 601,000.

Only 604 of the 832 Kuskokwim Area permit holders participated in the commercial fishery in 1999. The exvessel value of the harvest was \$0.55 million, 86% below the recent 10-year average exvessel value of \$3.8 million. The average exvessel earnings per permit holder was \$910, well below the most recent 10-year average value of \$4,800.

In the Kuskokwim River, fishing time was limited to a record low two 6-hour periods due to extremely weak chum and coho runs. The chum salmon harvest was 93% below the recent 10-year average. The coho salmon harvest was 95% below the recent 10-year average and the lowest since 1972. Chinook and sockeye harvests, taken incidentally during the chum fishery, were well below average.

The Quinhagak District opened on June 21 and commercial fishing occurred on a below-normal schedule due to weak chinook and coho salmon harvests. The chinook harvest was 13% below the recent 10-year average. The coho salmon harvest was 90% below the recent 10-year average. The sockeye harvest was 32% below the recent 10-year average. The incidental chum harvest was 33% below the recent 10-year average. The below-average sockeye and chum harvests were partially due to reduced fishing effort in the Quinhagak District in June and July.

The Goodnews Bay District opened in late June to provide for a directed harvest of sockeye salmon and protect earlier running chinook salmon. The chinook harvest was 36% below the recent 10-year average, while the escapement goal of 3,500 fish was achieved. The sockeye harvest was 41% below the recent 10-year average. However, the Middle Fork Goodnews River escapement goal of 25,000 sockeye salmon was achieved. The incidental chum harvest was 26% below the recent 10-year average although the Middle Fork Goodnews River escapement goal of 15,000 chum salmon was met. As in the Quinhagak District, below-average harvests of sockeye and chum salmon were due largely to below-average fishing effort in July. The coho harvest was 89% below the recent 10-year average.

Yukon Area

The 1999 Yukon Area total commercial harvest was 121,000 salmon. Sales were composed of 70,000 chinook salmon, 29,000 summer chum salmon, 20,000 fall chum salmon, and 2,000 coho salmon. The 1999 chinook harvest was 28% below the recent 5-year (1994–1998) average of 97,000 fish and the third lowest harvest since 1961. The 1999 summer chum salmon harvest was well below the recent 5-year average of 403,000 fish and the second lowest harvest since 1968. The 1999 fall chum and coho harvests were well below the recent 5-year average harvests of 91,000 fish and 29,000 fish, respectively.

The exvessel value of the Yukon Area commercial salmon fishery was an estimated \$5.1 million, which was 3% above the recent 5-year average of \$4.9 million.

Lower Yukon Area fishermen harvested 65,000 chinook, 28,000 summer chum, 19,000 fall chum, and 2,000 coho salmon. The estimated average price paid per pound in the Lower Yukon Area was \$3.80 for chinook salmon, \$0.10 for summer chum salmon, \$0.25 for fall chum salmon, and \$0.35 for coho salmon. The average price paid for chinook salmon was well above the recent 5-year average of \$2.22 per pound. The exvessel value of the Lower Yukon Area commercial fishery was \$5.0 million. The average income for each of the 632 Lower Yukon Area fishermen who participated in the 1999 commercial fishery was \$8,000.

Upper Yukon Area fishermen harvested 5,000 chinook, 1,000 summer chum, and 1,000 fall chum salmon. The estimated average price paid per pound in the Upper Yukon Area for fish in the round was \$1.10 for chinook salmon, \$0.18 for summer chum salmon, and \$0.20 for fall chum salmon. The exvessel value of the Upper Yukon Area commercial fishery was \$0.1 million. The average income for each of the 38 Upper Yukon Area fishermen who participated in the 1999 commercial fishery was \$2,000. Upper Yukon Area fishermen sold 1,000 pounds of chinook and summer chum salmon roe. The estimated average price paid per pound was \$2.11 for chinook salmon roe and \$2.25 for summer chum salmon roe.

The 1999 Yukon River salmon runs continued to exhibit the decline in productivity observed in recent years. The 1999 chinook salmon run was poor in abundance, but better than the weak return in 1998. Chinook salmon escapements were below recent 5-year averages throughout the drainage. The chinook salmon spawning escapement estimate for the Canadian mainstem Yukon River was less than 50% of the rebuilding escapement goal. However, minimum escapement goals were achieved in three surveyed tributaries in Alaska.

The abundance of summer and fall chum salmon was poor in 1999. The poor abundance of chum salmon was unexpected based on the excellent escapements documented throughout the drainage in 1994 and 1995. Chum salmon spawning escapements to selected tributaries in 1999 were well below most other years, except for the Chena River, which was near average. No other summer chum salmon escapements in monitored tributaries met minimum goals or were considered adequate; results ranged from 41% to 89% below recent year averages.

The 1999 fall chum salmon return had an unusually strong component early in the season. By August 1, approximately 30% of the run had entered the Yukon River. Based on average run timing, it appeared that the fall chum salmon run would be large enough to support commercial fishing. As the run continued, run size projections decreased below levels necessary to continue commercial fishing. Based on lower Yukon River indicators, the total run size was estimated to be 535,000 to 634,000 fall chum salmon. Upriver assessment and escapement monitoring projects also indicated a below-average to poor fall chum salmon run. The poor run to the Tanana River drainage prompted a closure of the personal use fishery in the Fairbanks Nonsubsistence Area on September 20, until October 4. The Delta River area was the only fall chum salmon escapement goal met in 1999.

Yukon River coho salmon have a slightly later, but overlapping, run timing with that of the fall chum salmon, the primary species of management concern during the fall season. Coho salmon abundance appeared to be below average based on the commercial harvest and selected escapements monitored

during 1999. The Delta Clearwater River, with the only established escapement goal for coho salmon in the Yukon River drainage, met escapement goals.

Norton Sound

The Norton Sound commercial salmon harvest, comprised of 2,000 chinook salmon, 13,000 coho salmon, and 8,000 chum salmon, totaled 23,000 fish. The chinook harvest was 68% below the previous 5-year average and 66% below the previous 10-year average. The coho harvest was the lowest since 1987, 77% below the previous 5-year average and 79% below the previous 10-year average. The Norton Sound commercial chum harvest was the lowest on record, 68% below the 5-year average and 83% below the 10-year average. The low chum harvest can be attributed primarily to the combination of a low harvestable surplus throughout the district and poor markets in the Southern Subdistricts. There was no commercial fishery for pink salmon during 1999, due to very little harvestable surplus and no market interest.

The Norton Sound salmon district has 201 salmon permits, of which 60 fished during the 1999 season. The exvessel value of the Norton Sound fishery was the lowest value since 1968, and 83% below the previous 5-year (1994–1998) average. The number of participating fishers this season was 39% below the previous 5-year average and 46% below the previous 10-year average.

Kotzebue

The Kotzebue District commercial salmon harvest for 1999 consisted of 139,000 chum salmon. The chum harvest was 4% below the recent 5-year average, but 21% below the recent 10-year average. There were 60 permits that fished in 1999, 19% below the recent 5-year average and 45% below the recent 10-year average. Due to low salmon prices, fishers concentrated their effort close to Kotzebue; only a few fish were harvested outside statistical area 331-01.

Kodiak

The 1999 Kodiak commercial salmon fishery began on June 9 and the last landing occurred on September 23. Harvest levels of sockeye salmon, pink salmon, and chum salmon were better than expected, while those of coho and chinook salmon were less than expected. The 1999 chinook salmon harvest of 18,300 fish was below the last 10-year average harvest of 22,000 fish. The sockeye harvest of 4.65 million fish was the fourth highest on record, substantially above the recent 10-year average of 4.1 million fish. Large contributions to the harvest came from supplemental production projects (about 600,000 fish). The Cape Igvak fishery contributed about 570,000 to the total; the proportion of the Igvak harvest attributable to Chignik bound sockeye salmon taken during the allocation period through July 25 was approximately 15.4% of the total Chignik-bound harvest. The coho harvest of 296,000 fish was one of the lower harvests in recent years. Approximately 39% of coho salmon harvested (116,000 fish) were produced by the Kitoi Bay Hatchery. The pink salmon harvest of 11.9 million fish included approximately 4.0 million fish produced by the Kitoi Bay Hatchery. The pink salmon harvest was well below the 10-year average of 16.1 million fish. The 1999 chum harvest of 914,000 fish was the highest in recent years, above the average of 794,000, and reversed a trend in declining production that has occurred during the previous three seasons. Approximately 140,000 chum salmon were caught near Kitoi Bay Hatchery.

Of the 608 eligible permit holders, only 397 participated in the 1999 fishery. By gear type, a total of 4 beach seine, 173 set gillnet, and 220 purse seine permit holders fished. The estimated exvessel value of the 1999 fishery was \$31.0 million, compared to the most recent 10-year (1988–1998, excluding 1989²) average exvessel value of \$43.5 million.

A total of 26,900 chinook salmon were estimated as escapement, through fish weirs. Escapement counts were 13,100 chinook salmon into the Karluk River and 13,500 chinook salmon into the Ayakulik River. An additional 280 chinook salmon entered Dog Salmon River. The remaining 25 chinook salmon were counted through four other weirs. Escapements for sockeye salmon, overall, were excellent with 2.12 million fish counted. Approximately 1.98 million sockeye salmon (93% of the total escapement estimate) were counted into systems through fish weirs. Coho salmon escapements were excellent throughout the area, but due to the late timing of the coho salmon returns this year, many systems were not surveyed. Pink salmon escapement levels and distribution, geographically, were excellent. Chum salmon escapement estimates were the best in years.

Chignik

The Chignik Management Area salmon fishing season in 1999 was characterized by exceptionally strong sockeye salmon runs to both Black and Chignik Lakes. The first commercial fishing opening took place on June 13 and local processors stopped purchasing salmon on September 17.

The exvessel value of the 1999 commercial salmon harvest was estimated at \$22.0 million, approximately \$9.0 million above the 1989–1998 average. Approximately 96% of the total fishery exvessel value is attributable to sockeye salmon harvests. Ninety of the 100 available salmon permits were fished with an estimated average exvessel value per permit holder of \$244,900.

The 1999 chinook harvest of approximately 3,300 fish is slightly less than the forecast, and substantially less than the 10-year (1989–1998) average of 6,700 fish. The 1999 harvest of sockeye salmon greatly exceeded preseason forecasts. The sockeye harvest of 3.12 million is the largest catch on record. The total number of sockeye salmon bound for the Chignik River system, through September 17, is estimated at 4.46 million, including Cape Igvak and the Southeast District Mainland fisheries. Coho harvests of 89,400 were below forecast and below the 10-year average of 184,000. The pink salmon harvests of 1.69 million exceeded preseason forecasts and the 10-year average of 925,000. The chum harvest of 141,000 was less than forecast and less than the 10-year average of 187,000.

Chignik River escapements were estimated by video counts of fish passing through the weir. Escapement is estimated by aerial surveys for all other streams. All species, except coho salmon, were adequately surveyed. The 1999 Chignik Management Area chinook salmon, sockeye salmon, pink salmon, and chum salmon escapements met or exceeded goals. Escapement to the Chignik River and Lakes system for chinook salmon was good with a total of 3,730 fish, slightly above the 10-year average of 3,560. Sockeye escapement to the Chignik River system was also good, with a total escapement of 716,000, even though it was almost 100,000 fish below the 10-year average of 815,000. Postseason scale pattern analysis apportioned 457,000 sockeye salmon for escapement to the Black Lake run and 259,000 sockeye salmon to the Chignik Lake run.

² The year of the *Exxon Valdez* oil spill.

Alaska Peninsula – Aleutian Islands

South Peninsula

The 1999 total South Peninsula chinook salmon harvest of 4,820 was less than the forecast of 10,000. The sockeye salmon catch of 3.0 million fish was substantially greater than the preseason expectation of 2.1 million. The coho salmon harvest of 192,000 was less than the preseason expectation of 250,000. On the other hand, the pink salmon harvest of 8.4 million exceeded the preseason expectation of 8.0 million. The total South Peninsula chum harvest was 817,000, well above the preseason forecast of 750,000 fish.

The June fishery. Total June fishery harvests for sockeye salmon was 1.1 million at South Unimak and 269,000 for the Shumagin Islands, for a total South Peninsula June sockeye salmon catch of 1.4 million fish, slightly above the combined June fishery sockeye guideline harvest level. Total chum salmon harvest in the South Unimak-Shumagin Islands June fishery was 245,000 fish, well below the guideline harvest level. The total exvessel value of the June fishery was approximately \$10 million, with sockeye salmon harvests contributing \$9.9 million.

The Southeastern District Mainland fishery. The 1999 total salmon harvests for the Southeastern District Mainland fishery, for both the early and late Chignik River sockeye salmon runs were stronger than expected. Consequently, approximately eight days of fishing during June and two days in July were permitted to target Chignik stocks in the Southeastern District Mainland fishery prior to July 25.

The Northwest Stepovak Section is managed on the basis of local stocks beginning July 1. In 1999 the final estimated Orzinski Lake sockeye salmon escapement was 15,000, the lower limit of the escapement goal range. As a result, there were no commercial fishing periods during July in the Northwest Stepovak Section.

The Southeast District Mainland fishery harvest prior to July 25 (excluding the Northwest Stepovak Section after July 1) was approximately 217,000 sockeye salmon, with an estimated 173,600 fish that were considered to be Chignik bound. This constituted 5.9% of the 6.0% allocation of the total Chignik bound sockeye salmon harvest through July 25. To insure that pink and chum salmon escapements were achieved, no commercial fishing periods were allowed during August 22–31.

The fall fishery opened on September 1. Coho, chum, and chinook catches were below the most recent 10-year average (1989–1998) while pink catches were above the most recent 10-year average and sockeye catches were the highest on record.

The remainder of South Peninsula post-June fishery. On July 5, test fishing in the Shumagin Islands indicated a presence of immature salmon above the Board of Fish mandated threshold of 100 immature salmon per purse seine set. Accordingly, the first post-June commercial salmon fishing period began on July 6 with restrictions in areas of immature salmon abundance. Commercial fishing in the Shumagin Islands resumed on July 8 without immature salmon-based area restrictions.

For non-terminal areas, during the period July 22–31, there was a 60,000 fish cap to coho harvests. During this period, approximately 58,000 coho salmon were harvested.

The total South Peninsula post-June fishery includes the Southeast District Mainland. The chinook harvest of 1,600 was 52% of the 1989–1998 average of 3,100 fish. The sockeye harvest of 1.4 million was the highest on record and almost double the 1989–1998 average of 730,000 fish. The coho harvest of 192,000 was the fifth lowest since 1978 and is slightly over 70% of the previous 10-year average of 273,000 fish. The pink harvest of 8.41 million exceeded the 1989–1998 average of 7.22 million by approximately 16%. The chum harvest of 568,000 was 77% of the previous 10-year average.

The total exvessel value of the South Peninsula salmon fishery, including the \$10.0 million derived from the June fishery was \$23.6 million. Sockeye salmon contributed \$19.6 million, pink salmon \$3.1 million, chum salmon \$0.56 million, and coho and chinook salmon combined contributed \$0.34 million.

The South Peninsula sockeye salmon escapement of 97,000 fish was within escapement goal range. The South Peninsula pink salmon escapement index was the third highest on record. The South Peninsula chum salmon escapement index was the fifth highest on record.

North Peninsula

In 1999, 222 permit holders (of which 22 were Area T permit holders) participated in commercial salmon fisheries along the North Peninsula. The North Peninsula is predominantly a sockeye salmon fishery, although directed chinook, chum and coho salmon fisheries occur. During even-numbered years, pink salmon are targeted in select locations if abundance is high and market conditions are favorable. For the second year in a row, harvests for all species were well below the previous 10-year average. Both the chinook and chum harvests were the lowest since 1975. The sockeye harvest, while well above the 1998 catch, was 71% of the 1989–1998 average. The coho harvest was the lowest since 1977. The 1999 pink harvest was only 29% of the 1989–1997 average for odd-numbered years. Poor markets played a significant roll in keeping pink and chum salmon harvests below preseason projections and chinook and coho salmon runs were weak.

The total exvessel value for the North Peninsula salmon fisheries was about \$9.24 million, approximately 98% of which was attributable to sockeye salmon.

The sockeye harvest of 1.78 million was close to the preseason projection of 1.8 million fish. The North Peninsula sockeye escapement was estimated to be 897,000 fish. Systems with fish weirs (Bear, Nelson, Sandy, and Ilnik) accounted for 76% of North Peninsula sockeye salmon escapement. All sockeye escapement goals were met or exceeded.

The North Peninsula chinook escapement was 10,900 fish. Chinook salmon escapements surpassed the lower end of the cumulative escapement goal of 7,400 fish. The total chum salmon escapement was within escapement goal ranges; however, due to poor market conditions, there was no fishing effort directed at chum salmon. Pink salmon escapements were at least 20,000 fish; the North Peninsula is not a major pink salmon producer and larger runs tend to occur during even-numbered years.

Aleutian Islands and Atka-Amlia Islands Areas

In 1999, no salmon were commercially harvested in the Aleutian Islands and Atka-Amlia Islands Areas.

**PRELIMINARY FORECASTS OF 2000 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 2000 fishing year, forecast fisheries are as follows:

Southeast	—	pink salmon
Prince William Sound	—	pink, chum, sockeye, and coho 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 (early and late)	—	sockeye salmon
Chignik	—	sockeye salmon
Bristol Bay	—	sockeye and chinook salmon
Alaska Peninsula, Bear Lake	—	sockeye salmon
Alaska Peninsula, Nelson River	—	sockeye 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 2000 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	233 ^a	1,920 ^a	3,010 ^a	37,500 ^b	14,000 ^a	56,700
Prince William Sound						
<i>Common Property</i>	61	2,140	613	18,200	3,010	24,000
<i>Cost Recovery</i>	0	116	16	10,300	570	11,000
Upper Cook Inlet	15	3,000	150	500	200	3,900
Lower Cook Inlet	1	487	15	1,890	10	2,400
Bristol Bay	42	22,300	74	32	648	23,000
Central Region Total	119	28,000	870	30,900	4,440	64,300
Kodiak Area						
Chignik	4	3,470	185	1,000	200	4,950
South Peninsula	10	2,000	200	4,500	1,000	7,710
North Peninsula	8	2,000	125	75	75	2,280
Aleutian Islands	0	5	0	200	0	205
Westward Region Total	42	11,000	800	16,000	2,000	29,800
AYK Region Total	76	123	485	503	661	1,800
Statewide Total	470	41,000	5,170	84,900	21,100	153,000

Columns may not total exactly due to rounding.

^a Average harvest for the five-year, 1995–1999, period.

^b Mid point of the 55–84 million predicted return minus the 32 million midpoint of the 24–40 million escapement goal.

Modified April 6, 2000.

Note that these numbers correct mistakes made in the January 14, 2000 projections for Lower Cook Inlet, and for the statewide chinook total.

Table 2. Preliminary 1999 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	190 ^a	1,160	3,570	77,700	14,900	97,500
Prince William Sound	63	2,030	245	45,000	2,990	50,300
Upper Cook Inlet	14	2,680	125	16	174	3,000
Lower Cook Inlet	2	477	8	1,140	8	1,640
Bristol Bay	28	25,300	20	0	716	26,000
Central Region Total	108	30,500	400	46,200	3,900	81,000
Kodiak Area	18	4,650	296	11,900	914	17,800
Chignik	3	3,120	89	1,690	141	5,000
South Peninsula	5	2,950	192	8,440	817	12,400
North Peninsula	5	1,780	54	4	50	1,890
Aleutian Islands	0	0	0	0	0	0
Westward Region Total	31	12,500	631	22,000	1,920	37,100
AYK Region Total	97	81	47	0	269	500
Total Alaska	430	44,200	4,600	146,000	21,000	216,000

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

^a Total commercial harvest of chinook salmon for the October 1, 1998 to September 30, 1999 catch accounting period.

Modified May 23, 2000

Note that totals for Westward Region coho and chum salmon have been modified from the original January 2000 estimates.

Table 3. Preliminary 1999 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	2,930	6,830	21,400	228,000	140,000	399,160
Prince William Sound	1,360	12,200	2,000	134,000	24,600	174,160
Upper Cook Inlet	337	15,400	732	50	1,400	17,919
Lower Cook Inlet	26	2,220	53	2,870	63	5,232
Bristol Bay	279	147,000	130	0	4,800	152,209
Central Region Total	2,000	177,000	2,900	137,000	30,900	349,800
Kodiak Area	233	24,500	2,200	36,400	7,240	70,573
Chignik	57	20,600	617	4,850	1,060	27,184
South Peninsula	87	16,100	1,150	25,900	5,560	48,797
North Peninsula	59	9,060	345	13	338	9,815
Aleutian Islands	0	0	0	0	0	0
Westward Region Total	400	70,300	4,300	67,200	14,200	156,400
AYK Region Total	1,810	530	302		2,100	4,742
Total Alaska	7,200	254,000	28,900	432,100	187,200	910,000

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

Columns may not total exactly due to rounding.

Modified January 14, 2000

Table 4. Preliminary 1999 Southeast Region commercial salmon harvests, by fishing area and species, in thousands of fish.

Fishing Area	Species					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Tree Point Gillnet	2	160	65	611	179	1,017
Prince of Wales Island Gillnet	1	105	206	473	448	1,234
Stikine River Gillnet	1	37	28	49	117	231
Seine - Southern Districts	3	320	183	36,700	2,700	39,907
Southern S.E. Alaska Total	7	622	482	37,800	3,400	42,400
Taku-Snettisham Gillnet	2	79	17	59	429	587
Lynn Canal Gillnet	0	157	34	41	233	464
Yakutat Setnet	5	129	187	30	1	351
Seine - Northern Districts	1	95	214	33,700	1,670	35,680
Northern S.E. Alaska Total	9	460	452	33,800	2,330	37,100
Winter Troll ^a	31	0	1	0	0	32
Experimental Troll	18	1	12	30	4	66
Hatchery Terminal Area Troll	2	0	0	0	1	3
Summer Troll	94	5	2,250	510	69	2,929
Troll Fishery Harvest Total	146	6	2,260	541	75	3,000
Hatchery Terminal Area Gillnet	3	8	3	24	758	795
Hatchery Terminal Area Seine	13	9	19	1,540	4,570	6,151
Hatchery Cost Recovery	11	35	304	3,050	3,590	6,990
Annette Island	1	22	49	896	100	1,069
S.E. Alaska - Other Total	28	74	376	5,500	9,000	15,000
Southeast Region Total	190	1,160	3,570	77,700	14,900	97,500

^a Includes salmon caught by troll gear from October 11, 1998 through April 14, 1999.

Columns may not total exactly due to rounding.

Modified May 23, 2000

(Total for Southeast Region sockeye and coho salmon revised from earlier calculations.)

Table 5. Preliminary 1999 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	0	9	69	12,300	107	12,500
Northern	0	3	1	4,980	11	5,000
Coghill	0	3	0	3,510	621	4,140
Southwestern ^b	0	9	7	9,510	11	9,540
Montague ^a	0	0	0	190	639	830
Southeastern	0	0	0	915	83	999
Drift Gillnet						
Bering River ^b	0	14	10	0	0	24
Copper River ^{a, b}	62	1,680	153	10	25	1,931
Unakwik	0	9	0	0	0	9
Coghill	0	106	1	32	689	829
Eshamy	0	86	2	127	13	228
Set Gillnet						
Eshamy	0	74	1	43	11	130
Hatchery ^c	0	29	0	13,100	777	13,906
Misc. PWS ^d	0	10	0	247	0	258
Prince William Sound Total	63	2,000	245	45,000	3,000	50,300
Southern District						
Kamishak District	2	243	3	1,100	5	1,353
Outer District	0	47		1	0	48
Eastern District	0	51	2	33	2	87
Lower Cook Inlet Total	0	135	4	2	1	142
Central District						
Upper Cook Inlet Total	2	477	8	1,140	8	1,630
Central District						
Naknek-Kvichak	11	2,620	94	16	170	2,911
Nushagak District	3	59	32	1	4	98
Upper Cook Inlet Total						
Naknek-Kvichak	14	2,700	125	16	174	3,010
Bristol Bay District						
Naknek-Kvichak	1	8,970	0	0	273	9,244
Nushagak District	11	6,260	3	0	184	6,458
Egegik District	1	7,420	12	0	75	7,508
Ugashik District	2	2,270	2	0	71	2,345
Togiak District	13	384	3	0	113	513
Bristol Bay Total	28	25,300	20	0	716	26,100
Central Region Total						
	108	30,500	400	46,200	3,900	81,000

^a Totals include discarded sockeye, coho, 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 may not total exactly due to rounding

Modified May 23, 2000

(Total for Central Region chinook salmon revised from earlier calculations.)

Table 6. Preliminary 1999 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	18	4,650	296	11,900	914	17,778
Chignik Areas	3	3,120	89	1,690	141	5,043
South Peninsula	5	2,950	192	8,440	817	12,404
North Peninsula	5	1,780	54	4	50	1,893
Alaska Peninsula Total	10	4,730	246	8,440	867	14,300
Aleutian Islands	0	0	0	0	0	0
Westward Region Total	31	12,500	631	22,000	1,920	37,100

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

Columns may not total exactly due to rounding

Modified January 14, 2000

Table 7. Preliminary 1999 Arctic-Yukon-Kuskokwim Region commercial salmon harvests, by fishing area and species, in thousands of fish.

Fishing Area	Species					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Kuskokwim River	5	17	23		23	68
Kuskokwim Bay	20	64	9		50	143
Kuskokwim Area Total	25	81	32	0	73	211
Lower Yukon River	65		2		47	114
Upper Yukon River ^a	5		0		2	7
Yukon River Total ^a	70	0	2	0	49	121
Norton Sound	2		13		8	23
Kotzebue Area					139	139
AYK Region Total	97	81	47	0	269	494

^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 may not total exactly due to rounding

Modified January 14, 2000

Table 8. Comparison of actual and forecast 1999 salmon runs, with errors and relative errors for some major Alaskan salmon fisheries, in millions of fish.

Area	Species	1999	1999	1999 Harvest	Forecast Run	Forecast Harvest	Error 2/ Error 2/	Relative Error 3/ Error 3/
		Estimated Run 1/ Run 1/	Escape- ment ment					
Southeast Total	Pinks	153.6	75.98	78	74.70	41.00	-78.90	-105.6%
Prince William Sound	Pinks	47.46	2.46	45.00	32.90	30.10	-14.56	-30.7%
	Chums	3.34	0.34	3.00	3.24	2.97	-0.10	-3.0%
	Sockeye	2.09	0.09	2.00	0.26	0.19	-1.83	-87.6%
	Coho	na	na	0.25	0.16	0.16	nd	nd
	Chinook	na	na	0.063	nd	nd	nd	nd
Copper River	Sockeye	1.79	0.10	1.69	2.36	1.86	0.57	31.8%
	Chinook	na	na	0.62	nd	0.05	nd	nd
Upper Cook Inlet	Sockeye	4.50	1.48	2.68	3.50	2.00	-1.00	-22.2%
Lower Cook Inlet	Pinks	1.35	0.206	1.14	4.32	3.80	2.97	221.0%
Kodiak	Pinks	16.40	na	11.90	11.80	9.50	-4.60	-28.0%
Upper Station, Early	Sockeye	0.09	na	0.05	0.15	0.10	0.06	66.7%
Upper Station, Late	Sockeye	0.57	na	0.36	0.53	0.38	-0.04	-7.0%
Frazer	Sockeye	0.36	na	0.13	0.52	0.38	0.16	44.4%
Ayakulik	Sockeye	0.99	na	0.69	1.40	1.10	0.41	41.4%
Karluk, Early	Sockeye	0.58	na	0.18	0.36	0.16	-0.22	-37.9%
Karluk, Late	Sockeye	1.00	na	0.42	1.03	0.63	0.03	3.0%
Chignik	Sockeye	4.46	1.34	3.75	2.33	1.68	-2.13	-47.8%
Bristol Bay	Sockeye	39.50	14.10	25.30	26.20	15.10	-13.30	-33.7%
Nushagak	Chinook	0.63	0.62	0.01	0.21	0.14	-0.42	-66.0%
Total		278.7	101.8	176.9	166.0	111.3		

Updated January, 2000.

1/ Run is harvest plus Escapement

2/ Error Is Forecast Run minus Run

3/ Relative Error is Error divided by Run times 100%

The notation "na" means data not available.

Modified January 14, 2000

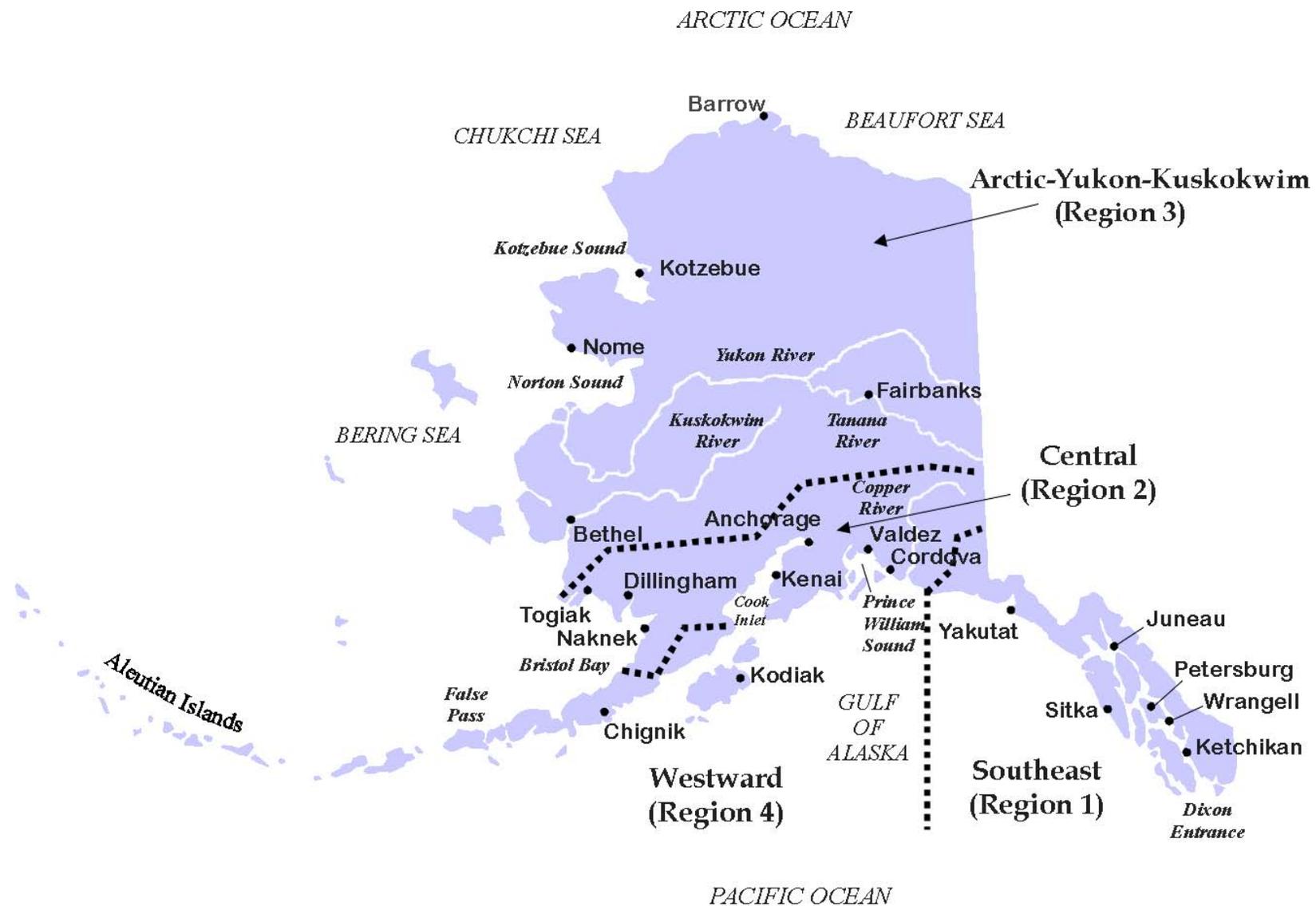


Figure 1. The four fishery management regions (Southeast, Central, Arctic-Yukon-Kuskokwim, and Westward) of the Alaska Department of Fish and Game, Division of Commercial Fisheries.

Chinook Salmon

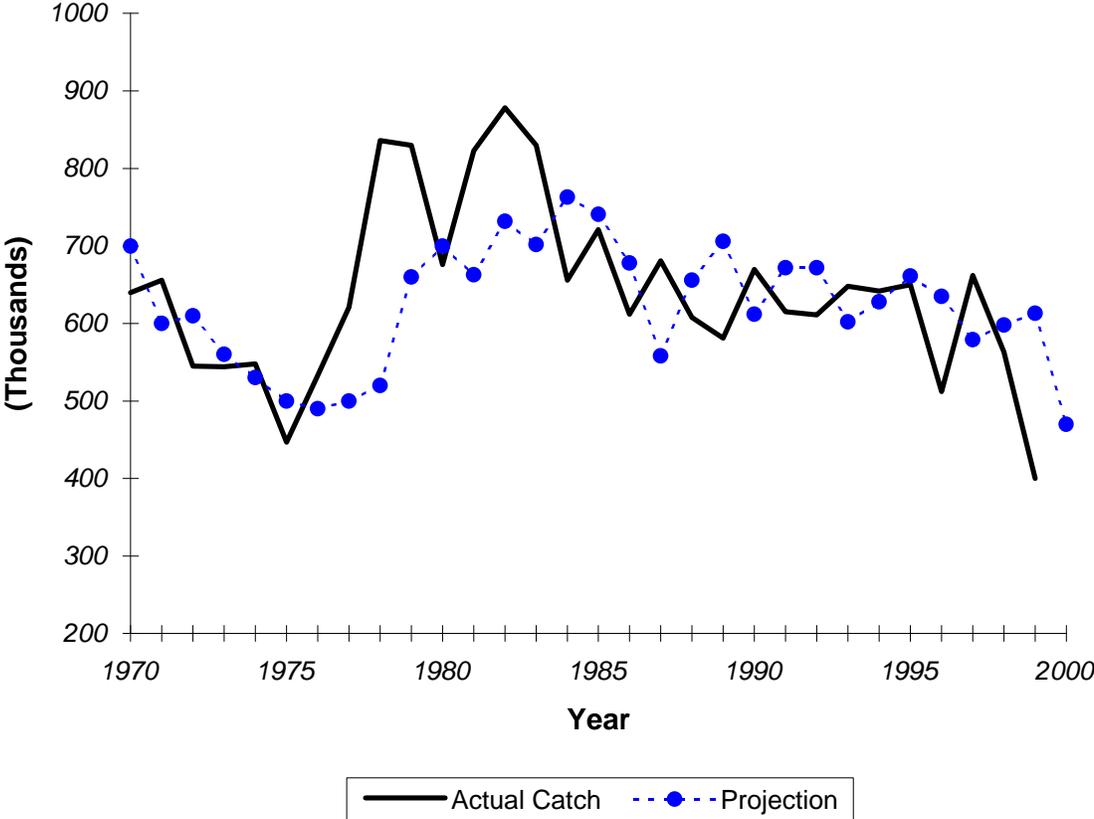


Figure 2. Relationship between actual catch (thousands) and projected catch (thousands) for Alaskan chinook salmon fisheries from 1970–1999, with the 2000 projection.

Sockeye Salmon

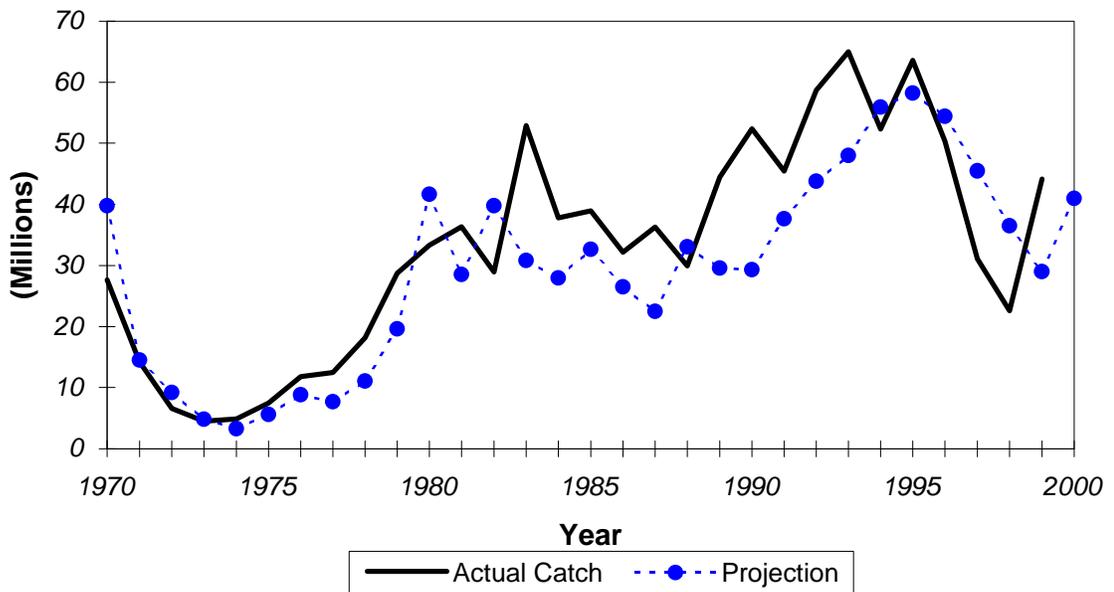


Figure 3. Relationship between actual catch (millions) and projected catch (millions) for Alaskan sockeye salmon fisheries from from 1970–1999, with the 2000 projection.

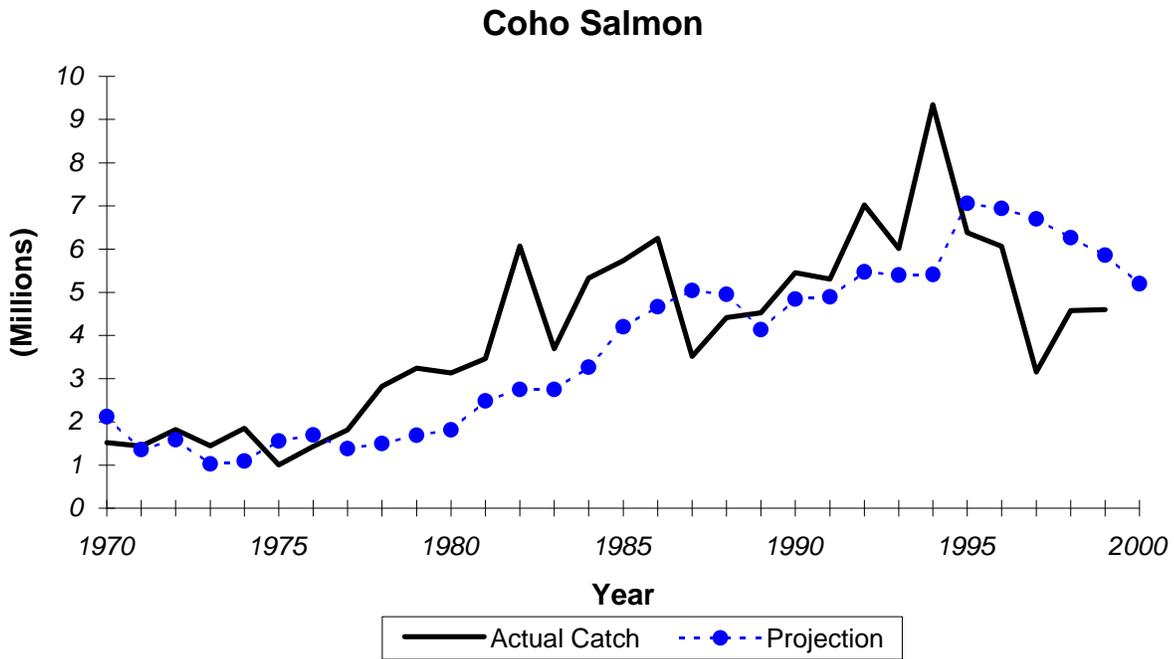


Figure 4. Relationship between actual catch (millions) and projected catch (millions) for Alaskan coho salmon fisheries from 1970–1999, with the 2000 projection.

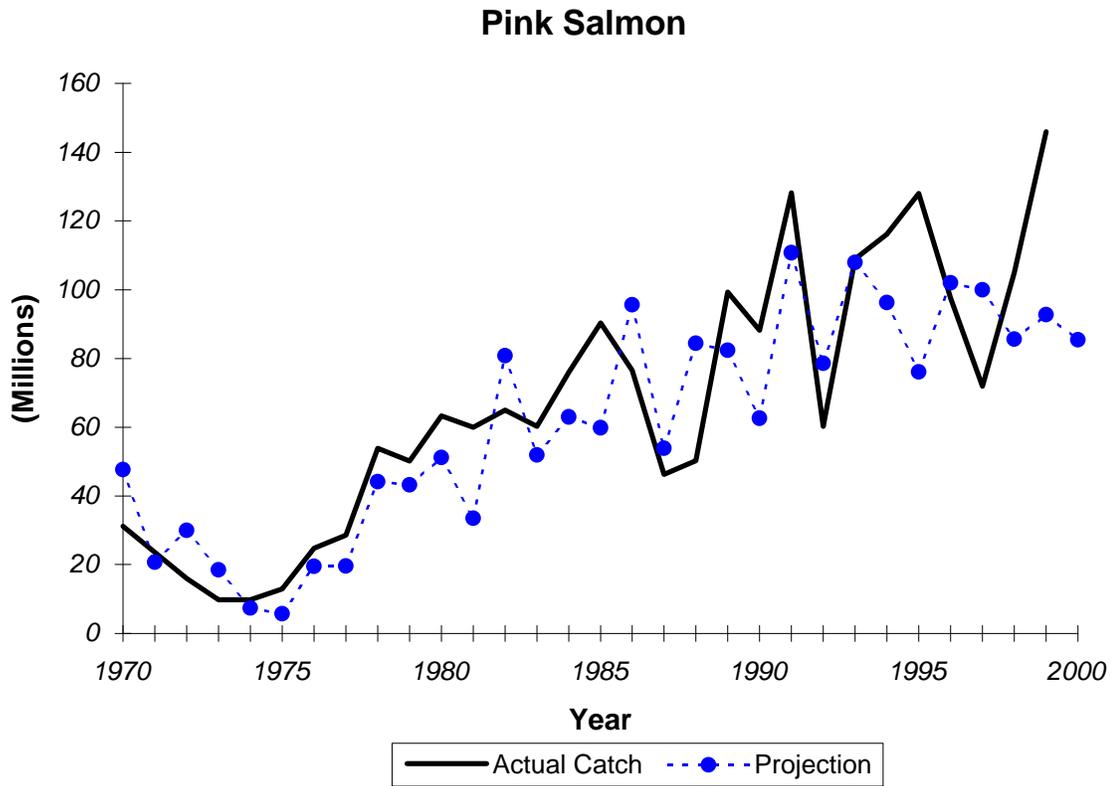


Figure 5. Relationship between actual catch (millions) and projected catch (millions) for Alaskan pink salmon fisheries from from 1970–1999, with the 2000 projection.

Chum Salmon

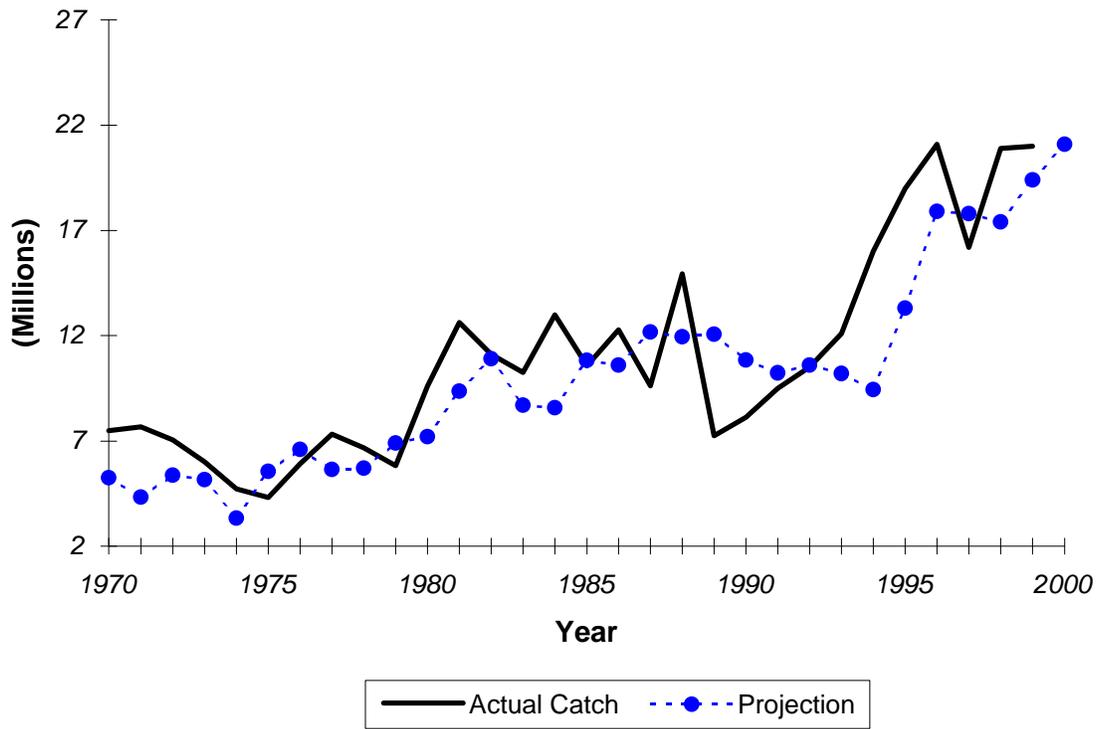


Figure 6. Relationship between actual catch (millions) and projected catch (millions) for Alaskan chum salmon fisheries from from 1970–1999, with the 2000 projection.

Appendix

**Preliminary Total Return Predictions/Projections
For Southeast Alaska Pink Salmon in 2000**

This preseason prediction of the total return of pink salmon to Southeast Alaska in 2000 is based on selecting one of five different return magnitude categories. These categories for TOTAL ADULT RETURN were obtained by calculating the 20th, 40th, 60th, and 80th percentile of Southeast Alaska's pink salmon returns (harvest + escapement) during the 1967 through 1998 time period.

These categories are:

Category	Range	Percentile
Disaster	Less than 18 million	Less than 20 th
Weak	18 to 32 million	21 st to 40 th
Average	33 to 54 million	41 st to 60 th
Strong	55 to 84 million	61 st to 80 th
Excellent	More than 84 million	Greater than 80 th

The pink salmon return in 2000 is predicted to be STRONG with estimated total returns in the 55 to 84 million fish range. The peak aerial escapement index goals for all Southeast Alaska streams are between 9.6 and 16 million fish; this equates to an estimated actual escapement between 24 and 40 million (using the traditional 2.5 times expansion). The decision this year to change from forecasting harvests to forecasting returns was made to avoid the variability that management actions, fishing conditions, and harvest and processing capacity have on the biological factors influencing run strengths.

We provide forecasts for three geographic areas of Southeast Alaska:

Southern, Districts 1-8

Northern Inside, Districts 9-15 except the majority of District 13, and
Northern Outside, District 13 excluding Hoonah Sound.

The forecast breakdown is:

Sub-Region	Category	Return	Escapement Goal
Southern	Strong	35 to 54 million	15 to 22 million
Northern Inside	Strong	12 to 28 million	7 to 14 million
Northern Outside	Excellent	Greater than 5 million	2 to 4 million
Total	Strong	55 to 84 million	24 to 40 million

These preseason predictions are based on the following considerations:

- 1) Brood year escapements in 1998 were fourth highest ever for the region, the sixth highest in Southern (SSE); fifth highest on record in Northern Inside (NSEI); and the third highest on record in Northern Outside (NSEO) (Figures 1-4).

- 2) Brood year escapements in 1998 in all three areas were at the upper range of those that have yielded the largest runs in past years (Figures 1-4)
- 3) Three statistical models (Ricker spawner-recruit relationship, a “generalized Ricker” fit, and a Loess Smooth) were used, and all produced similar estimates for 2000.
- 4) Winter incubation temperatures throughout Southeast Alaska were slightly lower during November 1998 through February 1999 for the 120 day mean low (Figure 5) than the previous year, but the 21-day mean low for this period was well above average (Figure 6). Thus, winter weather conditions should not produce any significant causes for mortality for the 2000 return.
- 5) There were no early marine fry surveys in Southeast Alaska in 1999 to indicate fry abundance.

FORECAST AREA: Prince William Sound SPECIES: Pink Salmon

Preliminary Forecast of the 2000 Run:	Forecast Estimate (millions)	Forecast Range (millions)
NATURAL PRODUCTION:		
<i>Prince William Sound General Districts</i>		
Total Run	6.6	1.4-11.9
Escapement Goal	1.4	
Harvest Estimate	5.2	0.0-10.5
HATCHERY AND SUPPLEMENTAL PRODUCTION:		
<i>Valdez Fisheries Development Association – Solomon Gulch Hatchery</i>		
Hatchery Run	7.7	4.5–11.0
Broodstock Needs	0.5	
Cost Recovery Needs	4.3	3.8–5.1
Limited Entry Harvest	2.9	2–6.7
Historic Survival for Even Years: Range = 1.8% - 8.9%, Mean = 3.6%		
<i>Prince William Sound Aquaculture Corporation – Cannery Creek Hatchery</i>		
Hatchery Run	5.0	3.8–6.2
Broodstock Needs	0.3	
Cost Recovery Needs	2.0	1.8–2.4
Limited Entry Harvest	2.7	1.7–4.1
Historic Survival for Even Years: Range = 0.5% – 6.6%, Mean = 3.8%		
<i>Prince William Sound Aquaculture Corporation – A. F. Koernig Hatchery</i>		
Hatchery Run	6.2	4.3–8.2
Broodstock Needs	0.3	
Cost Recovery Needs	2.0	1.8–2.4
Limited Entry Harvest	3.9	2.2–6.1
Historic Survival for Even Years: Range = 1.4% – 13.3%, Mean = 4.7%		
<i>Prince William Sound Aquaculture Corporation – W. H. Noerenberg Hatchery</i>		
Hatchery Run	5.8	3.7–7.9
Broodstock Needs	0.3	
Cost Recovery Needs	2.0	1.8–2.4
Limited Entry Harvest	3.5	1.6–5.8
Historic Survival for Even Years: Range = 0.9% – 8.4%, Mean = 4.7%		
TOTAL PRODUCTION:		
Run Estimate	31.3	17.7–45.2
Natural Escapement Goal	1.4	
Broodstock Needs	1.4	
Cost Recovery Needs	10.3	9.2–12.3
Limited Entry Harvest	18.2	5.7–33.2

FORECAST AREA: Prince William Sound
SPECIES: Pink Salmon

Forecast Methods

The 1999 natural run of pink salmon is the mean total run of natural production for 1989–1999. This differs markedly from previous predictions that used linear regressions of adult production on brood year escapement for indicator spawning streams.

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 historic mean marine survival rate at each hatchery. The forecast interval is derived from the confidence interval around the mean of the marine survival data.

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 brood stock.

All cost recovery harvest estimates are preliminary. Cost recovery harvests for the Prince William Sound Aquaculture Corporation are based on a revenue goal of \$3.8 million using a base price of \$0.18/lb and a 3.5 lb average size for the returning adult pink salmon. The range was calculated using prices of \$0.15/lb and \$0.20/lb as the lower and upper bounds of the run forecast minus the broodstock goal. Actual Prince William Sound Aquaculture Corporation cost recovery harvests will depend on the actual run at each facility. The Valdez Fisheries Development Association projected cost recovery harvest is based on a revenue goal of \$2.7 million. The upper and lower bounds of the Valdez Fisheries Development Association cost recovery harvest are based on the same assumptions about pink salmon weight and price used for the Prince William Sound Aquaculture Corporation return.

Forecast Discussion

Previous forecasts employed surveys of preemergent eggs and juveniles, or linear regressions of adult production on brood year escapement for indicator spawning streams. Surveys of preemergent eggs and juveniles are no longer conducted, and the information is not available for forecasting. Because R^2 values for regressions of the logarithm of return-per-spawner on parent-year escapements were extremely low (0.0007), calculations of natural pink salmon runs using these data were deemed inappropriate and produced estimates no better than the recent average. The previous 10-year period was chosen for calculation of average return, because reliable estimates of natural and hatchery contributions are only available for that time period.

The release of 602 million pink salmon from hatcheries in Prince William Sound in 1999 was about average for the last 10 years. Marine survival estimates for each hatchery have been calculated since 1987 using coded wire tag recoveries and have probably somewhat underestimated hatchery production. Mean even-year survival was used to calculate the estimated run. Zooplankton and ocean temperatures during the initial 30 days of marine residence affect the growth rate and predation rates of juvenile pink salmon. Mean zooplankton density and temperature measured at Prince William Sound hatcheries were

about 10% below average during this initial rearing period in 1999. These conditions may cause slightly lower than average survival for most fry released in 1999. However, about 50% of the fry released at W. H. Noerenberg and Solomon Gulch hatcheries were relatively large (>0.5 g), and their survival may be higher than average. Effects of predators are extremely difficult to quantify and can greatly affect the survival of pink salmon juveniles. This forecast does not explicitly account for predation. Another factor that could affect forecast accuracy is the current La Niña climatic event. We do not know what effect this may have on the 2000 run. Future enhancements to forecasting accuracy may come from work nearing completion on a number of projects funded by the *Exxon Valdez* oil spill (EVOS) Trustee Council. Most promising are project components within the Sound Ecosystem Assessment (SEA) study which incorporate smolt size, ocean temperatures, plankton abundance, and growth rate in bioenergetic models to estimate pink salmon ocean survival.

The midpoint hatchery forecast of 24.7 million pink salmon to Prince William Sound would be the third largest hatchery run achieved. All hatcheries are expected to produce similar numbers of returning adult salmon.

Mark Willette
Fisheries Biologist III
Prince William Sound Project Leader
Cordova

FORECAST AREA: Prince William Sound
SPECIES: Chum Salmon

Preliminary Forecast of the 2000 Run:	Forecast Estimate (millions)	Forecast Range (millions)
NATURAL PRODUCTION:		
<i>Prince William Sound General Districts</i>		
Total Run	0.80	0.61–0.98
Escapement Goal	0.23	
Harvest Estimate	0.57	0.38–0.75
HATCHERY AND SUPPLEMENTAL PRODUCTION:		
<i>Prince William Sound Aquaculture Corporation – W. H. Noerenberg Hatchery (Onsite Returns)</i>		
Hatchery Run	2.45	1.40–3.54
Broodstock Needs	0.14	
Cost Recovery Needs ^a	0.56	0.32–0.81
Limited Entry Harvest	1.75	0.94–2.59
<i>Prince William Sound Aquaculture Corporation – W. H. Noerenberg Hatchery (Port Chalmers Remote Returns)</i>		
Hatchery Run	0.64	0.37–0.93
Broodstock Needs	0.0	
Cost Recovery Needs ^a	0.0	
	0.64	0.37–0.93
<i>Prince William Sound Aquaculture Corporation – A. F. Koernig Hatchery (Onsite Returns)</i>		
Hatchery Run	0.06	0.04–0.09
Broodstock Needs	0.0	0.01–0.02
Cost Recovery Needs ^a	0.01	
Limited Entry Harvest	0.05	0.03–0.07
TOTAL PRODUCTION		
Run Estimate	3.95	2.41–5.54
Escapement Goal	0.23	
Broodstock Needs	0.14	
Cost Recovery Needs	0.57	0.33–0.83
Limited Entry Harvest	3.01	1.72–4.34

^a Chum salmon cost recovery is pooled with the sockeye salmon cost recovery at Main Bay Hatchery to provide a revenue goal of \$2.3 million.

FORECAST AREA: Prince William Sound
SPECIES: Chum Salmon

Forecast Methods

The forecast of the total natural chum salmon run was calculated as the average of all natural runs since 1970. Returns of natural chum salmon since 1985 were calculated by subtracting estimated hatchery chum salmon production from total returns.

The forecast of the total hatchery chum run is the sum of individual hatchery forecasts. The forecast for each hatchery was the product of the number of fry released and their historical mean marine survival rate and age composition. Hatchery runs for all age classes were calculated from fry releases made during 1994–1998 multiplied by a mean marine survival of 1.22% (range: 0.70–1.76%). Mean survival for all released fry was based on nine years of fry release and adult return data from W. H. Noerenberg Hatchery. The average age composition for previous chum returns during 1983–1999 was used in the calculation. However, hatchery rearing practices were altered in 1995, and this resulted in released fry about 2.5 times larger in body size than those from earlier years. An adjustment to the total forecast was made based upon differences between the actual and forecasted chum returns in 1998 and 1999. This approach was used to account for changes in age at maturity and marine survival that may have resulted from releasing fry at a larger size. The forecast interval was derived from the confidence interval around the mean of marine survival data.

The A. F. Koernig Hatchery run is expected to be composed of three- and four-year-old chum salmon returning from releases in 1996 and 1997. Historical survival data is not available at this site. The Port Chalmers chum salmon run is expected to be comprised of all adult age classes in 2000, but no historic survival data is available for releases at this site.

W. H. Noerenberg Hatchery historical survival estimates were used to forecast Solomon Gulch, A. F. Koernig, and Port Chalmers runs and associated forecast intervals. The forecast for the W. H. Noerenberg Hatchery run was based on sibling relationships, and far exceeds the upper confidence interval calculated from average survivals. Record three- and four-year-old components returned to the W. H. Noerenberg Hatchery in 1999 from fry that were released at over twice the average body size of historical releases. Large size at release could shift adult returns to earlier age classes, as well as significantly increase overall survival. In addition, marine survival of pink salmon released in 1998 was very high, so returns of age-3 chum salmon in 2000 may also be high.

Projected broodstock needs for each facility were based on the expected number of eggs produced from each female and expected proportion of females in the brood stock. Broodstock needs will not change unless hatchery program changes occur. The projected sales harvest for Prince William Sound Aquaculture Corporation is based on a revenue goal of \$2.3 million for species other than pink salmon. Prince William Sound Aquaculture Corporation expects to achieve this revenue goal primarily from hatchery sales of sockeye and chum salmon. The forecasted sockeye salmon run would be insufficient to provide half of the total non-pink salmon revenue goal. Therefore, additional chum salmon will be sold to compensate for any shortfall in sockeye salmon sales. A revenue goal of \$1.61 million for W. H. Noerenberg Hatchery chum salmon was based on an estimated price of \$0.35/lb and average adult weight of 8 lb. Under these assumptions, the corporation would require sales of about 24% of the total chum

salmon return produced by Prince William Sound Aquaculture Corporation. Nearly all hatchery sales harvests will occur at the W. H. Noerenberg Hatchery site. About 500 late-run chum salmon are forecasted to return to Solomon Gulch Hatchery in 2000. The run is expected to be composed solely of six-year-old adults from a very small chum salmon release in 1994. This will be the last year that late-run chum salmon will return to this facility.

Forecast Discussion

Our ability to accurately forecast natural chum salmon is limited by the small amount of data available. Accurate estimates of wild stock contributions to harvests are not available for recent years due to elimination of the coded wire tag recovery program for this species. Age data from escapements and harvests are unavailable for most areas of Prince William Sound. If actual run size is close to the forecasted run for 2000, it would be about the same size as the 1999 run and 45% greater than the average run for the period 1988–1998.

Our ability to accurately forecast hatchery chum salmon runs is limited because recent changes in hatchery practices appear to have greatly altered survival and possibly also age at maturity. If the forecast for W. H. Noerenberg Hatchery chum salmon is realized, it would be the largest run produced by that facility. Age-5 chum salmon generally contribute about 40% to the run, but previous returns of age-3 and 4 siblings in 1998 and 1999 produced actual returns about 3 times greater than those predicted by a model based on average survivals and age composition. The strong returns from this brood year were probably due to releases of larger fry, favorable environmental conditions, and a possible increase in the proportion of this year class returning at younger ages. The midpoint forecast for the five-year-old age class return was increased to compensate for the strength of this brood year. The four-year-old component, which generally contributes about 53% of return, is expected to produce the third highest run for this age class at W. H. Noerenberg Hatchery. This forecast is based on the number of three-year-old siblings that returned in 1999, which was about 10 times more abundant than predicted. The three-year-old component typically contributes about 4% to the run, but returns of age-3 chum salmon from the 1995 and 1996 brood years were 4 and 10 times greater than predicted by a model based on average marine survival and age composition. The forecast for the three-year-old component was increased to account for the higher returns of this age class since chum fry were reared to a large size at this hatchery. Returns from Port Chalmers remote releases of chum salmon fry from W. H. Noerenberg Hatchery are expected to be about the same as the 1999 run. Together, the W. H. Noerenberg Hatchery onsite and Port Chalmers remote returns are expected to produce over 3.0 million adult chum salmon.

Chum salmon released at A. F. Koernig Hatchery in 1996 and 1997 were also reared to a large size. Returns in 1999 were about 2 times greater than predicted. The forecast for returns to this hatchery in 2000 were not adjusted to account for changes in marine survival or age at maturity because insufficient data were available. Cost recovery harvests at A. F. Koernig Hatchery should end prior to commencement of commercial fishing by the purse seine fleet in this area.

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FORECAST AREA: Prince William Sound
SPECIES: Sockeye Salmon

Preliminary Forecast of the 2000 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
NATURAL PRODUCTION:		
<i>Prince William Sound – Coghill Lake</i>		
Total Run	588.8	240.8–1448.8
Escapement Goal	25.0	
Harvest Estimate	563.8	215.8–1423.8
<i>Prince William Sound – Eshamy Lake</i>		
Total Run	61.1	41.6–80.5
Escapement Goal	35.0	
Harvest Estimate	26.1	6.6–45.5
<i>Prince William Sound – Unakwik District</i>		
Harvest Estimate	10.8	8.3–13.2
HATCHERY AND SUPPLEMENTAL PRODUCTION:		
<i>Prince William Sound Aquaculture Corporation – Main Bay Hatchery (Eyak Stock Onsite Returns)</i>		
Hatchery Run	7.2	6.2–9.7
Broodstock Needs	0.0	
Cost Recovery Needs	7.2	6.2–9.7
Limited Entry Harvest	0.0	
<i>Prince William Sound Aquaculture Corporation – Main Bay Hatchery (Coghill Stock Onsite Returns)</i>		
Hatchery Run	8.8	8.0–9.6
Broodstock Needs	7.5	
Cost Recovery Needs ^a	0.0	
Limited Entry Harvest ^b	1.3	0.5–2.1
<i>Prince William Sound Aquaculture Corporation – Main Bay Hatchery (Eshamy Stock Onsite Returns)</i>		
Hatchery Run	289.2	279.9–300.8
Broodstock Needs	0.0	
Cost Recovery Needs	108.5	105.7–110.6
Limited Entry Harvest	180.7	174.2–190.2
TOTAL PRODUCTION		
Run Estimate	965.9	584.8–1862.6
Natural Escapement Goal	60.0	
Broodstock Needs	7.5	
Cost Recovery Needs	115.7	111.9–120.3
Limited Entry Harvest	782.7	405.4–1674.8

^a Includes a remote release at Boulder Bay, near Tatitlek.

^b Includes remote releases at Cordova, Whittier and Chenega.

Forecast Methods

The forecast of the natural sockeye salmon run to Coghill Lake is the total of estimates for five age classes. Linear regression models using logarithm-transformed data were used to predict runs for two age classes: age-1.2 and 1.3 sockeye salmon. The run of each of these two age classes was predicted from the relationship between returns of that age class and returns of the age class one year younger from the same brood year. For example, the model used to predict the run of age-1.2 sockeye salmon in 2000 used the run of age-1.1 sockeye salmon in 1999 as the input parameter. The predicted run of age-1.1, 2.2, and 2.3 sockeye salmon were calculated as the mean return of those age classes in past years. Although catch and escapement numbers, as well as age composition data, are available for Coghill sockeye salmon runs since 1962, escapement numbers prior to installation of a full weir in 1974 are considered unreliable. Therefore, only data collected since 1974 were used to estimate model parameters, calculate individual age class forecasts, and generate confidence intervals using a cross-validation technique. The predicted total run to Coghill Lake was the sum of predictions.

The forecast of the natural run to Eshamy Lake is the mean of the 1970–1992 brood year returns. Eshamy Lake escapements have been enumerated at a weir since 1950 for all but two years: 1987 and 1998. Commercial catches are available for the same period, but age composition data are available only for some years since 1962, and were not collected in 1987 and 1998. Only available data collected since 1970, excluding 1987 and 1998, were used to calculate the mean run used for the forecast and the 80% confidence interval.

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

Main Bay Hatchery, operated by Prince William Sound Aquaculture Corporation (Prince William Sound Aquaculture Corporation), is the only facility producing sockeye salmon within Prince William Sound. Three sockeye salmon stocks (Coghill, Eshamy, and Eyak Lake stocks) are used, and 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 is the sum of predictions for individual ages.

The forecast of the Eyak Lake sockeye salmon onsite return is based on age-specific marine survivals (0.65% for four-year-old and 4.5% for five-year-old sockeye salmon) for hatchery releases in brood years 1990, 1991, 1993, and 1994. Survival estimates were based on fry releases, catch contribution estimates from coded wire tag recoveries, and broodstock data. Marine survival estimates were calculated from adults returning from releases of age-0 sockeye salmon, but adults returning in 2000 from brood year 1995 and later are from age-1 smolt releases. Because survival data were not available from multiple brood years, 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 confidence intervals around Eyak Lake age-specific forecasts. It is expected that all returning Eyak sockeye salmon will be used for cost recovery. This stock is being phased out of hatchery production.

The forecast of the Coghill sockeye salmon stock onsite return is based on age-specific mean marine survival of hatchery returns from brood years 1986 through 1993 (0.73% for three-year-old, 8.01% for four-year-old, and 3.68% for five-year-old sockeye salmon). Survival estimates are based on fry releases, catch contribution estimates from coded wire tag recoveries, and broodstock data. Because only limited data were available from multiple brood years, age-specific survival estimates were calculated separately for 24 separate release groups within four complete brood years. Means of these estimates were then used to forecast three-, four-, and five-year-old returns, and the variance about each mean was used to estimate

associated forecast intervals. It is expected that up to 90% of the Coghill stock return to Main Bay Hatchery will be used for broodstock, leaving less than 2,500 adults for common property harvest. Coghill stock remote smolt releases have been discontinued, and no further adult returns are expected from prior releases. Less than 100 sockeye are expected to return to Solf Lake in 2000 from a fry release in 1998.

The forecast of the late-run Eshamy sockeye salmon onsite return is based on age-specific mean marine survival from four complete brood year cycles of hatchery production (0.25% for three-year-old, 12.52% for four-year-old, and 0.07% for five-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 forecasts of late-run Eshamy stock onsite returns.

Projected broodstock needs for each facility were based on the expected number of eggs produced from each female and the expected percentage of females in the broodstock. Broodstock needs will not change unless hatchery program changes occur. Prince William Sound Aquaculture Corporation cost recovery needs for sockeye salmon are based on a revenue goal of \$2.3 million for species other than pink salmon. This revenue goal is divided between chum salmon and sockeye salmon produced in hatcheries. The sockeye salmon portion of the revenue goal is expected to be \$1.1 million. The midpoint estimate of the number of sockeye salmon adults needed to achieve this cost recovery goal was calculated using an expected price of \$1.00/lb and an average adult weight of 6 lb. The midpoint forecast of hatchery returns suggests an insufficient number of adults will return to meet the original cost recovery goal. As a result, a revised sockeye salmon revenue goal of \$0.7 million was used. This lower revenue goal was calculated assuming about 40% of the total sockeye return to this hatchery will be harvested for cost recovery. Prince William Sound Aquaculture Corporation will probably harvest additional chum salmon to make up for the shortfall in revenues from sockeye salmon returns.

Forecast Discussion

The natural Coghill sockeye salmon run appears to be recovering after a period of poor runs in the first half of this decade, which appears to be due in part to limnological conditions in Coghill Lake. The biological escapement goal for this system was lowered to allow plankton populations to recover, and fertilizers were added to the lake in a cooperative project with the U. S. Forest Service to improve the forage base for rearing sockeye salmon juveniles. Returns in 1996–1999 appear to mark the resumption of higher production levels, and are expected to continue in 2000. Biological escapement goals for the Coghill Lake natural run were met in 1999 for the sixth time since 1990. The forecast for the natural run to Coghill Lake in 2000 of approximately 588.8 thousand sockeye salmon would be the third largest run in the 1968–1999 time series. The average run is 190,000 sockeye salmon for this system.

The forecast for natural stocks was generated using sibling regression models, similar to projections in previous years. However, sibling relationships do not account for the return of presmolts released into Coghill Lake in 1994 and 1995. Few adults returned in 1998 and 1999 from these releases, but insufficient data are available to evaluate survival or typical age at maturity. Estimated smolt emigration numbers for 1997 suggest the 2000 run could be much smaller than the point estimate from sibling models. Evidence that suggests the smolt estimates are low includes a 22% smolt-to-adult survival at age 4 and no relationship between smolt weight and proportion of brood year return at age 4.

The forecast for the natural run of sockeye salmon to Eshamy Lake is the 1972–1997 average run of 60.7 thousand adults. The Eshamy Lake natural stock appears to exhibit a four-year cycle of peak abundance,

and the 2000 run should be the peak year in the cycle; however, the last peak year had a total return of 20 thousand and a spawning escapement of only 83 hundred. That spawning escapement was the sixth smallest since 1967. The 1995 spawning escapement was one of the latest escapements on record, and many adults matured completely in salt water before entering Eshamy Lake. Resulting spawning success was thought to have been very low. Mean run size for this point in the cycle for the period 1968–1997 is 102.3 thousand sockeye salmon. The low 1996 escapement combined with late 1995 escapement suggests that the forecast based on mean run size will probably be an overestimate.

The Eshamy Lake natural stock is the largest natural stock contributor to commercial harvests of sockeye salmon in Prince William Sound outside of the Coghill District. The Eshamy Lake natural run has historically contributed to a substantial incidental harvest by the purse seine fishery in the Southwestern District. Although escapements into Eshamy River have been counted at a weir for 50 years, collection of age, sex, and size data has only been recently instituted for the escapement, the Eshamy District directed harvest, and the Southwestern District incidental harvest. These data were used to construct brood tables for this run, which in turn were used to calculate the 1997 and 1998 forecasts. Contributions to commercial harvests in western Prince William Sound of sockeye salmon produced by the Main Bay Hatchery have been estimated by recovery of coded wire tags. However, not all harvests can be adequately estimated, increasing uncertainty of total run estimates for all wild and enhanced sockeye salmon stocks in western Prince William Sound. Age composition data and weir counts were not collected in 1987 and 1998 due to budget shortfalls, and future funding of tag recovery and Eshamy weir projects is uncertain. Loss of this data will reduce the Eshamy forecast to a harvest projection based on the mean of past harvests.

The Main Bay Hatchery onsite run of Eyak stock will be small in 2000. The run will consist mostly of four- and five-year-old sockeye salmon from brood years 1995 and 1996. Returns from both brood years were released as age-1 smolts. Age-specific marine survivals of age-0 Eyak stock smolts were used to forecast the return in 2000. Actual returns may be greater than forecast if these older smolts survived better than age-0 smolts. A water pipeline break during the winter of 1995–1996 caused high mortality in the production for brood years 1995 and 1996, greatly reducing the number of juveniles released and the expected number of returning adults.

The onsite hatchery return of Coghill stock in 2000 is expected to be less than the 1999 run. The return will be composed mostly of five-year-old sockeye salmon from a smolt release in 1997. No Coghill stock smolts were released from Main Bay Hatchery in 1998 and 1999. This stock is being reintroduced to the Main Bay Hatchery and will replace all other stocks currently at that facility.

The onsite hatchery run of Eshamy stock is expected to be composed almost entirely of four-year-old sockeye salmon. The forecast is based on expected survival of smolts released in 1998, and is expected to be greater than the 1999 return because of the larger number of smolts released. The accuracy of this forecast is uncertain because there have been only four complete brood year returns for this hatchery stock.

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FORECAST AREA: Prince William Sound
SPECIES: Coho Salmon

Preliminary Forecast of the 2000 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
HATCHERY AND SUPPLEMENTAL PRODUCTION:		
<i>Valdez Fisheries Development Association – Solomon Gulch Hatchery (Onsite Releases)</i>		
Hatchery Run	136.4	110.6–160.4
Broodstock Needs	1.5	
Cost Recovery Needs	16.0	
Common Property Harvest	118.9	93.1–142.9
Historic Survival: Range = 0.9% – 14.5% , Mean = 7.4%		
<i>Valdez Fisheries Development Association – Solomon Gulch Hatchery (Remote Releases)^a</i>		
Hatchery Run	1.5	1.2–1.7
Broodstock Needs	0.0	
Cost Recovery Needs	0.0	
Common Property Harvest	1.5	1.2–1.7
<i>Prince William Sound Aquaculture Corporation – W. H. Noerenberg Hatchery (Onsite Releases)</i>		
Hatchery Run	61.4	48.9–73.9
Broodstock Needs	1.0	
Cost Recovery Needs	0.0	
Common Property Harvest	60.4	47.9–72.9
Historic Survival: Range = 3.0% – 14.3% , Mean = 7.4%		
<i>Prince William Sound Aquaculture Corporation – W. H. Noerenberg Hatchery (Remote Releases)^b</i>		
Hatchery Run	17.6	14.0–21.2
Broodstock Needs	0.0	
Cost Recovery Needs	0.0	
Common Property Harvest	17.6	14.0–21.2
TOTAL HATCHERY PRODUCTION:		
Run Estimate	215.4	173.5–255.5
Broodstock Needs	2.5	
Cost Recovery Needs	16.0	
Common Property Harvest	196.9	155.0–237.0

^a Includes a remote release at Boulder Bay, near Tatitlek.

^b Includes remote releases at Cordova, Whittier and Chenega.

Forecast Methods

Harvest projections for natural coho salmon in Prince William Sound have typically been estimated from the mean of historic annual harvests of this species. In recent years, commercial harvests have targeted primarily hatchery returns, and no stock contribution estimates are available to assess natural production. Estimates of sport harvests, which target natural coho salmon runs, are not available until the following summer. For these reasons, no projection is estimated for natural production of this species for 2000.

The forecast for each hatchery return is the product of the number of smolts released from each facility in 1999 and mean marine survival achieved for each facility (7.4% for Solomon Gulch Hatchery and 7.4% for W. H. Noerenberg Hatchery). Forecast ranges are based on 80% confidence intervals about mean survivals.

Forecast Discussion

Coho smolt releases from the W. H. Noerenberg Hatchery in 1999 were four times greater than the previous year. Marine survival estimates for coho salmon hatchery stocks were based on the assumption that all harvest taken in the vicinity of each hatchery is comprised of production from that hatchery. Survival estimates could be overly optimistic if hatchery and natural runs mix in harvest areas. Return estimates to remote stocking locations are based on hatchery survival estimates because little information is available on actual sport harvest of these stockings. No direct cost recovery harvest is anticipated at the W. H. Noerenberg Hatchery because of the expected small run. However, some revenue could be generated from coho salmon incidentally captured during the pink salmon cost recovery harvest.

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FORECAST AREA: Copper River
SPECIES: Sockeye Salmon

Preliminary Forecast of the 2000 Run:	Forecast Estimate (millions)	Forecast Range (millions)
NATURAL PRODUCTION:		
Natural Run	1.20	0.75–1.99
Escapement Goal	0.48	
Common Property Harvest ^a	0.72	0.27–1.51
HATCHERY AND SUPPLEMENTAL PRODUCTION:		
<i>Prince William Sound Aquaculture Corporation – Gulkana Hatchery</i>		
Hatchery Run	0.89	0.49–1.29
Broodstock Needs	0.02	
Supplemental Escapement ^a	0.23	
Common Property Harvest ^a	0.64	0.24–1.04
TOTAL PRODUCTION:		
Run Estimate	2.09	1.24–3.28
Natural Escapement Goal	0.48	
Broodstock Needs	0.02	
Supplemental Escapement ^a	0.23	
Common Property Harvest ^b	1.36	0.51–2.55

^a Includes harvests from commercial, subsistence, personal use and sport fisheries.

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

Forecast Methods

The forecast of the natural run of sockeye salmon to the Copper River is the total of estimates for six age classes. Linear regression models using logarithm-transformed data were used to predict runs for three age classes: age-1.2, 1.3, and 2.2 sockeye salmon. The run of each of these three age classes was predicted from the relationship between returns of that age class and returns of the age class one year younger from the same brood year. For example, the model used to predict the run of age-2.2 sockeye salmon in 1999 used the run of age-1.2 sockeye salmon in 1999 as the input parameter. Finally, predicted runs of age-1.1, 2.3, and 0.3 sockeye salmon were calculated as the mean return of those age classes in past years. The 80% confidence bound for the total forecast of natural production is the sum of 80% confidence bounds for each age class, which were estimated using either a cross-validation technique for predictions based on regression models or the confidence interval around the mean. Forecast methods for 2000 are similar to forecast methods used in 1998 and 1999, but differ substantially from earlier methods. Prior to 1998, forecasts were calculated as the product of historical mean return-per-spawner and parent-year escapements weighted by age class (four-, five-, and six-year-old sockeye salmon). Mean return-per-spawner values were estimated from linear regressions of adult production on brood year escapements.

Supplemental production from Gulkana Hatchery remote releases to Crosswind and Summit Lakes was predicted using smolt-to-adult survival estimates based on coded wire tag recoveries in harvests and enumerated adult escapements. Survival of juveniles released into Paxson Lake was assumed to be between values estimated for Crosswind and Summit Lake. Average proportion of 1996–1999 runs harvested (72.0%) was used to project total harvest of Gulkana Hatchery stocks in 1999. The 80% confidence interval for the forecast of supplemental production was calculated using mean square error estimates calculated for natural runs.

Forecast Discussion

Forecasts before 1998 used return-per-spawner values for parent-year abundance similar to that of the dominant age class (age 5) for the forecast year. Recent Copper River sockeye salmon runs have exceeded all previously documented runs, although escapements generally have been only slightly above average. High return-per-spawner values for the three most successful brood years on record (1991–1993) reflect this apparent increased productivity. Because average return-per-spawner values do not reflect recent increased production, and because returns are still incomplete from the most recent brood years, linear regressions of brood year sibling returns were used to produce the 1998–2000 forecasts. Linear regressions of sibling returns were not used before because age composition data for some escapements and harvests were not available. Additionally, reliable estimates of survival and contributions from supplemental production for individual brood years have only recently become available through coded wire tag recoveries in harvest and escapements. Although historic estimates of Gulkana Hatchery production are thought to be inaccurate, improved contribution estimates for 1997–1999 indicated large contributions from supplemental production and provided smolt-to-adult survival estimates for Crosswind Lake releases that exceeded 30%.

The 2000 run will be composed primarily of returns from the 1996 and 1995 brood years. Five-year-old sockeye salmon from the 1995 brood year are expected to dominate Copper River Delta and Upper Copper River runs. Recent record large runs suggest conditions have been unusually favorable for these stocks. The 1999 run, although still above average, may signal a return to more typical production levels for this system. If realized, the forecast for the 2000 total run will still be above the 1983–1998 average. However, a 1.20 million natural run would still be slightly below average runs documented before substantial supplemental production, but a 0.89 million Gulkana Hatchery run would be nearly double that observed for most recent years.

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FORECAST AREA: Copper River
SPECIES: Chinook Salmon

Preliminary Forecast of the 2000 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
HARVEST PROJECTION FOR NATURAL RUN:		
Copper River District	60.8	49.7–71.8

Forecast Methods

The harvest projection for the 2000 chinook salmon run to the Copper River area is the average limited entry commercial fishery harvest for 1995–1999. The range is the 80% confidence interval about the mean harvest.

Forecast Discussion

During the past 15 years, chinook salmon runs to the Copper River have tended to be above average, and several catch records have been set. Total harvests in all Copper River fisheries (commercial, subsistence, personal use, and sport) since 1995 have exceeded all documented annual harvests since 1890. Escapements appear to have been maintained, and conditions generally appear to favor continued good production. Because aerial surveys to estimate escapement were not conducted in the Upper Copper River in 1993, and surveys in 1992 and 1995 were made under poor conditions, it is no longer possible to forecast chinook total run abundance using previous methods requiring spawning escapements to approximate total run size. However, forecasting performance based on this method was poor, and all but two of the predictions made during 1985–1997 were less than actual runs.

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FORECAST AREA: Copper and Bering Rivers
SPECIES: Coho Salmon

Preliminary Forecast of the 2000 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
HARVEST PROJECTION FOR NATURAL RUN:		
Copper River District	295.3	58.6–532.0
Bering River District	120.5	0.0–273.6

Forecast Methods

The harvest projection for the 2000 run of coho salmon to the Copper and Bering River areas is the average limited entry commercial fishery harvest for 1981–1999. The forecast range is the 80% confidence interval about the mean harvest.

Forecast Discussion

The 1997–1999 runs of coho salmon to the Copper and Bering River areas were well below the 1980–1996 average, and commercial fishery harvests were restricted in each year. Although aerial survey information did not indicate parental escapements were unusually low, these runs followed years in which the second (1994) and third (1995) largest commercial fishery harvests were taken. Winters with extremely low temperatures and little snow cover, and summers with either near-drought or high-water conditions have occurred regularly since 1990. The occurrence of extremely high and low brood year returns during this period may help identify environmental factors affecting freshwater survival of coho salmon juveniles, which may be used to improve forecast accuracy. Forecasting accuracy may also be improved with information obtained jointly, since 1994, by the department and U.S. Forest Service on climatological factors and coho salmon survival from eggs deposited in spawning channels.

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FORECAST AREA: Upper Cook Inlet
SPECIES: Sockeye Salmon

Preliminary Forecast of the 2000 Run:	Forecast Estimate (millions)	Forecast Range (millions)
NATURAL PRODUCTION:		
Total Run:	4.5	1.0 – 8.0
Escapement Goal:		1.5
Harvest Estimate:		3.0

Forecast Methods

The major sockeye salmon systems in Upper Cook Inlet are the Kenai, Kasilof, Susitna, and each system. Forecasts for all systems and age classes, except Kenai age-1.3 sockeye salmon, were made from two models: one using the relationship between adult returns and spawners, and the other using the relationship between adult returns and siblings. In most cases, sibling relationships Crescent Rivers, and Fish Creek. Spawner, sibling, and fry data, if available, were examined for were used. A model using the relationship between adult returns and fall fry was used for Kenai River age-1.3 sockeye salmon. The forecast interval for the total forecasted run was calculated using the squared deviations between past forecasts and actual runs as the forecast variance (mean square error).

Forecast Discussion

The total run to Upper Cook Inlet in 1999 was 4.5 million sockeye salmon, and the preseason forecast was 3.5 million. The Kenai River sockeye salmon return of 2.5 million fish was approximately 800,000 fish stronger than forecast due to stronger returns of age-1.3 and 2.2 fish. The Kasilof River sockeye salmon return was estimated at almost 1 million fish, as contrasted with the preseason forecast of 660,000. All age classes returned stronger than forecasted. The Susitna River return was 60,000 fish less than the forecast of 452,000 sockeye salmon. Fish Creek, Crescent River, and minor system forecasts were fairly close to actual returns.

The forecasts for Crescent River and Fish Creek are highly uncertain because models used fit the data relatively poorly. The Kenai River sockeye salmon age-1.3 forecast is based on the fall fry-to-adult return model which estimated a return of 1.3 million fish. In contrast, the sibling model estimated 1.5 million age-1.3 fish. The reader is cautioned that in 1995 the Kenai and Kasilof Rivers were affected by a significant flood event (greater than 100 year flood) and fry production was reduced. However, the 1999 return indicated good marine survival for the age-1.2 sockeye salmon which is reflected in the stronger projections for 2000.

Forecast runs to individual freshwater systems are as follows:

System	Run	In River Goal
Crescent River	99,000	25,000 – 50,000
Fish Creek	86,000	50,000
Kasilof River	786,000	150,000 – 50,000
Kenai River	2,453,000	750,000 – 50,000
Susitna River	482,000	200,000
Minor System	585,000	N/A

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Research Project Leader
Upper Cook Inlet

FORECAST AREA: Lower Cook Inlet
SPECIES: Pink Salmon

Preliminary Forecast of the 2000 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
NATURAL PRODUCTION:		
Total Run	1,033	268–4,523
Escapement	83	287–478
Commercial Harvest	670	83–4,045
SUPPLEMENTAL PRODUCTION:		
Total Run	1,380	960–1,860
Broodstock and Escapement	160	
Commercial Harvest	1,220	
TOTAL AREA PRODUCTION:		
Total Run	2,413	1,228–6,383
Broodstock and Escapement	523	
Commercial Harvest	1,890	

Notes:

All values are rounded to the nearest thousand fish.

Escapement values include an escapement goal shortfall of 19 thousand fish for systems with a forecast in 2000.

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 returns to 11 harvest areas in the Lower Cook Inlet Management area was based on spawner-return regressions and Ricker spawner-recruit analysis using 26 to 38 years of observations. An 80 percent confidence range about the forecast of natural production was developed using cross-validation methods. Projected harvest from natural production was obtained by subtracting both escapement goals and escapement shortfalls from the overall forecast. Forecast range of supplemental production in Tutka Bay was based on even-year ocean survival rates of 1.6% to 3.1%. Projected harvest from supplemental production was obtained by subtracting broodstock goals from the supplemental production forecast.

Forecast Discussion

The natural production forecast model was tested using cross-validation methods. The model correctly predicted 36 out of 38 changes in direction of annual run size. Accordingly, we have some confidence

that the 2000 total return will break the cycle of fewer fish returning in even-numbered years. We have been less successful in correctly predicting the actual size of individual runs, although forecasts have usually fallen within the 80 percent confidence interval. For example, in 1998, the last even-numbered year, 10 of the 11 systems for which a forecast was made had runs within the forecast range. The 2000 forecast for natural production of 1.0 million pink salmon has an 80 percent confidence interval of 268 thousand to 4.5 million pink salmon. If realized, a natural run of 1.03 million pink salmon would be very similar to the median run size of 1.02 million fish for even years between 1960 and 1998. The pink salmon escapement goal is 383 thousand for systems with a forecast, but a combined escapement shortfall of 19 thousand fish is expected. The resulting escapement forecast is 364 thousand pink salmon.

In the Southern District, the projected harvest of naturally produced pink salmon is 15.3 thousand fish, all in Seldovia Bay. No harvest is expected from Port Graham River or Humpy Creek, neither of which achieved its escapement goal in 1998. 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. The Tutka Hatchery released 60.1 million fry in 1999. Assuming an average even-year ocean survival rate of 2.3%, about 1.4 million pink salmon are expected to return to Tutka Bay and Lagoon in 2000 (pers. comm. with G. Fandrei, Cook Inlet Aquaculture Association). Because cost recovery requirements are dependent upon inseason fish prices, the allocation of supplemental-production salmon returns between common property and cost recovery fisheries cannot be determined at this time.

In the Outer District, harvests are projected to be 342.6 thousand pink salmon in Port Dick, 22.0 thousand in Port Chatham, 96.0 thousand in Rocky Bay, and 29.9 thousand for Nuka Island. No harvest is anticipated in Windy Bay. If realized, the Port Dick harvest would be the largest in an even-year since 1964.

In the Eastern District, a harvestable surplus of 46.0 thousand pink salmon is projected for Resurrection Bay. This would be the largest even year harvest in the Eastern District since 1984.

In the Kamishak Bay District, a harvestable surplus of 90.5 thousand fish is projected in Bruin Bay, and 27.4 thousand fish in Ursus and Rocky Coves. If realized, this would be the largest even year harvest for Bruin Bay since 1986.

Edward O. Otis
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Homer

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Area Finfish Management Biologist
Homer

FORECAST AREA: Kodiak
SPECIES: Pink Salmon

Preliminary Forecast of the 2000 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
NATURAL PRODUCTION:		
Total Run Estimate	13.4	6.1–20.7
Escapement Goal ^a	4.2	4.2
Harvest Estimate	9.2	1.9–16.5
HATCHERY PRODUCTION:		
Total Run Estimate	1.3	0.8–5.4
Escapement Goal	0.3	0.3
Harvest Estimate	1.0	0.5–5.1
TOTAL PRODUCTION:		
Total Run Estimate	14.7	6.9–26.1
Escapement Goal	4.5	4.5
Harvest Estimate	10.2	2.4–21.6

^a Midpoint indexed escapement goal. The Kodiak Management Area pink salmon escapement goal ranges from 2.4 to 6.0 million for even-numbered years. The average even-year pink salmon escapement has been 4.8 million for the past five even years (1990–1998), ranging from 3.4 to 7.1 million.

Forecast Methods

A limited preemergent pink salmon fry survey was conducted in 1999; digs were made in 16 streams during the spring of 1999, a substantial decrease in the number of streams typically surveyed (prior to 1998 approximately 35 streams were sampled each year). The forecast for the 1999 wild stock or natural pink salmon run to the Kodiak Management Area was estimated by a linear regression of pink salmon fry densities versus the subsequent pink salmon return. Only data from those 16 streams surveyed in 1999 were used for each return year from 1988 to 1998, excluding 1995 (the 1995 return year data were not used due to an abnormally high return). This produced a significant regression ($P = 0.0163$, $r^2 = 0.53$). The forecast for the 2000 Kitoi Bay Hatchery pink return was developed using survival rates from the 1978–1998 even-numbered brood years, excluding the two lowest and highest. The range estimates were calculated by using the average survival rate of the two lowest and two highest 1978–1998 even-year returns.

Forecast Discussion

Parent-year (1998) pink salmon escapements were excellent (7.1 million pink salmon, well above the upper escapement goal of 6.0 million). The upper end of each district's escapement goal was exceeded,

except in the Eastside Kodiak District which had escapements just above the midpoint of the desired range. Weather conditions in the fall and winter of 1998/1999 were extremely harsh. Record rainfall caused flooding in the fall, and in the winter there were sustained periods of record low temperatures with very little insulating snow cover. Kodiak remained extremely cold and stormy into the spring, with average temperatures well below freezing from late February to mid March. There was concern that this extreme weather could severely reduce survival of pink salmon eggs and fry in Kodiak Management Area streams. A limited preemergent pink salmon fry sampling project was conducted, directly funded by two Kodiak Management Area salmon processing companies. Poor weather and frozen streams limited sampling efforts. Streams in the Afognak, Westside Kodiak, East and Northeast Kodiak areas were sampled, but attempts to sample Alitak Bay District streams were unsuccessful. Live pink salmon fry were found in all streams sampled, though signs of flooding or freezing damage were evident (large numbers of dead fry and frozen eggs were found). The overall average fry density for all streams sampled was fair to good. The Kitoi Bay Hatchery released 127.7 million reared fry, and the size and condition of hatchery fry at release was excellent. Despite the unfavorable conditions for pink fry outmigration and spring survival, there were many reports of large numbers of pink fry in nearshore areas throughout the Kodiak Management Area during the summer of 1999.

The year 2000 wild stock return, as estimated from regression analysis of fry densities, will be 13.4 million pink salmon, with an 80% prediction interval of 6.1 to 20.7 million pink salmon. Estimates of hatchery production add 1.3 million pink salmon to the forecast (range: 800 thousand to 5.4 million). Subtracting broodstock and midpoint escapement requirements yields a forecasted harvest of 10.2 million pink salmon. If realized, this harvest would exceed the average harvest for the past five even-years (8.6 million, 1990–1998), but would nearly equal the average pink salmon harvest for the past ten even years.

It is expected that the mid point forecast return will be realized in 2000, however it is not expected to be exceeded. It should be noted that some of the coldest spring temperatures on record were observed within the Gulf of Alaska during 1999, which may have an unexpected detrimental effect on the pink salmon return for 2000. Effects could be significant, including a reduction in return numbers, lower average weights, and/or abnormal migration timing. Alternative forecasts calculated by using fry densities plus spring temperature data (as has been done in the past) yield much lower total return projections.

The 2000 forecast can be apportioned by districts, based on historical percentages:

District	Total Return	Escapement/Broodstock	Estimated Harvest
Afognak (Wild Stocks)	1,480,000	290,000	1,190,000
Afognak (Hatchery)	1,310,000	350,000	960,000
Westside	7,250,000	2,530,000	4,720,000
Alitak	1,480,000	320,000	1,160,000
East/Northeast	1,680,000	540,000	1,140,000
Mainland	1,500,000	510,000	990,000
TOTAL	14,700,000	4,540,000	10,160,000

Kevin Brennan
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Kodiak

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Kodiak

FORECAST AREA: Kodiak, Upper Station (Early Run)
SPECIES: Sockeye Salmon

Preliminary Forecast of the 2000 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL PRODUCTION:		
Total Run Estimate	115.0	65–164
Escapement Goal	50.0	25–75
Harvest Estimate	65.0	

Forecast Methods

The 2000 Upper Station early-run forecast was prepared primarily by investigating simple linear regression models employing recent brood year (1981–1995) sibling relationships for five major age classes. In constructing and evaluating each of the regression models, standard regression diagnostic procedures were considered and applied where appropriate. Age classes 1.2, 1.3, and 2.3 were predicted from age classes 1.1, 1.2, and 2.2, respectively. The age-0.3 and 2.2 sibling relationships were not significant ($P > 0.25$); therefore, median return was used as the forecast estimate. Minor age classes (ages 0.1, 0.2, 1.1, 2.1, 0.4, 3.1, 1.4, 3.2, 3.3, and 2.4) were estimated by summing them across brood years and taking the median (1981–1992). The variances for the median forecasts were calculated assuming the distribution of the mean. The total run forecast was calculated by summing individual age class estimates along with the estimate for the minor age classes. The variances associated with individual and pooled minor age classes were summed to calculate 80 percent prediction intervals.

Forecast Discussion

The 2000 forecast is approximately 30 thousand fish less than the 1999 forecast (145 thousand) and about 27 thousand fish greater than the actual 1999 run of 88 thousand fish. Although the 1999 run fell within 80 percent prediction intervals of the forecast, individual age class predictions were fair to poor; therefore, our confidence in this forecast is fair. The 2000 run should be composed of approximately 71 percent five-year-old fish and 12 percent six-year-old fish. If this run is realized, it will be slightly less than the recent 10-year average run of 125 thousand fish, but greater than the previous three years.

The biological escapement goal range is 50-75 thousand; however, the Alaska Board of Fisheries has adopted 25 thousand as a sustainable yield goal within the Alitak Bay District Management Plan. The projected harvest of 65 thousand fish is based on achievement of the midpoint of the escapement goal range of 25-75 thousand (the lower bound of the biological escapement goal). The dominant age classes in the run should be 2.2 (50 percent) and 1.3 (21 percent).

Nick Sagalkin
 Finfish Research Biologist
 Kodiak

FORECAST AREA: **Kodiak, Upper Station (Late Run)**
 SPECIES: **Sockeye Salmon**

Preliminary Forecast of the 2000 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL PRODUCTION:		
Total Run Estimate	541	222–861
Escapement Goal	175	150–200
Harvest Estimate	366	

Forecast Methods

The 2000 Upper Station late-run forecast was prepared primarily by investigating simple linear regression models employing recent brood year (1981–1995) sibling relationships for six major age classes. In constructing and evaluating each of the regression models, standard regression diagnostic procedures were considered and applied where appropriate. Age-1.3 and 2.2 fish were both forecasted from age-1.2 fish (similar to the 1999 forecast), and age-0.3 fish were predicted from age-0.2 siblings. Age-0.2, 1.2, and 2.3 sibling relationships were not significant ($P>0.25$); therefore, median return was used as the forecast estimate. Minor age classes (ages 0.1, 1.1, 2.1, 3.1, 0.4, 1.4, 3.2, 3.3, and 2.4) were estimated by summing them across brood years and taking the median (1981–1992). The variances for the median forecasts were calculated assuming the distribution of the mean. The total run forecast was calculated by summing individual age class estimates. The variances associated with individual and pooled minor age classes were summed to calculate 80 percent prediction intervals.

Forecast Discussion

The 2000 forecast is about 13 thousand fish more than the 1999 forecast (528 thousand), and about 28 thousand fish less than the actual 1999 run of 569 thousand fish. Although the 1999 run fell within 10 percent of the forecast, individual age class predictions were fair; therefore, our confidence in this forecast is fair. The 2000 run should be composed of approximately 23 percent four-year-old fish and 61 percent five-year-old fish. If this run is realized, it will be slightly less than the recent 10-year average run of 572 thousand fish.

The projected harvest of 366 thousand fish is based on achievement of the lower bound of the escapement goal range of 150-200 thousand. The dominant age classes in the run should be 2.2 (48 percent), 1.2 (14 percent), and 1.3 (13 percent).

Nick Sagalkin
 Finfish Research Biologist
 Kodiak

FORECAST AREA: Kodiak, Frazer Lake (Dog Salmon River)
SPECIES: Sockeye Salmon

Preliminary Forecast of the 2000 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL PRODUCTION:		
Total Run Estimate	447	85–810
Escapement Goal	140	140–200
Harvest Estimate	307	

Forecast Methods

The 2000 Frazer Lake (Dog Salmon River) forecast was prepared primarily by investigating simple linear regression models employing recent brood year (1981–1995) sibling relationships for six major age classes. In constructing and evaluating each of the regression models, standard regression diagnostic procedures were considered and applied where appropriate. Age-2.3, 3.2, and 3.3 fish were predicted from age-2.2, 3.1, and 3.2 siblings, respectively. The age-1.2, 1.3, and 2.2 sibling relationships were heavily influenced by 1986 and 1989 returns; therefore, the median return was used as the forecast estimate. Minor age classes (ages 0.2, 1.1, 0.3, 2.1, 3.1, 1.4, and 2.4) were estimated by summing them across brood years and taking the median (1981–1992). The variances for the median forecasts were calculated assuming the distribution of the mean. The total run forecast was calculated by summing individual age class estimates along with the estimate for the minor age classes. The variances associated with individual and pooled minor age classes were summed to calculate 80 percent prediction intervals.

Forecast Discussion

The 2000 forecast is about 75 thousand fish less than the 1999 forecast (522 thousand) and about 90 thousand fish greater than the actual 1999 run of 357 thousand fish. Although the 1999 run fell within the 80 percent prediction interval of the forecast, the estimated run was considerably lower than the point estimate and individual age class predictions were fair to poor; therefore, our confidence in this forecast is fair. Age-2 smolts were not used as part of the forecast because high water in 1998 prevented population estimates. The 2000 run should be composed of approximately 72 percent five-year-old fish and 18 percent six-year-old fish. If this run is realized, it will be approximately 63 percent of the recent 10-year average run of 710 thousand fish and the third lowest in that time span.

The projected harvest of 307 thousand fish is based on achievement of the lower bound of the escapement goal range of 140–200 thousand. The dominant age classes in the run should be 2.2 (65 percent) and 2.3 (15 percent).

Nick Sagalkin
 Finfish Research Biologist
 Kodiak

FORECAST AREA: Kodiak, Ayakulik (Red River)
SPECIES: Sockeye Salmon

Preliminary Forecast of the 2000 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL PRODUCTION:		
Total Run Estimate	745	194–1,300
Escapement Goal	300	200–300
Harvest Estimate	445	

Forecast Methods

The 2000 Ayakulik (Red River) forecast was prepared primarily by investigating simple linear regression models utilizing recent brood year (1980–1995) sibling relationships for four age classes. In constructing and evaluating each of the regression models, standard regression diagnostic procedures were used. Prediction estimates from regression models were only used in cases where the slope of the regression was significantly different from zero ($P < 0.25$). Ages 1.2, 1.3, and 2.3 were predicted from ages 1.1, 1.2, and 2.2 siblings, respectively. A sibling regression model was also employed to estimate the age-2.2 component of the run from returns of age-1.2 sockeye salmon. All other age classes were estimated by summing 11 minor age class returns (0.2, 1.1, 0.3, 2.1, 0.4, 3.1, 1.4, 3.2, 2.4, 3.3, and 3.4) by brood year (1980–1992) and calculating the pooled median contribution. The total run forecast was calculated by summing individual and pooled age class estimates. When the median return by age class was used, the variance calculated from the mean distribution was applied to the estimate. The variances associated with individual and pooled age class estimates were summed to calculate 80 percent prediction intervals.

Forecast Discussion

The 2000 forecast is about 637 thousand fish less than the 1999 forecast and about 245 thousand fish less than the actual 1999 run of 990 thousand fish. Our confidence in this forecast is fair due to the age class error realized in the 1999 forecast. The 2000 run should be composed of approximately 55 percent five-year-old fish (1995 brood year). If realized, this run will be about 250 thousand fish less than the recent 10-year average (1990–1999) run of 995 thousand fish. Based on recent levels of production, it is reasonable to expect the 2000 run to fall close to the point estimate.

The projected harvest of 445 thousand fish is based on achievement of the upper bound of the escapement goal range (300 thousand fish). The dominant age classes in the run should be age 2.2 (37 percent) and 2.3 (26 percent).

Patricia Nelson
 Finfish Research Biologist
 Kodiak

FORECAST AREA : Kodiak, Spiridon Lake
SPECIES: Sockeye Salmon

Preliminary Forecast of the 2000 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL PRODUCTION:		
Total Run Estimate	226	151–301
Escapement Goal	none	none
Harvest Estimate	226	

Forecast Methods

A barrier falls prevents escapement into Spiridon Lake; thus, sockeye salmon fry stocking is intended to provide the complete harvest of returning adults. The 2000 Spiridon Lake forecast was estimated based on: (1) 1997–1999 smolt estimates; (2) 1995–1999 average adult age composition from terminal harvests and average adult age of returns from 1992–1995 stocking years; and (3) average, low, and high observed smolt-to-adult survival from 1992–1995 stocking years. The 1997 smolt emigration from Spiridon Lake was composed of approximately 636 thousand age-1 and 231 thousand age-2 fish. The 1998 emigration was composed of approximately 515 thousand age-1 and 211 thousand age-2 smolts. Approximately 780 thousand age-1 smolts and 119 thousand age-2 smolts emigrated in 1999. Smolt-to-adult survival has averaged 28%, ranging from 23% to 44%, for fry stocking years 1992–1995. A smolt to adult survival of 30% (a lower range of 20% and upper range of 40%) was used for forecasting the 2000 run.

The age compositions of the 1995–1999 terminal harvest area sockeye salmon runs were averaged separately for 1995–1997 (Upper Station broodstock) and 1998–1999 (primarily Saltery Lake broodstock) to enable estimating both the Upper Station and Saltery Lake components of the run. Similarly, the age compositions of the sockeye salmon returns were averaged for 1992–1994 stocking years (Upper Station broodstock) and also for the 1995 stocking year (Saltery Lake broodstock) to provide an alternative technique for estimating both the Upper Station and Saltery Lake components of the 2000 run. These proportions were applied to the total return estimates from the 1997–1999 smolt emigrations to generate numbers of returning fish by age (and year), and results were summed to estimate the expected total run by age in 2000 for each technique. Lastly, the results of the two methods were averaged to estimate adult returns expected in 2000.

Forecast Discussion

The forecast for 2000 is based upon the marine age at return remaining similar to previous years (predominantly 2-ocean); however, Saltery Lake sockeye, which were stocked in 1995, are predominantly 3-ocean (~75%). The 2000 run is predicted to be slightly less than average (1994–1999 average run was 266 thousand sockeye salmon) and about 12 thousand fish more than forecast for the 1999 run (214 thousand), but approximately half of the 1999 run (465 thousand). The predominant age class in the run is expected to be age-1.2 fish (~60%) as a result of late-run Upper Station Lake stock fry releases. Returning age-1.3 and 2.2 fish (~25% of the run) will also be from Upper Station stock releases.

The majority of the remaining fish will return as a result of Sallery Lake fry releases. The run timing should be similar to the 1998 and 1999 runs, approximately three weeks earlier than in 1994–1997. The run is expected to begin in late June to early July and end by mid September. The run will be bimodal: Sallery Lake stock returns will peak in mid to late July, and late-run Upper Station stock returns will peak early to mid August. The mid August peak (age-1.2 fish) should be substantially larger than the July peak.

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Kodiak

FORECAST AREA: Kodiak, Karluk Lake (Early Run)
SPECIES: Sockeye Salmon

Preliminary Forecast of the 2000 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL PRODUCTION:		
Total Run Estimate	468	252–684
Escapement Goal	200	150–250
Harvest Estimate	268	

Forecast Methods

The 2000 Karluk River early run forecast was prepared primarily by investigating simple linear regression models utilizing recent brood year (1979–1995) sibling relationships for six age classes. In constructing and evaluating each of the regression models, standard regression diagnostic procedures were used. Prediction estimates from regression models were only used in cases where the slope of the regression was significantly different from zero ($P < 0.25$). Ages 1.3, 2.2, 3.2, and 3.3 were predicted from ages 1.2, 2.1, 3.1, and 3.2 siblings, respectively. Following nonsignificant regression results, the median brood year return by age class was used to estimate the age-1.2 and 2.3 components of the run. Other age classes were estimated by summing 13 minor age class returns (0.2, 1.1, 0.3, 2.1, 0.4, 3.1, 1.4, 4.1, 2.4, 4.2, 3.4, 4.3, and 4.4) by brood year (1982–1991) and calculating the pooled median contribution. The total run forecast was calculated by summing individual and pooled age class estimates. When the median return by age class was used, the variance calculated from the mean distribution was applied to the estimate. The variances associated with individual and pooled age class estimates were summed to calculate 80 percent prediction intervals.

Forecast Discussion

The 2000 forecast is about 111 thousand fish greater than the 1999 forecast and about 107 thousand fish less than the actual 1999 run of 575 thousand fish. Our confidence in this forecast is fair due to the error realized in the 1999 forecast. The 2000 run should be composed of approximately 59 percent five-year-old fish and 30 percent six-year-old fish. If realized, this run will be slightly higher than the recent 10-year average (1990–1999) run of 459 thousand fish.

The projected harvest of 268 thousand fish is based on achievement of the midpoint of the escapement goal range (200 thousand fish). The dominant age classes in the run should be age-2.2 (45 percent) and 2.3 (22 percent).

Patricia Nelson
 Finfish Research Biologist
 Kodiak

FORECAST AREA: Kodiak, Karluk Lake (Late Run)
SPECIES: Sockeye Salmon

Preliminary Forecast of the 2000 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL PRODUCTION:		
Total Run Estimate	969	435–1,500
Escapement Goal	400	400–550
Harvest Estimate	569	

Forecast Methods

The 2000 Karluk River late-run forecast was prepared primarily by investigating simple linear regression models utilizing recent brood year (1979–1995) sibling relationships for six age classes. In constructing and evaluating each of the regression models, standard regression diagnostic procedures were used. Prediction estimates from regression models were only used in cases where the slope of the regression was significantly different from zero ($P < 0.25$). The age-2.2 component of the run was predicted from returns of age-1.2 sockeye salmon, and age-2.3 fish were predicted from age-2.2 siblings. Following non-significant regression results, the median brood year return by age class was used to estimate the age-1.2, 1.3, 3.2, and 3.3 components of the run. Other age classes were estimated by summing 13 minor age class returns (0.1, 0.2, 1.1, 0.3, 2.1, 0.4, 3.1, 1.4, 2.4, 4.2, 3.4, 4.3, and 4.4) by brood year (1982–1991) and calculating the pooled median contribution. The total run forecast was calculated by summing individual and pooled age class estimates. When the median return by age class was used, the variance calculated from the mean distribution was applied to the estimate. The variances associated with individual and pooled age class estimates were summed to calculate 80 percent prediction intervals.

Forecast Discussion

The 2000 forecast is about 63 thousand fish less than the 1999 forecast and about 35 thousand fish less than the actual 1999 run of 1,004 thousand fish. The 1999 forecast was within three percentage points of the forecast and individual age class predictions were fair; therefore, our confidence in this forecast is fair. The 2000 run should be composed of approximately 59 percent five-year-old fish and 36 percent six-year-old fish. If this run is realized, it will be larger than the recent 10-year average run of 935 thousand fish. The estimated return of age-1.2 fish to the Karluk late run in 1999 was stronger than expected suggesting favorable 1995 brood year conditions. This result, coupled with the significant sibling relationship between age-1.2 and 2.2 Karluk late-run fish, suggests that the actual run may fall between the point estimate and the upper bound.

The projected harvest of 569 thousand fish is based on achievement of the lower bound of the escapement goal range (400 thousand fish). This run should be primarily age-2.2 fish (58 percent) followed by age-2.3 (22 percent) fish.

Patricia Nelson
Finfish Research Biologist
Kodiak

FORECAST AREA: **Chignik**
SPECIES: **Sockeye Salmon**

Preliminary Forecast of the 2000 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL PRODUCTION:		
Early Run (Black Lake)		
Total Run Estimate	3,900	2,830–4,960
Escapement Goal	400	350–400
Harvest Estimate	3,500	
Early Run (Chignik Lake)		
Total Run Estimate	1,090	300–1,890
Escapement Goal	250	200–250
Harvest Estimate	840	
Total Chignik System		
Total Run Estimate	4,990	3,720–6,260
Escapement Goal	650	550–650
Harvest Estimate	4,340	

These figures include harvests of Chignik-bound sockeye salmon by the Southeastern District Mainland and Cape Igvak fisheries; approximately 3.47 million sockeye salmon are projected to be harvested in the Chignik management area.

Forecast Methods

The forecasts for Black and Chignik Lakes 2000 runs were based on simple linear regressions between sibling relationships or median values of returns for brood years since 1977, and were evaluated against smolt emigration data since 1994. Significant sibling regression relationships ($P < 0.10$) were used to estimate Black Lake ages-1.3 and 2.3 and Chignik Lake age-1.3 runs. The remaining age classes were estimated by the median value of each age class. Prediction intervals (80%) were either calculated from the regression analyses or from the variance associated with the age classes when no significant sibling relationships existed.

The 2000 sockeye salmon run to the Chignik River is expected to be 4.99 million fish, which is 500 thousand more fish than the record run of 1999. The Black Lake (early) run is expected to be large (3.90 million) when compared with the Chignik Lake (late) run (1.09 million).

A large portion of the early run (2.88 million) is expected to be age-1.3 fish. Two lines of evidence point to a large age-1.3 return in 2000. First, the age-1.2 (brood year 1995) component in the 1999 run was large, which is an indicator of the 2000 age-1.3 run. Brood year 1979 possessed similar age-1.2 return characteristics as brood year 1995 is showing, and resulted in an age-1.3 run of over 3 million fish.

Second, the brood year 1995 age-1. sockeye salmon smolt emigration was large when compared with other available smolt emigration data.

The 2000 late run is expected to be 900 thousand sockeye salmon less than the 1999 late run. The 2000 late run may be larger than the point estimate because the dominant age class for this run (age 2.3) was estimated using median values. The actual run may be between the median and the upper bound.

Because the 2000 run is expected to be the largest on record, predictions were made on the extreme end of available data making our confidence in this forecast fair. It is possible an unusually large proportion of the brood year 1995 age-1. fish returned as age-1.2 fish in 1999 and the 2000 age-1.3 return will be lower than forecasted.

Ken Bouwens
Finfish Research Biologist
Kodiak

FORECAST AREA: **Bristol Bay**
SPECIES: **Sockeye Salmon**

Forecast of the 2000 Return:	Forecast Estimate (millions)	Forecast Range (millions)
TOTAL PRODUCTION:		
Total Run	35.4	18.2 – 52.7
Escapement Goal	11.1	
South Peninsula Harvest Quota	2.0	
Commercial Common Property Harvest (Inshore)	22.3	

Forecasted sockeye harvests for inshore Bristol Bay fishing districts are as follows:

Naknek-Kvichak	7.7 million
Egegik	6.8 million
Ugashik	3.4 million
Nushagak	3.7 million
Togiak	0.5 million

Forecast Methods And Results

The forecast for the sockeye salmon return to Bristol Bay in 2000 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 (ages 1.2, 1.3, 2.2, and 2.3 sockeye salmon). 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 adult returns and spawners or siblings from previous years. Also, regression models based on the relationship between returns and smolts were examined for Kvichak, Egegik, and Ugashik Rivers. Adult escapement and return data from brood years 1972–1989 were used for all models. Results from a regression model were excluded from final forecast calculations if the slope of the line was not significantly different from zero ($R < 0.25$). Mean squared error of the total run forecast was calculated using deviations of actual runs from published run predictions made for 1988 to 1999. Run predictions for the period 1988 to 1999 were based on similar methods used for the 2000 forecast. Mean square error was used to estimate the standard error and 80% confidence bounds of the total run forecast.

A total of 35.4 million sockeye salmon are expected to return to Bristol Bay in 2000. This prediction is 17 percent lower than the previous 10-year mean (42.8 million) and 12 percent lower than the previous 20-year mean (40.4 million, range; 19.6 million to 66.3 million) returns. Runs are expected to exceed spawning escapement goals for all systems. A return of 35.4 million sockeye salmon can be expected to produce a total harvest of 24.3 million fish if all escapement goals are met.

The 2000 inshore harvest is expected to be 22.3 million sockeye salmon. A harvest of this size would be 13% smaller than the previous 20-year mean harvest of 25.6 million (range: 9.9 million to 44.2 million) and 23% less than the previous 10-year mean of 28.8 million (range: 9.9 million to 44.2 million). An additional 2.0 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 Bristol Bay sockeye harvest of 24.3 million).

Forecast Discussion

We excluded some historical escapement and return data to prepare the 2000 forecast. Beginning with the 1972 brood year (\geq 1978 return year), the number of returning adults produced from each spawner in Bristol Bay showed a dramatic increase across all 9 stocks. As a result, recent Bristol Bay sockeye salmon forecasts have been based on data from this more productive period in order to more accurately predict returns. Poor sockeye salmon returns to Bristol Bay in 1996 (4-year-old fish only), 1997 and 1998 (offspring from brood years 1992–1994) suggested we might be entering a period of productivity more similar to the pre-1977 period. However, the fish from the 1996–1998 return years reared in the ocean when ocean temperatures were above average, whereas cooler-than-average ocean temperatures characterized the pre-1978 period. In addition, there has been no consistent statewide signal in salmon productivity despite recent anomalous returns. More recent ocean-temperature data and the returns to Bristol Bay in 1999 suggest that returns in 2000 may be more characteristic of the period 1977–1995. Hence, we used these data to prepare our forecast.

The greatest source of uncertainty in the 2000 forecast is in predicting the return of 5-year-old fish (age-1.3 and age-2.2 fish). Our forecasted return of 3.4 million age-2.2 fish to the Kvichak is very uncertain. Using only the escapement of 10 million fish to the Kvichak in 1995 to forecast returns in 2000 indicates an age-2.2 return of 16 million. However, two other sources of information suggest this is an overestimate. First, we caught no jacks in the Kvichak River sampling program in 1999 (age-2.1 fish, the siblings of the age 2.2 fish returning in 2000), suggesting the return of age-2.2 fish in 2000 might be only 2 to 3 million. Also, no jacks were observed during surveys of the spawning grounds in the Iliamna area in August and September. Second, recent smolt production and ocean-survival rates suggest a return of only about 3.4 million age-2.2 fish to the Kvichak in 2000. Because the latter two methods (jacks and smolts) have performed better in recent years, we used these data to forecast the return of age-2.2 fish to the Kvichak in 2000.

Our forecasted return of 13 million age-1.3 fish to all systems is also very uncertain. Usually, we can accurately forecast abundance of age-1.3 fish based on returns of age-1.2 fish (their siblings) the previous year. The 1999 return to Bristol Bay contained 21 million age-1.2 fish (4-year-old fish from the 1995 brood year). This was the third largest return of 4-year old fish since 1956. The large return of 4-year-old fish in 1999 could indicate a large return of 5-year-old fish in 2000. Conversely, if a large proportion of the fish from the 1995 brood year matured as 4-year-olds instead of 5-year-old fish, only a modest number of 5-year-old fish will return in 2000. Two other large returns of age-1.2 fish (1960 and 1983) produced only moderate numbers of age-1.3 fish the following year. Therefore, we assumed returns of age-1.3 fish will be moderate in 2000, and large returns of age-1.2 fish in 1999 were due to fish maturing earlier than normal.

We do not know why Bristol Bay sockeye salmon returns in 1996–1998 were poor, and whether decreased production will persist in the near future or this was a only a short-term anomaly. The 1999

return to Bristol Bay (41 million) suggests poor returns in 1996–1998 were anomalies. However, last season’s relatively large return is insufficient evidence to conclude that the 1977–1995 production will continue. We are actively working with scientists inside and outside the department to develop better techniques for forecasting sockeye salmon returns to Bristol Bay.

Michael R. Link
Research Project Leader
Anchorage

Dan Gray
Research Biologist
Anchorage

FORECAST AREA: Bristol Bay, Nushagak District
SPECIES: Chinook Salmon

Forecast of the 2000 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL PRODUCTION:		
Total Run	101	31 – 171
Inriver Run Goal ^a	75	
Commercial Common Property Harvest	26	

^a The Nushagak inriver run goal is 75,000 chinook salmon which provides for a biological escapement goal of 65,000 spawners and an additional harvest of 10,000 chinook salmon by upriver subsistence and sport fisheries.

Forecast Methods

The 2000 chinook salmon forecast for Nushagak District is the sum of individual predictions of 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 2000 based on age-1.3 returns in 1999). Natural logarithm-transformed data were used for all regressions. Predictions from regression models were only used if the slope of the line was significantly different from zero ($P < 0.25$). Regression models for forecasting age-1.1 and -1.2 runs were not significant. The last 10-year mean return for the age-1.1 class was used to forecast the 2000 return. Mean age-specific recruits-per-spawner from the last two years was used to forecast the age-1.2 run in 2000.

Mean squared error of the total run forecast was calculated from deviations of actual runs from forecasts made using the same method we used in 2000 for return years 1984 to 1999. Mean square error was then used to estimate the standard error and 80% confidence bounds of the total run forecast.

Forecast Discussion

Age composition of the forecasted run is 1% (0.75 thousand) age 1.1, 9% (9.5 thousand) age 1.2, 44% (44 thousand) age 1.3, 43% (43 thousand) age 1.4, and 3% (3.0 thousand) age 1.5. The 2000 forecasted run of 101 thousand chinook salmon is 44% less than the previous 20-year mean run of 178 thousand and 35% less than the most recent 10-year mean run of 155 thousand. The projected harvest of 26 thousand chinook salmon is 69% less than the previous 20-year mean harvest of 83 thousand and 63% less than the most recent 10-year mean harvest of 70 thousand. The 2000 forecast represents the fourth smallest run and harvest in the previous 20 years and third smallest run and harvest in the last 10 years.

Poor production from recent brood years is expected to continue for 2000 returns. The 1999 return and harvest were the smallest since at least 1979 (prior to 1979, only incomplete data are available). Chinook spawners from brood years 1993–1995 yielded one-third to one-half as many age-1.2, 1.3 and 1.4 fish in 1999 as were produced on average during the previous 10 years. Poor recruitment from these brood years

suggests relatively low returns of age-1.3, 1.4 and 1.5 fish (siblings of the fish that returned in 1999) in 2000.

Michael R. Link
Research Project Leader
Anchorage

FORECAST AREA: Alaska Peninsula, Bear Lake (Late Run)
SPECIES: Sockeye Salmon

Preliminary Forecast of the 2000 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL PRODUCTION:		
Total Run Estimate	794	335–1,250
Escapement Goal	100	75–125
Harvest Estimate	694	

Forecast Methods

The 2000 Bear Lake late-run forecast was primarily constructed using simple linear regressions of recent brood year sibling relationships between 1980 and 1995. Standard regression diagnostics were employed including analysis of residuals and outlier points. Regression estimates were only used if the slope was significantly different from zero ($P < 0.25$) and non-negative. In cases of nonsignificance, the median brood year return for the age class (1980–1995) was used. The major age classes 2.2 and 2.3 were predicted from age classes 2.1 and 2.2, respectively. Age classes 1.2, 1.3, and 2.1 were estimated using the median. Other age classes (0.2, 1.1, 0.3, 0.4, 3.1, 1.4, 3.2, 2.4, and 3.3) were estimated by summing the minor age class brood year returns (1981–1992) and utilizing the median return. The variance estimates from each individual age class estimate were summed, and the collective variance was used to calculate the 80% prediction intervals of the total run.

Forecast Discussion

The 2000 forecast for Bear Lake late run is 794 thousand sockeye salmon, which is 28 thousand fish greater than the actual 1999 run and 321 thousand greater than the 1999 forecast. The forecast for the 2000 run is on the order of the recent historical mean, being only 14 thousand fish less than the ten-year average between 1990 and 1999. Significant regressions for the two major age classes (2.2 and 2.3) indicate that confidence for the estimate is good to fair.

The projected harvest of 694 thousand fish is based upon the achievement of the escapement goal of 100 thousand fish. The dominant age classes, 2.2 (59 percent) and 2.3 (32 percent), should constitute 91 percent of the run.

Matthew Birch Foster
 Finfish Research Biologist
 Kodiak

FORECAST AREA: Alaska Peninsula, Nelson River
SPECIES: Sockeye Salmon

Preliminary Forecast of the 2000 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL PRODUCTION:		
Total Run Estimate	478	148–806
Escapement Goal	150	100–200
Harvest Estimate	328	

Forecast Methods

The 2000 Nelson River forecast was constructed using simple linear regressions of recent brood year sibling relationships between 1980 and 1995 and median estimators of age class returns. Standard regression diagnostics were employed including analysis of residuals and outlier points. Regression estimates were only used if the slope was significantly different from zero ($P < 0.25$) and non-negative. In cases of nonsignificance, the median brood year return for the age class (1979–1995) was used. Of the major age classes, regression estimates were only used for age classes 1.3 and 2.3 (predicted from 1.2 and 2.2, respectively) and the median estimator was utilized for the remainder. Other age classes (0.1, 0.2, 1.1, 0.3, 0.4, 3.1, 1.4, 3.2, 1.5, 2.4, and 3.3) were estimated by summing the minor age class brood year returns (1983–1992) and utilizing the median return. The variance estimates from each individual age class estimate were summed and the collective variance was used to calculate the 80% prediction intervals of the total run.

Forecast Discussion

The 2000 forecast for Nelson River is 478 thousand sockeye salmon, which is 39 thousand more fish than the actual 1999 run. The poor predictive value of the sibling relationships for most age classes led to the use of the median estimator for a majority (60 percent) of the run. Therefore, the confidence in the estimate is fair. The 1999 forecast was 101 thousand fish greater than the actual run. However, if the median estimator had been used for every age class in 1998 to predict the 1999 run, it would have differed from the actual run of 439 thousand fish by only 40 thousand fish. The 2000 forecast is similar in magnitude to the recent historical mean, being 90 thousand fish less than the 10-year average (1990–1999) and 62 thousand fish less than the 15-year average (1985–1999).

The projected harvest of 328 thousand fish is based upon the achievement of the midpoint of the escapement goal range of 100–200 thousand fish. The dominant age classes, 2.2 (50 percent) and 2.3 (22 percent), should constitute 72 percent of the run.

Matthew Birch Foster
 Finfish Research Biologist
 Kodiak

FORECAST AREA: Arctic-Yukon-Kuskokwim
SPECIES: All Salmon

Commercial salmon harvest outlook for the AYK Region, year 2000, in thousands of fish:

Management Area	Species					
	Chinook	Sockeye	Coho	Pink	Chum	Fall Chum
Kuskokwim	15–40	75–170	140–600	2–3	95–350	
Yukon	25–65		0–100		25–300	0–300
Norton Sound	2–4		50–80	500	20–30	
Kotzebue Sound					200–300	

South Peninsula June Fishery Chum Salmon Guideline Harvest Level

Background

In 1998, the Alaska Board of Fisheries replaced the chum salmon cap in the South Peninsula June fishery, with a “floating” guideline harvest range. This range of chum harvest is now determined annually by two factors: a forecast of an index of summer chum salmon harvest in the Arctic-Yukon-Kuskokwim (AYK) region, and a check to see if the department has any *management concerns* for summer chum salmon in that region. The level of the forecast index, in relation to the 33rd and 66th percentiles of the historic series, determines the range. For a forecast less than the 33rd percentile, the June fishery guideline harvest range covers 350,000 to 450,000 chum salmon. Between the 33rd and the 66th percentile, the range covers 450,000 to 550,000 chum salmon. Above the 66th percentile, the range covers 550,000 to 650,000 chum salmon. If the department identifies a *management concern* for summer chum salmon within the (AYK) region, the department must manage the June fishery for the lower half of the applicable guideline harvest range (e.g., 350,000 to 400,000 for the first range). A *management concern* means a chronic inability to meet escapement objectives, despite the use of specific management measures. The term “chronic” refers to the continuing or anticipated inability to meet escapement objectives over a four-year period, which is generally equivalent to a life cycle or generation of chum salmon.

The 2000 June Fishery Guideline Harvest Level

The 2000 forecast for the AYK summer chum catch index is 981 thousand – even lower than last year’s forecast of 1.05 million summer chum salmon. This catch, if realized, will be in the bottom third of the index series, and it therefore restricts the June fishery guideline harvest range to 350,000 to 450,000 chum salmon. Because the department has identified *management concerns* for summer chum salmon in seven systems in the AYK region this further restricts the guideline harvest range to 350,000 to 400,000 chum salmon in the June fishery. In the Yukon system there is a *management concern* for the Andreafsky River for summer chum salmon. In Norton Sound there are *management concerns* for summer chum salmon on the Sinuk, Snake, Nome, Bonanza, Solomon, and Tubutulik rivers.

Forecast Methods

The catch index is made up of commercial and subsistence catches of summer chum salmon in the Yukon River (including the subsistence harvest, Yukon area personal use summer chum salmon, and Yukon area test fish given away for subsistence purposes, and excluding sport-caught chum salmon), and commercial chum harvests in the Kuskokwim area, in Norton Sound, and in the Kotzebue area. Final estimates are not yet available, so the forecast is based on a preliminary index number of 319 thousand – the lowest value in the series. To produce the forecast for next year’s value of this series, a statistical “regression” relationship was generated that predicts this index series by its value from the previous year. In 2000, the resulting forecast equation is given by

$$\text{forecast} = 647 \text{ thousand} + (0.583) \text{ last year's catch.}$$

To understand the mechanics of the forecast, it helps to notice that because the mean of both the independent and dependent variables are nearly the same (about 1.6 million), the above equation can be approximately written as a weighted average of the long-term average and the previous year's value of the index. In other words,

forecast » (1-regression coefficient) long-term average + (regression coefficient) last year's catch.

Forecast Discussion

The regression relationship that underlies the forecast is weak. The department is looking at ways to incorporate oceanographic information into the forecast, and we have recently started a three-year research project with the University of Alaska Fairbanks to look for ways to improve this forecast. As poor as the regression relationship is, it remains the best objective forecasting tool available. The current method provides a stable forecast that will not fluctuate wildly from year to year, and unfortunately, it will always miss sudden drops or increases in production. Except when the previous year's catch is very high or very low, this method will lead to the middle guideline harvest level (450,000 to 550,000).

To the extent this forecasting tool works, it is based only on the general tendency of catch to remain near the same level from one year to the next. In 1997, 1998, and 1999 catches were quite small, and these forecast methods correctly predicted low returns in 1998 and 1999. The low catch in 1999 brought the 2000 forecast below the 33rd percentile of the historic values in the index series.

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